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Changes in Lake Chad water chemistry during a drought period

J. Lemoalle (1), G. Favreau (2), J.-L. Seidel (2), R. Zairi (2)

(1) IRD – Divha, Maison des Sciences de l'Eau, BP 64501, 34394 Montpellier cedex 5, France, (2) UMR HydroSciences, IRD-CNRS-UMI-UMII, Université de Montpellier II, 300, Av. E. Jeanbrau, 34095 Montpellier cedex 5, France. (lemoalle@msem.univ-montp2.fr)

Lake Chad is a large shallow closed lake with no surface outflow. It is situated in the Sahel belt in central Africa within a region of semi-arid climate. The main components of its water budget are riverine inputs and evaporation. The mean residence time of the water in the lake is about one year. There is an increase in salt content in the water from the river input to the northernmost coast of the lake as a result of increased residence time and evaporation. During normal climatic years, the water remains fresh because of some limited seepage outflow and of original in-lake chemical equilibria which have already been described (Carmouze,1983). These include Ca and Mg carbonate deposition on the lake floor.

Since the beginning of the Sahel drought, in 1973, the water level has decreased and the lake has been split into different basins with occasional connections. A large part of the lake now functions as a seasonal marsh and an abundant vegetation has developed on seasonally exposed sediments (Lemoalle, 2004). As a result of these new environmental conditions, the chemical composition of the lake water has changed.

The relative decrease in K has been related with some absorption by the marsh vegetation while the high CO_2 partial pressure resulting from macrophyte decomposition now prevents Ca and Mg precipitation. The apparition of significant quantities of sulphate, which was previously almost below detection limits, has not yet been explained. Up to 210 mg SO_4/L have been observed in the northern basin of the lake in February 2004, while the river input is around 0.4 mg/L and did not show any change for the last decades. The possibility that this sulphate may originate in some recharge of the lake by groundwater seepage is under study.

For this endoreic lake, highly dependent on a large tributary, major changes in chemistry appear paradoxically more in relationship with internal processes than to river water change in chemistry.

As a result of the African Sahel drought, major changes in the water chemistry of the endoreic Lake Chad thus appear driven by internal processes, while the water quality of its inputs has not been significantly modified.

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