Chemostratigraphy and lead isotopic composition of a sediment core profile from a small pond in a remote equatorial island

S.M.B. DE OLIVEIRA[1], L.C.R. PESSENDA[2],
S.E.M. GOUVEIA[2], M. BABINSKI[1] AND D.I.T. FAVARO[3]

[1]Institute of Geosciences, Un. São Paulo, rua do Lago, 562, São Paulo, 05508-080 Brazil (soniaoli@usp.br, babinski@usp.br)
[2]C Laboratory, CENA, Un. of São Paulo, C.P. 96, Piracicaba, SP, 13416-000, Brazil, (pessenda@cena.usp.br, susyeli@cena.usp.br)
[3]IPEN, C.P. 11049, São Paulo, Brazil, (defavaro@ipen.br)

A 72-cm long core was collected from Lagoa da Viração (LV), a small pond in the Fernando de Noronha island, northern Brazil, in order to study vertical changes in major, trace and Pb isotopes concentrations with depth. Sediments from the lower section of the core (20-70 cm) contains essentially mineral matter, while in the upper section (0-20 cm) mineral matter is mixed with organic matter, which is increasingly more abundant toward the top. Lithogenic conservative elements – Si, Al, Fe, Ti, Co, Cr, Cu, Ga, Hf, Nb, Ni, Y, Zn, Zr and REE – exhibit remarkably constant values along the core, with concentrations similar or moderately higher than those of the bedrock. The vertical distribution of soluble elements – Ca, Mg, Na, K, P and Mn – is also homogeneous, but these elements are systematically depleted in relation to the bedrock. LOI, TOC, Br, Se, Hg and Pb, although showing nearly constant values in the lower section of the core, are significantly enriched in the upper section. Pb isotopic ratios are nearly constant and very similar to those of the bedrock in the lower section of the core, but are increasingly less radiogenic in the upper section. Ti-normalization allowed the separation of natural and anthropogenic Pb, indicating that the latter was restricted to the upper section of the core, and was probably added to the sediments via atmospheric transport. Se and Br appears to be originated from seawater sprays. The source of Hg seems more uncertain, but at least partially it might have been accumulated via atmospheric deposition. Whatever the source of Pb, Br, Se and Hg, their close association with TOC suggests that organic matter has played an important role in their accumulation in the surface sediments.

Molecular markers and trace-metals as proxis of biomass combustion in Central Amazon sediments

T.C.S. OLIVEIRA, A. WAGENER AND A.L. SCOFIELD

Departamento de Quimica, Pontificia Universidade Católica do Rio de Janeiro, 22453-900 Rio de Janeiro, Brazil (tcrist@rdc.puc-rio.br; angela@rdc.puc-rio.br; scofield@rdc.puc-rio.br)

Large scale forest fires occur in the region denominated “deforestation arc” circumscribing the southern area of the Amazon Region. Under certain meteorological conditions like in the dry season of 2005 clouds of particulate matter reached Manaus and the Central Amazon. The goal of the present work was to search for indicators of combustion in sediments of the Solimões River and associated lakes. For this sediments were sampled in the wet and dry seasons in 2005 and were analysed for 39 PAHs, molecular markers and trace-metals. Among other approaches, to verify the contribution of biomass combustion to the PAH pool in the sediments the diagnostic ratio Fl/(Fl+Py) was plotted versus 1.7/(1.7+2.6)DMPh, which was used as a proxy for combustion sources. The cross evaluation shows PAH in sediments deriving predominantly from mixed combustion sources. Evidently the traffic of ships along the river contributes for the pool of PAH in the sediments. Significant correlation ($p<<<0.05$) of perilene, the major PAH, with BbFl, BkFl, BaPy and several metals were found. These and additional correlations were confirmed in the factorial analysis in which the correlation coefficients in factor 1 were: 0.79 for Fl, 0.76 for BaA, 0.83 for BbFl, 0.66 for BkFl, 0.82 for BaPy, 0.83 for Cd, 0.77 for Pb, 0.79 for Cu and 0.73 for Zn. The association of perilene with combustion derived PAH and metals, which can also be produced in forest burning, is an indication that combustion is one of the relevant sources of this compound to the sediments. For the dry season samples, strong correlations were found between 1.7/(1.7+2.6)DMPh and trace metals (Cu, V, Zn, Pb, Cd) which confirm the contribution of forest fires for the pool of trace metals in sediments, especially in such occasions of intense combustion as in late 2005. The same approach applied to a dated core showed that biomass combustion imprint is present in sediments deposited since the end of the 19th century. In general the high values for the ratio ∑3-6 ring PAH/∑5 Alk PAH series sustain the evidence that combustion is a major source of PAH in the examined sediments.