Carbon and nitrogen isotopes as tracers of eutrophication in Bahia Cohana (Lake Titicaca)

Carlos .R. Heredia Aguilar[1], P. David Point [2], and Darío Acha [3].

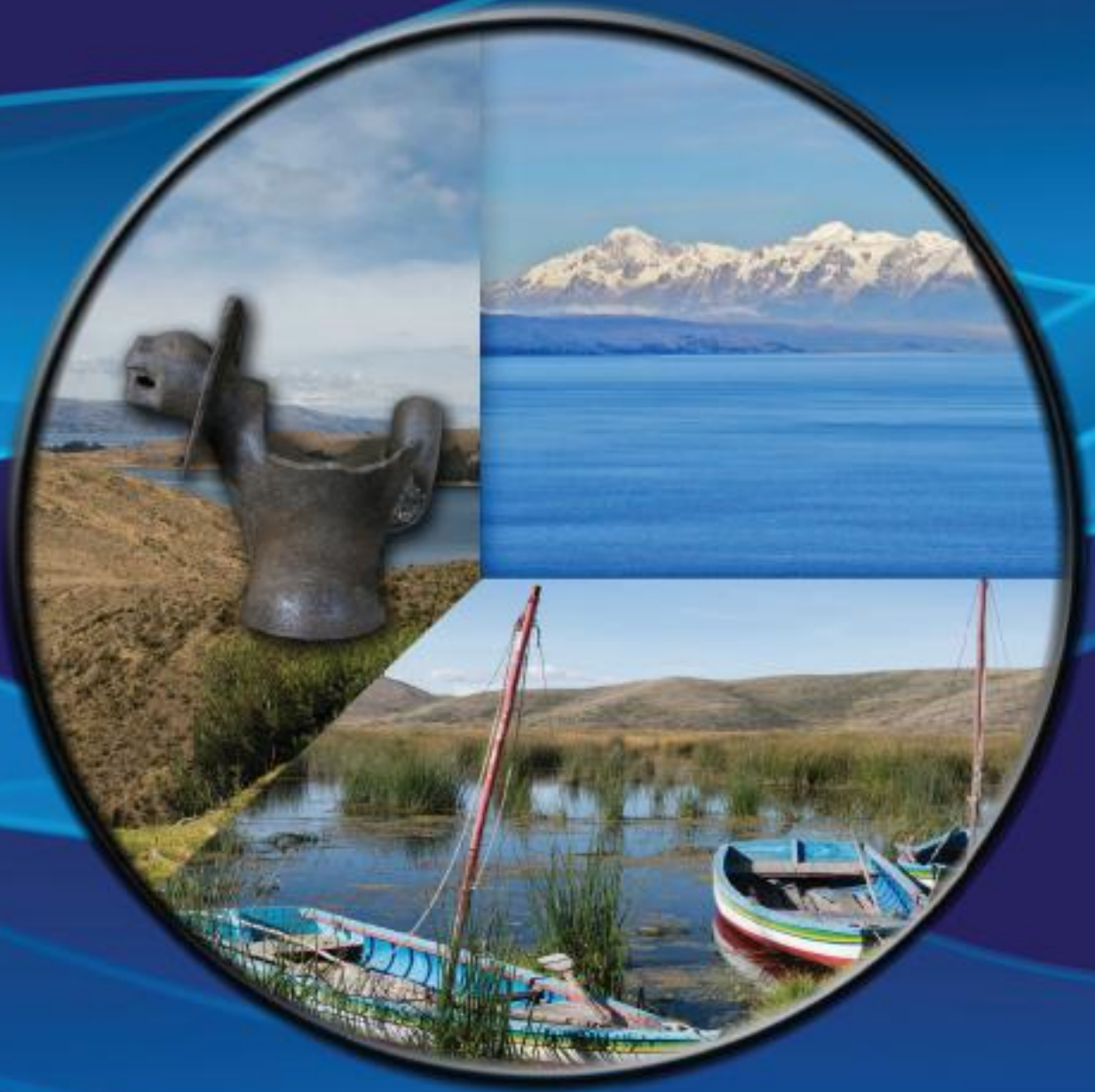
[1] Laboratorio de Calidad ambiental universidad Mayor de San Andrés, Cota Cota, La Paz - Bolivia.

[2] Institut de Recherche pour le Développement Bolivia, Obrajes, La Paz - Bolivia.

[3] Laboratorio de Calidad ambiental universidad Mayor de San Andrés, Cota cota, La Paz, Bolivia.

Anthropogenic reactive nitrogen (Nr) inputs from land to aquatic ecosystems lead to eutrophication processes that are difficult to handle and even harder to remediate. Establishing the source and fate of nutrients and pollutants has shown to be challenging, especially in alpine lakes where information is scarce and where spatial and temporal monitoring is needed for eutrophication control and management. To fill this gap, we examined the carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) stable isotope fractionation in primary producers (macrophytes, particular organic matter, periphyton) and in sediments along an eutrophication gradient in Cohana Bay and its surroundings in the southeast shallow productive part of Lake Titicaca (3812 m). Samples were collected during late wet season (April 2013) and late dry season (September 2013). In all cases, the $\delta^{15}N$ was negatively correlated with distance from Nr inputs (Katari River). The $\delta^{13}C$ was positively correlated with distance only in the case of macrophytes, particulate organic matter and sediments. The $\delta^{15}N$ distribution pattern suggests that primary producers are assimilating anthropogenic N that arrives to the lake and that this Nr is mainly from wastewater origin. The $\delta^{13}C$ spatial pattern suggests that carbon assimilation near the earth-water margin is predominantly allochthonous. We conclude that the eutrophication process can be tracked with isotopic parameters and that this process is still confined to Cohana Bay. This work shows the effectiveness of using C and N stable isotope fractionation as markers for monitoring the eutrophication processes in an alpine lake.

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



La Paz, 3 al 5 de mayo de 2016
Universidad Mayor de San Andrés, Cota Cota, La Paz

Proceedings

International colloquium on current and ancient contamination in Andes aquatic ecosystems

Coloquio internacional sobre la contaminación actual y histórica en los ecosistemas acuáticos Andinos

Colloque international sur la contamination actuelle et historique des écosystèmes aquatiques andins

La Paz – May 3rd – 5th 2016

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

Organization direction:

Stéphane Guédron (ISTerre-IRD/UMSA): stephane.guedron@ird.fr

Dario Acha Cordero (LCA/UMSA): darioacha@yahoo.ca

Marc-Antoine Vella (IFEA): mav.vella@gmail.com

Oswaldo Eduardo Ramos Ramos (IIQ/UMSA) : rroe@kth.se

Organization committee:

Stéphane Guédron (ISTerre-IRD/UMSA): stephane.guedron@ird.fr

Dario Acha Cordero (LCA/UMSA): darioacha@yahoo.ca

David Amouroux (LCABIE-IPREM/CNRS): david.amouroux@univ-pau.fr

Marc-Antoine Vella (IFEA): mav.vella@gmail.com

Christophe Delaere (ULB): Christophe.Delaere@ulb.ac.be

Oswaldo Eduardo Ramos Ramos (IIQ/UMSA) : rroe@kth.se

Mauricio. R. Ormachea Muñoz (IIQ/UMSA) : maurormache@gmail.com

Jorge Quintanilla (IIQ/UMSA): ceedi77@gmail.com

David Point (GET-IRD/UMSA): david.point@ird.fr

Céline Duwig (LTHE-IRD/UMSA): celine.duwig@ird.fr

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).