

EGU2020-2975

<https://doi.org/10.5194/egusphere-egu2020-2975>

EGU General Assembly 2020

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## **A 25-kyr record of East African monsoon variability: Insights from grain-size distributions and end-member modeling of siliciclastic sediments from Lake Chala**

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Terrigenous particles deposited in all kinds of sedimentary records (terrestrial, marine and lacustrine) have proven to yield valuable information for reconstruction of paleo-climate and paleo-environments. Natural sediments typically represent a mixture of deposits of diverse provenance, potentially supplied by different transport processes, expressed in a bi-or poly-modal grain-size distribution. Recently, complex mathematical-statistical end-member models have been developed to disentangle the different sub-populations within one grain-size distribution, which are then assumed to represent a distinct sediment fraction that has a single provenance and/or was transported by the same process to the site of deposition.

Here we present end-member modeling results of the terrigenous sediment fraction in a 25-kyr sediment sequence from Lake Chala (Kenya/Tanzania), revealing valuable information on climate and environmental change in equatorial East Africa since the Last Glacial Maximum (LGM). Calculated end members could be related to distinct source areas and transport processes, namely to fine aeolian dust, fine-grained soil runoff, coarser aeolian dust from proximal sources and coarse erosive material originating from the crater rim surrounding the lake. Variations in the occurrence of distal versus proximal dust is suggested to be a reliable indicator for changes in East African monsoon circulation. During Northern Hemisphere cold periods, such as the LGM and Younger Dryas (YD), wind systems associated with the Intertropical Convergence Zone (ITCZ) were pushed southward, causing a more intense influence of the NE monsoon at Lake Chala. This resulted in high amounts of fine dust originating from the Horn of Africa region. At the same time, SE monsoon circulation was diminished due to a reduced atmospheric pressure gradient between the Asian/Indian continent and the Indian Ocean. Influx of coarse dust from proximal sources, which are mostly located east of Lake Chala, was impossible due to the weaker SE monsoon circulation. After termination of the YD, rapid reestablishment of the SE monsoon in the Early Holocene is recorded by an abrupt increase in the influx of coarse dust.

Lake Chala sediments contain one of the few continuous and high-resolution climate records in East Africa spanning the past 25 kyr, providing detailed information on long-term climate variation in an area highly sensitive to hydrological variations. Subdividing the clastic sediment fraction into statistically robust end members produces multiple quantitative and independent proxies to help

reconstruct this region's climate and environmental history.