Methylmercury production and exchanges in sediments of Lake Titicaca

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Abstract :

Lake sediment is known to be an important source of the neurotoxic monomethylmercury (MMHg) for surface water (Fitzgerald et al., 2014), in which trophic transfer occur in both benthic and pelagic organisms (Watras et al., 1998). Geochemical processes involved in the methylation of mercury (Hg) generally occurs in surface sediment or biofilms developed at the sediment/water interface (SWI) and imply various micro-organism amongst which the most documented are sulfate reducing (SRB) and iron reducing (IRB) bacteria (Benoit et al., 1999). Such processes occur specifically during early diagenesis, when a part of deposited fresh organic matter (OM) is mineralized close to the SWI, with O_2, NO_3^- , Fe- and Mn-oxyhydroxides or SO_4^{2-} acting as electron acceptors (De Lange, 1986; Froelich et al., 1979).

In this study, we provide a high resolution (mm scale) complete Hg speciation, major and trace elements in porewater and solid sediment from seven short core collected in Lake Titicaca.

Total Hg concentrations in sediment of Lake Titicaca are low in both shallow (depth < 10 m, THg = 23 ± 14 ng g^{-1}, N= 110) and deep areas (depth > 10 m, THg = 52 ± 52 ng g^{-1}, N= 101) with MMHg concentrations representing 2.9 ± 6.7 and 0.3 ± 0.1 %, in shallow and deep areas respectively. In opposition to sediment, MMHg concentrations are elevated in porewater, especially in shallow sulfate and carbonate rich sediments (2.2 ± 1.8 ng L^{-1}), where SRB are the likely major methylating organisms. Calculation of diffusive fluxes, highlighted very high MMHg diffusive fluxes being 91.8 ± 13.8 and 13.2 ± 2.0 ng m^{-2} d^{-1} in shallow and deep areas, respectively. Such fluxes would represent around 30 % of the MMHg contribution to the water column of Lake Huiñaimarca. Therefore, the major outcome of this study is that although THg concentration in sediment are low, the shallow carbonate facies and sulfate rich sediment are a major source of MMHg to the water column of the small Lake Titicaca (Huiñaimarca).

