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Plio-Quaternary palaeoenvironments in West Turkana (East African Rift System; Kenya): palaeolake fluctuations, palaeolandscapes and controlling factors

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The Turkana Depression consists of several Oligocene to Pliocene North-South oriented half-grabens that connect the Ethiopian and Kenyan rift valleys within the eastern branch of the Cenozoic East African Rift System. In the northern portion of the Turkana Depression, exposed on the west side of modern Lake Turkana, is the Nachukui Formation that consists of a > 700 m pile of fluvial-deltaic-lacustrine sediments deposited between 4.2 and 0.7 Ma. The Nachukui Fm is a world-class fossil-bearing succession into which more than 500 hominin fossils were discovered, including major discoveries for the understanding of Human evolution and more than 100 archaeological sites. Most significant discoveries include *Australopithecus anamensis*, *Kenyanthropus platyops*, *Paranthropus aethiopicus*, *Paranthropus boisei* and specimens of *Homo* (i.e., *H. rudolfensis* and *H. erectus*) and early members of *H. sapiens*, as well as the earliest evidence of Acheulean stone tool technology and, more recently, the most primitive Lomekwian stone tool technology.

Palaeoenvironmental changes may have had a strong influence on evolution, including that of the human lineage. However, in the Turkana Depression, palaeoenvironments are still very partially reconstructed and the respective role of climate and tectonism is still debated. Here, we used the interpretation of depositional environments, the delineation of depositional sequences and a record of $d^{13}C$ in pedogenic carbonates (i.e. paleovegetation proxy) to reconstruct 1) palaeolake Turkana fluctuations between ca. 4 and ca. 1.2 Ma and 2) the successive sedimentary palaeoenvironments and resulting landscapes that characterized the West Turkana area during the same time interval.

Facies and sequence analyses reveal that palaeolake Turkana experienced eight low-frequency transgression-regression (T-R) cycles between ca. 4 and ca. 1.2 Ma; superimposed lower amplitude and shorter duration T-R cycles are also locally identified revealing subordinate-order fluctuations. In the same time, two different palaeolandscapes (labelled type-1 and type-2)

alternated through times revealing variations in sediment supply coming from the western rift shoulder. A statistical treatment of the $d^{13}C$ record using a modified k-mean clustering allows us to confront a paleovegetation proxy and the sedimentological record. This combined approach reveals that the evolution of rainfall over the Ethiopian dome (i.e., drainage basin of the Omo river) controlled long-term palaeolake Turkana fluctuations during the Plio-Quaternary period while tectonism likely controlled the occurrence of different palaeolandscapes in West Turkana forced by changes in the rate of sediment supply.

Finally, our study shows that traditional methods of basin geology (i.e., facies and sequence analysis) are key tools to provide large-scale paleolandscape reconstructions and palaeolake fluctuations needed for investigating the interactions between hominins and palaeoenvironments. Such a powerful procedure, however, is rare for hominins sites and has yet to be integrated in the workflow utilized by the paleontology and archeology communities.

This is a contribution of the Rift Lake Sedimentology project (RiLakS).