Goldschmidt 2000
September 3rd–8th, 2000
Oxford, UK.

Journal of Conference Abstracts
Volume 5(2), 297

Hg and CO_2 Production Mechanism in the Petit Saut Dam Reservoir, French Guyana: Fe^{2+} as Key Actor

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Mercury contamination in South America is in part due to gold mining activities, a well defined anthropogenic source of Hg input to the ecosystem. Distribution of mercury was studied at the lake Petit Saut in tropical French Guyana. A permanent mercury input to the lake is delivered by the Koursibo River, which drains the heavily polluted gold mining area of Saint Elie. Field measurements were carried out in wet (June 99) and dry (December 99) seasons. Main physico-chemical parameters (dissolved O_2, pH, Eh, temperature, alkalinity, $[Fe^{2+}]$, $[HS^-]$) as well as the concentration of Hg and $Hg_{reactive}$ were determined in the field. Concentration of major cations and anions were measured in the laboratory. Hg and $Hg_{reactive}$ concentrations were measured on the shore of the lake by cold vapor atomic fluorescence spectroscopy.

Whatever the season the lake is stratified. The oxicline is 4m deep (the maximum depth of the lake is 35m). Temperature shifts from 30-31ºC above the oxicline, to 25ºC below, and pH from 6.6 in the epilimniun to 5.7 in the hypolimniun. The detailed water chemistry of the hypolimnium is very dependant on the season. In wet season, no significant change in alkalinity and Fe^{2+} concentrations occurs throughout the anoxic water column (HCO_3^- and Fe^{2+} average concentrations equal to 120 and 4.7µmol/l, respectively) and Hg is barely detectable. The hypolimnium is thus well mixed. Mixing of deep waters could observed after a storm event in a branch of the lake, where multiple O_2 stratifications were recorded. In contrast, clear diffusion-like profiles are observed below the oxicline at the end of the dry season for alkalinity, Fe^{2+} and Hg . The hypolimnium bicarbonate concentration steadily increases from 110 at the oxicline to 460mmol/l at the bottom of the lake, ferrous iron concentration from zero to 0.18mmol/l, and Hg concentration from 38 - 55pg/l in surface waters to 71-115pg/l at the bottom. Concentration gradients for H_2CO_3 Fe^{2+} and Hg were computed and are equal to 1.9 $x10^{-2}$, $5.5x10^{-3}$, $2.8x10^{-17}$ $molem^{-4}$, respectively. The flux of CO_2 within the hypolimnion from the bottom of the lake toward the oxicline was estimated that way, and is in close agreement with the value reported by Galy-Lacaux et al. (1999).

The congruence of HCO_3^-, Fe^{2+} and Hg diffusion-like profiles lead us to assume that the CO_2 production results from the reductive dissolution of iron hydroxides. The produced aqueous ferrous iron ions may in turn reduce the "reactive" mercury (II), in the same way as it reduces U(VI)(Liger et al., 1999). The detailed mechanism of Hg production by Fe^{2+} and HCO_3^- at the surface of suspended particles is explored.

Galy-Lacaux C, Delmas R, Kouadio G, Richard S, Gosse P, *Global biochemical cycles*, **13(1)**, 503-517, (1999).
Liger, E, Charlet, L and Van Cappellen, P, *Geochim. Cosmochim. Acta*, **19/20**, 2939-2956, (1999).