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From peaks and patterns to proxy and palaeo: towards a reliable palaeoenvironmental record (Chew Bahir, southern Ethiopia)

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How do we convert variabilities and trends in hundreds of potential parameters that are typically analyzed in the framework of a scientific drilling project to actual climate proxies? Using the case study from the Chew Bahir core from the southern Ethiopian Rift, we will show that deciphering climate information from lake sediments is challenging, because of the complex relationship between climate parameters and sediment composition. Establishing a reliable climate proxy for a new terrestrial archive requires the stepwise development of a profound understanding of both climate-controlled and non-climate controlled processes in the catchment.

As a contribution towards an enhanced understanding of human-climate interactions the Chew Bahir Drilling Project, as part of HSPDP (Hominin Sites and Paleolakes Drilling Project) recovered 280 m-long sediment records from a deep, tectonically-bound basin in the southern Ethiopian rift in late 2014. The Chew Bahir record covers the past ∼600 ka of environmental history, a critical time period that includes the transition to the Middle Stone Age, and the origin and dispersal of modern Homo sapiens. By deconvolving the relationship between sedimentological processes and geochemical parameters and strongly climate-controlled processes in the Chew Bahir basin, such as weathering (incongruent dissolution), transportation and authigenic mineral alteration, site-specific indicators for climate shifts on different magnitudes are being developed to eventually provide a detailed and reliable climate record. This study uses a multi indicator approach including whole rock and clay mineral analyses (XRD), XRF geochemistry and sedimentology such as grain size analysis. We will illustrate how sensitively the degree of authigenic transformation in especially clay minerals and zeolites has recorded even subtle shifts in the hydrochemistry of paleolake and porewaters, thereby representing a robust tool for differentiating contrasting chemical environments controlled by climatic change. The precise time resolution, largely continuous record and (eventually) a detailed understanding of site specific proxy formation, will give us a continuous record of environmental history on decadal to orbital timescales. Our data enable us to test current hypotheses of the impact of a variety of climate shifts on human evolution and dispersal.