Recent sedimentation rates and trace elements determined in cores from Pantanal, Mato Grosso do Sul, Brasil

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Introduction

Pantanal, located in southwest part of Brazil (80%), is one of the world's largest freshwater wetlands (Figure 1).

Figure 1. Pantanal and its ponds.

The entire area of Pantanal, range between 140,000 km^2 to 210,000 km^2, depending on the season time (Figure 2).

Figure 2. Brazil map and Pantanal area.

This natural ecosystem has been affected due to urban contamination, irregular use of the land, tourism without control, etc. It is an huge alluvial plain depression of slight declivity along the Paraguay River and tributaries that becomes flooded during the rainy season. The rains cause widespread flooding in the basin that results in a landscape of river channels, seasonally isolated swamps, and lakes.

The predominant vegetation in the region is *cerrado* (savanna), with a low density of small trees with a high density of grass. The weather is tropical, with dry winter and rains in the summer. It was recognized as National Inheritance by the Brazilian Constitution and in 2000 it was designated as Biosphere Reserve by UNESCO and as Humanity Natural Inheritance.

The objectives of this work is to characterize chemically, by INAA, two sediment cores that were collected in ponds located in Nhecolândia Pantanal and determine the granulometric composition of the sediments samples to evaluate the chemical processes that occurs in the ponds. The ^{210}Pb method was used to determine the sedimentation rate and sediment age for one pond, Salina da Ponta.

Material and Methods

Two cores were collected in 2006, at Salina da Ponta pond, TA - 41 cm long and other at Salina Pedra do Sol pond, PS - 54 cm long; they were sliced every 2cm, dried at 60ºC and homogenized in a glass mortar for grain size analysis.

The elements As, Ba, Br, Ce, Co, Cr, Cs, Eu, Fe(%), Hf, K(%), La, Lu, Na(%), Nd, Rb, Sb, Sc, Ta, Tb, Th, U, Yb, Zn and Zr were determined (in mg kg^{-1}) by instrumental neutron activation analysis, INAA, in the samples fraction silt + clay. The methodology validation was performed by measuring the reference materials Buffalo River Sediment (NIST SRM 8704) and Soil 7 (IAEA). The results obtained for both ponds chemical characterization, were compared with UCC values.

Dates and sedimentation rate were obtained by ^{210}Pb method for Salina da Ponta, TA.

Results and Conclusions

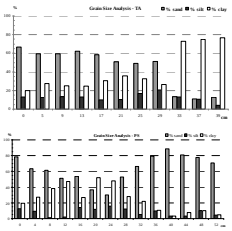

Figure 3 presents the grain size analysis for core TA and PS.

For core TA, until 30cm the grain size is dominantly sand and in the last 10cm the patterns change indicating the prevalence of settling porcesses; this part of the core is dark probably due organic matter.

For core PS, the grain size is dominantly sand with some parts in the middle, from 12cm to 30cm, where can be observed an increase of the silt and clay content.

Figure 3. Grain size analysis for TA and PS cores

Table 1. Mean concentration of the elements (mg kg^{-1}) for core TA

TA	As	Ba	Br	Ce	Co	Cr	Cs	Eu	Fe(%)	Hf	K(%)	La	Lu
mean	24,5	1019	6,06	20,8	33	32	1,21	0,41	4,6	7,90	2,25	8,85	0,30
UCC	1,5	668	1,6	64	10	35	3,7	0,9	3,5	5,8	3,46	30	0,32
TA	Na(%)	Nd	Rb	Sb	Sc	Sm	Ta	Tb	Th	U	Yb	Zn	Zr
mean	3,21	11,7	67	0,53	2,08	1,74	0,52	0,30	2,86	1,72	1,30	31	183
UCC	3,45	26	110	0,2	11	4,5	2,2	0,66	10,3	2,5	2,2	71	85

Table 1 presets the mean results of multielemental analysis in the sediment samples obtained by INAA, in mgkg^{-1}, and their comparison with UCC values (Upper Continental Crost), for the same elements, for Salina da Ponta, core TA.

The mean values obtained for the elements As, Ba, Br, Co, Fe, Hf, Sb and Zr are higher than the UCC values, for the other elements the values are lower. The results obtained for the elements As, Br, Co and Zr show that these elements are enriched in this pond, when compared with UCC reference values.

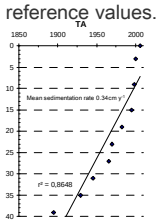

Figure 4. Dates and sedimentation rate for core TA

Isotopic ages for core TA are presented in Figure 4. ^{210}Pb profile depicts a well-defined linear trend from level 0cm, 2006, to level 40cm, 1894.

These results indicate an average accumulation rate of 0.34cmy^{-1}, that is in agreement with data from literature for the same kind of environment, which presents only rain and groundwater influence.

The age found for the total sedimentary column analyzed (about 112 years) indicates that geochemical processes, such as desorption, precipitation and dissolution are important to understand the geochemistry of these ponds.

Table 2. Mean concentration of the elements (mg kg^{-1}) for core PS

PS	As	Ba	Br	Ce	Co	Cr	Cs	Eu	Fe(%)	Hf	K(%)	La	Lu
mean	11,0	968	36,4	43,1	8,91	28,6	2,36	0,71	1,14	8,81	1,89	18,4	0,53
UCC	1,5	668	1,6	64	10	35	3,7	0,90	3,50	5,80	3,46	30	0,32
PS	Na(%)	Nd	Rb	Sb	Sc	Sm	Ta	Tb	Th	U	Yb	Zn	Zr
mean	15,8	24,3	49	0,47	4,26	3,79	0,68	0,53	4,79	10,0	1,92	62	274
UCC	3,5	26	110	0,2	11	4,5	2,2	0,66	10,3	2,5	2,20	71	85

Table 2 presents the mean results of multielemental analysis in the sediment samples obtained by INAA, in mg kg^{-1}, and their comparison with UCC values (Upper Continental Crost), for the same elements, for Salina da Ponta, core PS.

The mean values for the elements As, Ba, Br, Hf, Lu, Na, Sb, U and Zr are higher than the UCC values, for the other elements the values are lower. The results obtained for the elements As, Br, Na, U and Zr show that these elements are enriched in this pond, when compared with UCC reference values.

For both ponds the mean concentrations observed for some elements ponds showed higher values when compared with UCC values.

The enrichment of the elements cited below is due probably to their natural concentration in the studied area caused by geochemical process of desorption, precipitation and dissolution, that influence in the pond water pH.

The results obtained in the present study showed that these geochemical processes can contribute for the pH water in the saline ponds.