Evidence for the progressive alkalinization of the closed basin lakes in the Ethiopian Rift Valley

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Here we report geochemical data (pH, alkalinity, cation and anion concetrations, and carbon isotopes) from water samples collected in the Ethiopian Rift Valley during a dry season (i.e., October) of the year 2014. Specifically, we collected and analyzed water samples from nine closed basin lakes (Shetan, Chamo, Abaya, Hawasa, Shala, Abijata, Langano, Ziway and Koka), five major river inputs (Meki, Bilate, Kulfo, Bulbula, and Tikur Woha) to these lakes, and also four hot springs (Wendo Genet, Shallo, Borenita and Shala). The acquired pH data from the above lakes collected in 2014, were compared with the historical pH measurements from the identical lakes sampled about four decades ago, i.e., during a dry season of 1976 [see data in ref. 1]. This long-term prespective and comparison, indicte that the pH of all the studied Ethiopian rift lakes (with the exception of Lake Hawasa) has evolved over time towards more alkaline values, exhibiting a systematic increase in the pH ranging from about 0.3 (e.g., Lake Chamo and Abaja) up to 0.7 units (e.g., Shala and Abijata). Importantly, the observed increase in the pH of lake waters is tightly coupled with an increase in the alkalinity, dissolved inorganic carbon (DIC), $\delta^{13}C$ values, and the concentrations of Na^+ and Cl^- ions in the lakes. In this contribution we will discuss and critically evaluate (based on $\delta^{13}C$ data) how different processes such as (i) enhanced water evaporation, (ii) riverine input of carbon from the soil erosion, and/or (iii) the biological fixation and uptake of atmospheric CO_2, may have contributed to the observed progressive alkalinization of the studied lakes in the Ethiopian Rift Valley; with implications for the human-induced changes in the cycling and transport of carbon in the Earth's surface environment, and the effects of climate change on water budgets and chemisty of the closed basin lakes in this region.

[1] Vonn Damm & Edmon (1984) *Am. J. Sci.*, **284**, 835-862