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The long sediment record of lake Challa: a unique equatorial archive, potentially crucial for understanding early human dispersal

Maarten Van Daele (1), Jasper Moernaut (2,1), Marc De Batist (1), and Dirk Verschuren (3)

(1) Renard Centre of Marine Geology (RCMG), Department of Geology and Soil Science, Ghent University, Gent, Belgium, (2) Geological Institute, ETH Zürich, Zürich, Switzerland, (3) Limnology research group, Department of Biology, Ghent University, Gent, Belgium

Lake Challa (Mt. Kilimanjaro, Kenya/Tanzania) is located in a key site for reconstructing the climate and landscape history of equatorial East Africa and hence, climatic influences on the living environment of early modern humans, Homo sapiens. Seismic-reflection data from this crater lake reveal a ∼210-m thick sedimentary infill containing distinct seismic-stratigraphic signatures of late-Quaternary lake-level fluctuations. Extrapolation of a well-constrained age model on the cored upper part of the sequence shows that the signatures of these lake-level fluctuations represent a detailed record of climatic moisture-balance variation in equatorial East Africa, continuous over at least the last 140 kyr and encompassing in total ∼250 kyr. The most severe aridity occurred during peak Penultimate glaciation immediately before 130 kyr BP (coeval with Heinrich event 11) and during a Last Interglacial 'megadrought' period between ∼115 and ∼98 kyr BP; in comparison, Last Glacial Maximum (LGM) aridity was modest. The LGM was preceded by ∼75,000 years of relatively stable and moist climate conditions interrupted by eleven short-lived dry spells, five of which match the timing of Heinrich events 2 to 6. Also in the lower part of the sedimentary infill the seismic stratigraphy provides evidence for short-lived dry spells, but artefacts and changes in basin geometry complicate their detailed interpretation and dating, respectively. The ICDP deep-drilling project DeepCHALLA aims to core the entire sedimentary sequence, which will allow reconstructing regional climate and ecological dynamics for the past ∼250 kyr, i.e. the entire documented existence of anatomically modern humans in East Africa. Knowledge of climate history in this equatorial region, where the northeasterly and southeasterly monsoons strongly interact, is crucial for documenting the severity and geographical distribution of prolonged drought episodes across tropical Africa, and thus for understanding the early dispersal of modern humans from Africa into Eurasia between ∼100,000 and ∼50,000 years ago.