EGU21-14358, updated on 16 Oct 2021
https://doi.org/10.5194/egusphere-egu21-14358
EGU General Assembly 2021

Physicochemical processes in the main river of Mexico using geochemical models

Selene Olea-Olea, Javier Alcocer, and Luis A. Oseguera
Grupo de Investigación en Limnología Tropical, FES Iztacala, Universidad Nacional Autónoma de México, Av. de los Barrios 1, Los Reyes Iztacala, C.P. 54090, Tlalnepantla, Estado de México, México. (selene.olea.olea@gmail.com; jalcocerdurand@gmail.com; lose

The Usumacinta River is the most extensive tropical fluvial system in North America and the principal river in Mexico and the tenth of North America. Diverse and growing anthropogenic activities (land-use change, agriculture, and urban development) modify water quality. However, to separate natural (e.g., geology) from anthropic factors responsible for this system characteristics, we looked to evaluate geological environment's influence on the river's water quality.

Water and sediment samples were collected along the mainstem and principal tributaries in the rainy and the dry seasons (2017-2018). We analyzed the major ionic composition in water and metals in sediments. We applied inverse and evaporation models (PHREEQC code) to reveal the physicochemical reactions taking place in the river.

The inverse models in the middle basin in both seasons showed the influence of ion-exchange between Ca and K, dissolution of dolomite, and precipitation of kaolinite and calcite, whereas in the lower basin in the rainy season suggested the chemical composition is controlled by ion-exchange among Ca, Na and K, dissolution of dolomite, halite, plagioclase, and feldspar and precipitation of calcite, gypsum, and kaolinite. In addition, the evaporation models in the dry season in the lower basin demonstrate the dominant process taking place is the precipitation of calcite, dolomite, gypsum, halite, and kaolinite.

We found that Cr and Ni are the most abundant metals in the sediments along the river. The geological environment in the basin suggests that the volcanic rocks with felsic minerals could be the source of Ni, whereas sedimentary rocks such as shales and clays could be the source of Cr.

The use of geochemical models in river systems is of great relevance to understanding the presence of major ions concentrations in water and their seasonal and spatial variations, as well the physicochemical processes (i.e., ion-exchange, dissolution, precipitation, redox reactions, and so on) that allow associating or discard the presence of metals.