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Paleo-hydrological changes in the Chew Bahir area during the past 50 ka inferred from isotope signatures in aquatic microfossils

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A major challenge in paleo-anthropology is to understand the impact of climatic changes on human evolution. The Hominin Sites and Paleo-lakes Drilling Project (HSPDP) is currently meeting that challenge by providing records that cover the last ~3.7 Ma of paleoenvironmental change all located in close proximity to key paleo-anthropological findings in East Africa. One of the cored climatic archives comes from the Chew Bahir basin in southern Ethiopia, where duplicate sediment cores provide valuable insights about East African environmental variability during the last 550 ka.

The lake basins in the eastern branch of the East African Rift System today contain mainly shallow and alkaline lakes. However, paleo-shorelines in the form of wave cut notches, shell beds, and beach ridges are common morphological evidences for deep freshwater lakes that have filled the basins up to their overflow level during pronounced humid episodes, such as the African Humid Period (15-5 ka). Unfortunately, further back in time, many of those morphological features disappear due to erosion and the estimation of paleo-water depths depend merely on qualitative proxies from core analyses.

We here present a method that shows high potential to translate qualitative proxy signals from sediment core analyses to quantitative climate signals in the Ethiopian Rift. The method aims at water level reconstruction in the Chew Bahir basin using strontium isotope ratios (87Sr/86Sr, SIR) in lacustrine microfossils. SIR reflect the lithology of the drained catchment. SIR have changed pronouncedly when higher elevated paleo-lakes Abaya, Chamo and Awassa were overflowing into paleo-lake Chew Bahir. This new method may help to quantify paleo-lake levels beyond the past 20 ka and may also detect migrational barriers or routes due to the occurrence of synchronous large, connected and deep paleo-lakes.