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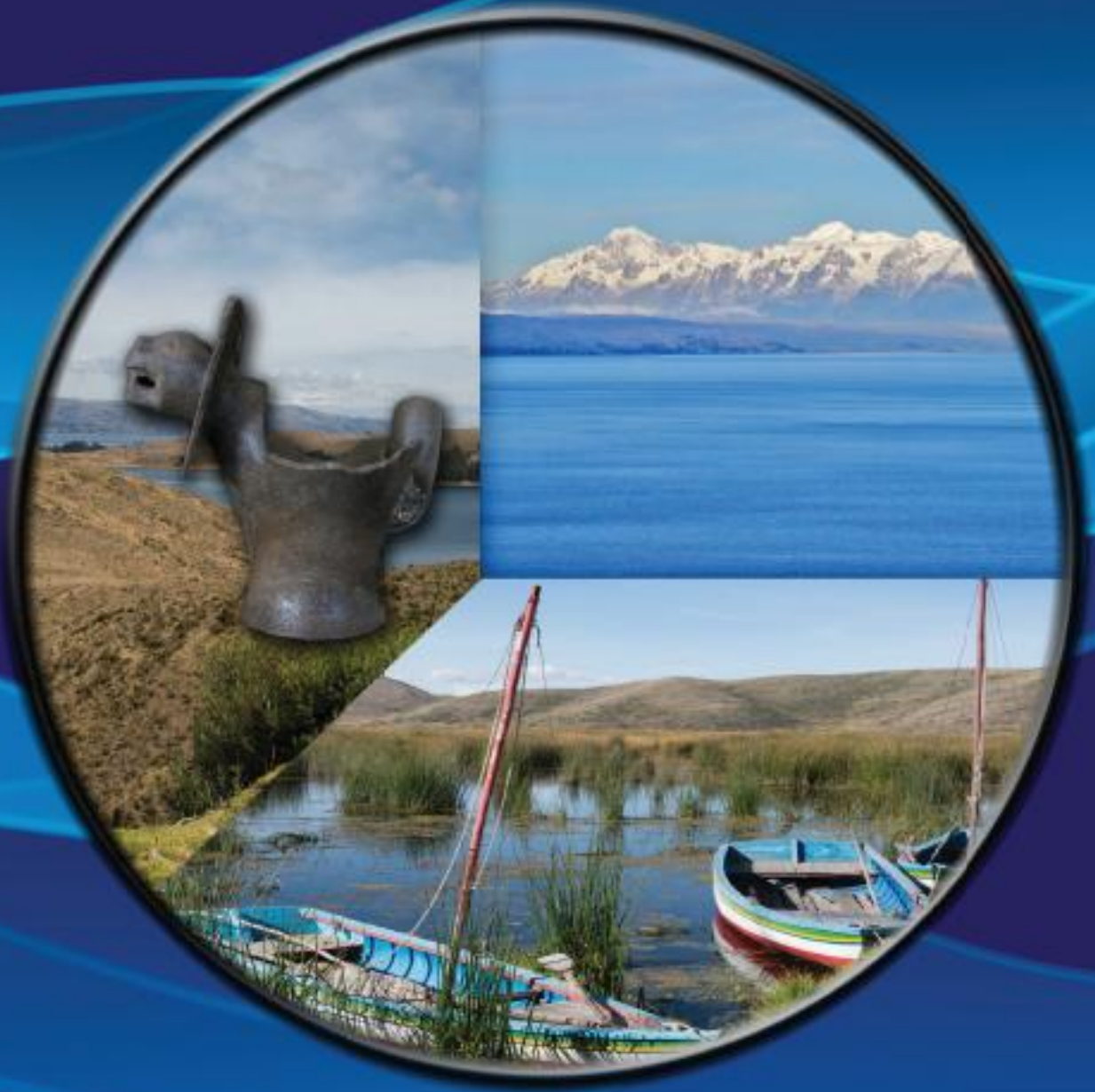
COLOQUIO INTERNACIONAL SOBRE LA CONTAMINACIÓN ACTUAL E HISTÓRICA EN LOS ECOSISTEMAS ACUÁTICOS ANDINOS



La Paz, 3 al 5 de mayo de 2016
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Proceedings

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Universidad Major de San Andrès – Campus de Cota-cota, La Paz

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General Planning

- **May 3rd 2016: Contamination and eutrophication of Lake Titicaca**

AM session: Mercury biogeochemistry and contamination of aquatic ecosystems of the Andes region
Keynote Lecture: Hg contamination in Latin America: the past is not what we think, nor the future (J.-R. Davee Guimarães).

PM session: Chemical contamination, eutrophication and monitoring of Lake Titicaca and its watershed
Keynote Lecture: Eutrophication of the Cohana Bay (D. Acha).

- **May 4th 2016: Arsenic issues in the Andes**

AM session: Arsenic biogeochemistry and contamination of aquatic ecosystems of the Andes region
Keynote Lecture: Arsenic contamination of groundwater (Chile) (G. Lobos).

PM session:
Workshop 1: Arsenic and mercury speciation.
Workshop 2: Paleoenvironmental studies in the Andean altiplano.

- **May 5th 2016: Historical reconstructions of the human-climate interactions in the altiplano: implication of archeological purposes**

AM session: Paleo-environmental reconstruction of Altiplano's archives
Keynote Lecture: Holocene Paleoclimatic and Paleoenvironmental History of the Lake Titicaca Basin (S. Fritz & P. Baker).

PM session: Archeology: historical human – environment interactions
Keynote Lecture: Recent contribution of terrestrial and subaquatic archeological investigation in Lake Titicaca (C. Delaere & M-A. Vella).