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Trace elements determined by INAA in a sediment core dated by Pb-210 method from Laguna de Peña, Uruguay

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Introduction: Lake systems are the continental environments most susceptible to climatic and anthropic action, whose physical, chemical, and biological changes are recorded in their sediments and can be detected by geochemical, microfossil and isotopic analyses, among others. Consequently, with these analyses one can reconstruct past environmental conditions. Lake sediments also constitute a potential ecosystem for the accumulation of trace elements[1] and can be used in the study of pollution, as indicators of the presence and levels of these elements. The study of the concentration of different metals is of great importance, because when they remain unaltered, they allow the historical reconstruction of metal deposition in the environment and inferences about the land use and occupation practices over time, in addition to historical knowledge of anthropic action at the study site[2]. The objectives of the present work are to determine the trace elements As, Ba, Br, Ce, Co, Cr, Cs, Eu, Fe, Hf, La, Lu, Na, Nd, Rb, Sb, Sc, Sm, Ta, Tb, Th, U, Yb, and Zn in a sediment core dated by the ^{210}Pb method from Laguna de Peña, located in Uruguay.

Methodology: Trace elements were determined by Instrumental Neutron Activation Analysis (INAA) in a sediment core collected at the center of the Laguna de Peña, located in the Santa Teresa National Park in Uruguay. The core was sectioned every 2 cm, the samples were dried, ground, pulverized and irradiated with reference materials in the IEA-R1 Research Reactor at IPEN. The determination of age and sedimentation rate of the sediment was performed by the ^{210}Pb method, with total beta measurement of the ^{210}Pb radionuclide in a proportional gas flow detector[3,4].

Results: The concentration results obtained for the trace elements, mg kg^{-1}, were compared with reference values from the Upper Continental Crust[5] - UCC, which are presented in Table 1 along with the concentration intervals and means values.

Table 1 – Interval, mean concentration values of trace elements and UCC values in mg kg^{-1}

	Interval	Mean	UCC		Interval	Mean	UCC
	mgkg^{-1}				mgkg^{-1}		
As	5.01 - 18.5	11.6	1.5	**Nd**	27 - 53	35	26
Ba	255 - 999	478	668	**Rb**	81 - 218	123	110
Ce	43 - 141	79	64	**Sb**	0.70 - 2.01	1.06	0,2
Co	7.61 - 46	21	10	**Sc**	8.06 - 41	19	11
Cr	40,9 - 153	64	35	**Se**	0.99 - 3.04	1.61	0.083
Cs	4.27 - 30	13.26	3.7	**Sm**	5.61 - 21	8.93	4.5
Eu	0.64 - 4.30	1.79	0.9	**Ta**	0.57 - 1.08	0,25	2.2
Fe	2.20 - 11	5.04	3.5	**Tb**	0.61 - 1.76	1.12	0.7
Hf	2.67 - 7.90	4.61	5.8	**Th**	7.90 - 18	10.62	10
K	0.48 - 1.60	1.14	2.87	**U**	2.89 - 9.7	4.77	2.5
La	17 - 79	38	30	**Yb**	2.30 - 7.93	3.64	2.2
Lu	0.36 - 1.25	0.59	0,3	**Zn**	31 - 508	153	71
Na	0.25 - 0.58	0.45	2.56				

Figure 1 shows the elements As, Cs, Co, Cr, Ce, Eu, Fe, La, Lu, Rb, Sb, Se, Sc, Sm, Th, U, Tb, Yb and Zn whose mean concentrations were higher than those of the UCC, as well as the age of the sediments as a function of the depth in cm. The sedimentary column presented an age of 85 years and a mean sedimentation rate of 0.89 cm y^{-1}. In the first 40 cm the sedimentation rate was 0.46 cm y^{-1} while the rest of the sedimentary column showed a much lower sedimentation rate, 0.46 cm y^{-1}.

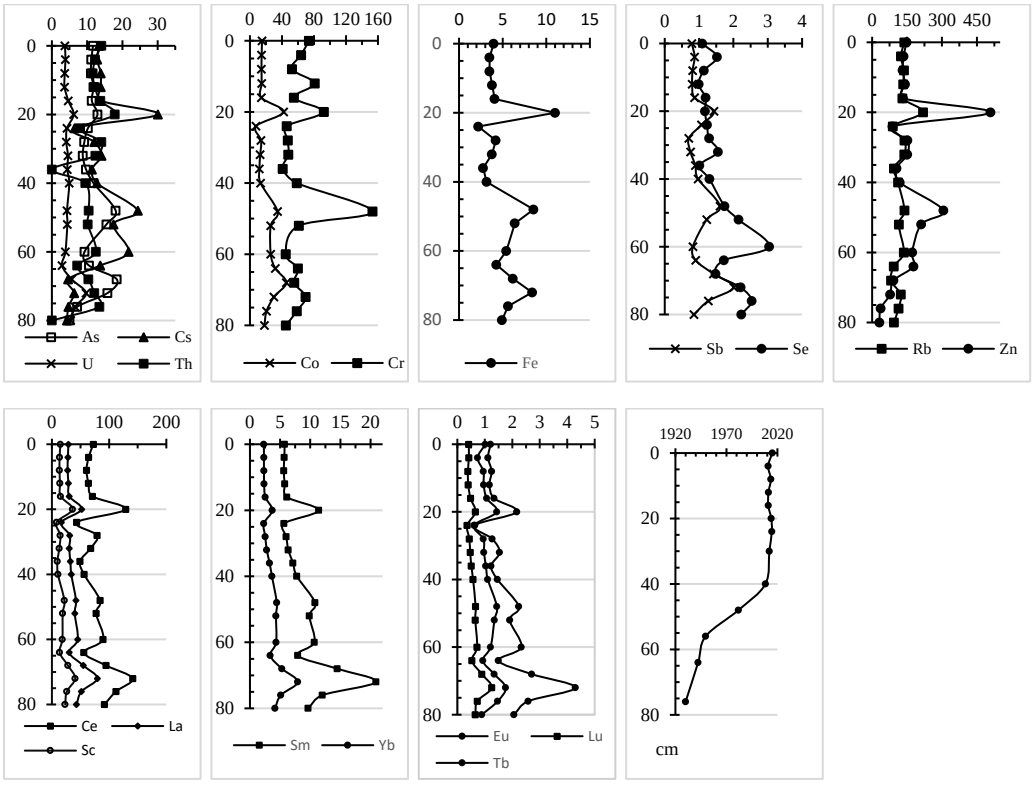

Figure 1 – Trace elements, mg kg^{-1} as a function of depth (cm) and age of the sediment.

Conclusions: This work analyzed a sediment core collected in Laguna de Peña located in Santa Teresa National Park in Uruguay for trace element concentration and determined the age of the sediment, as well as the sedimentation rate. The results obtained from the concentration of most of the analyzed elements showed mean concentration values higher than the reference values of the Upper Continental Crust, indicating a probable anthropic contribution to some of them, such as As, Cr and Sb, among others. The calculated mean sedimentation rate agrees with literature data for lacustrine environments.

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