Fractionation and characterization of epilimnetic soluble organic phosphorus in an Amazon lake

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Abstract
Lake Camaleao is a floodplain lake on the Solimões River, located on Marchantaria Island near Manaus. The area of the lake varies from 200–0.5 ha depending on river stage height and reaches a minimum depth at low water of around 1 m (Furch & Junk 1993). The lake is permanently connected to the river from which it receives most of its water and nutrients. Our objective in the present study was to investigate the distribution and dynamics of phosphorus within and among different compartments in the epilimnion of this lake, including several size fractions of dissolved organic phosphorus. $^{32}$PO$_4$ was used to trace the flow of phosphorus among the compartments. Surface water was collected during the low water period, inoculated with carrier free $^{32}$PO$_4$ and incubated in the dark. Samples were filtered through 0.2 μm, 1 μm and 3 μm filters at regular intervals during the incubation to follow the transfer of the phosphorus among these different size fractions. Part of the 0.2 μm filtrate was further size-fractioned by liquid chromatography through Sephadex G-200 gel. Sample activities were measured by liquid scintillation. After one hour of incubation, 65% of the activity was found in the <0.2 μm size fraction. After 12 hours of incubation a smaller fraction of the total activity (17%) remained in the <0.2 μm size fraction. Uptake rate constants for the first hour and for twelve hours were 0.0021/min and 0.0020/min, respectively. The uptake rate constants and calculated turnover times indicated that the lake was not phosphorus limited. The chromatography result showed 3 peaks of activity after 12 hours of incubation. 1% of the activity was found in the fraction eluting in the void position (M.W. >200,000), 43% eluted in an intermediate position (approx. M.W. 66,000) and 56% eluted in the phosphate position. According to Lean (1973 a, b) the transfer of phosphate among different molecular weight compounds is biologically mediated, with an intermediate molecular weight phosphorus compound (approx. 250 Daltons) called XP, apparently produced by plankton excretion, playing a key role. The dissolved organic phosphorus compounds encountered in Lago Camaleao were much larger and presumably more refractory than those encountered by Lean. The uptake rates estimated here were also much lower than those encountered by Lean indicating a slower rate of transfer among phosphorus compartments. These differences may be attributed to the refractory nature of the allochthonously derived organic matter which predominates in this riverine lake.

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References


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