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Trace elements by Neutron Activation Analysis in three sediment cores from the Alto Tietê River Sub-Basin, São Paulo-Brazil, dated by ^{210}Pb method

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The Tiete River drains an area composed of six sub-basins (Alto Tiete, Sorocaba/Médio Tiete, Piracicaba-Capivari -Jundiai, Tiete/Batalha, Tiete/Jacaré and Baixo Tiete). Along its extension (1,100 km), its margins bathe 62 municipalities. In spite of all its historical contributions, hydroelectric potential and being one of the most economically important rivers in the state of São Paulo, the Tiete River is one of the world's most polluted rivers especially when it crosses through the city of São Paulo. Along its length, several reservoirs were formed by damming its waters. As a result of pollution observed since the 1950s, a project was established with the aim of evaluating the historic concentration of some trace elements As, Ba, Br, Ca, Ce, Co, Cr, Cs, Eu, Fe, Hf, La, Lu, Na, Nd, Rb, Sb, Sc, Sm, Ta, Tb, Th, U, Yb and Zn in sediment cores dated by ^{210}Pb method, collected at three points of the river. The sediment cores were sliced every 2 cm and analyzed by instrumental neutron activation analysis (INAA) for elemental determinations and gross beta for ^{210}Pb measurement. The granulometric composition of the sediment core samples were also determined. This study presents the results obtained for the trace elements determined in three sediment cores collected in the reservoirs: Salesópolis county (near the Tietê River headwaters) (Usina Parque do Rio Tietê reservoir) and Santana do Parnaíba county (Santana do Parnaíba reservoir) and Pirapora do Bom Jesus county (Rasgão reservoir), located after São Paulo city. All sampling locations are located in the Alto Tietê River Sub-Basin. Precision and accuracy of the INAA technique were checked by means of certified reference materials BEN (Basalt-IWG-GIT), SL-1 (Lake Sediment - IAEA) and Soil-5 (IAEA), that shows certified concentration values for all elements analyzed. The INAA results were compared to the NASC reference values (North American Shale Composite) and regional basal values. The enrichment factor (EF) and geoaccumulation index (G') were used to assess the presence of anthropogenic pollution sources. $\text{EF} > 3$ (considering NASC as reference values) were obtained for the elements Br, Hf, Th and U in the core from Salesópolis (before São Paulo city) and for As, Br, Hf and Zn, in the core from Pirapora do Bom Jesus indicating an anthropogenic contribution mainly for As and Zn. The sedimentation rates obtained by the ^{210}Pb method showed that these sampling points are affected by the rainy season and urban expansion in its surroundings.