Geophysical Research Abstracts
Vol. 19, EGU2017-18172, 2017
EGU General Assembly 2017

Can phytoliths and lipid biomarkers constrain and refine isotopic palaeoclimatic reconstructions? Insights from the Homa Peninsula, western Kenya

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Several archaeological sites on the Homa Peninsula, western Kenya, host Plio-Pleistocene sedimentary sequences that contain hominin archaeological traces and faunal remains. As a result, the region preserves rare palaeoanthropological information of a crucial time period in East Africa. By reconstructing the palaeoenvironmental substrate here, a deeper understanding of hominin activities and behaviour in variable landscapes will be gained. This is the aim of the current research, which utilises a multiproxy approach to reconstruct the palaeoenvironment, encompassing analyses of particle size, phytoliths and lipid biomarkers.

Previous work at the most extensively studied site on the peninsula, Kanjera South, has shown sediments containing archaeological occurrences to be ca. 2 Ma in age. Reconstructions of the palaeoenvironment here have largely been based on field investigations and isotopic analysis of pedogenic/palaeosol carbonates and tooth enamel, which revealed clear evidence of a grassland setting (>75% C4 vegetation). However, in order to form robust and reliable reconstructions of palaeoclimate, information derived from a single proxy is insufficient. For example, the prolonged and seasonally biased formation of pedogenic carbonates can mask seasonal fluctuations in vegetation, causing variable environmental settings to be overlooked when using isotope data from this source. Soil organic matter offers another source of isotope data, however 13C enrichment from plant carbon may also introduce uncertainty here.

Resultantly, due to the significance of the site, it is essential that reconstructions of the palaeoclimate, palaeovegetation and palaeoenvironment as a whole are robust and reliable, and so multiproxy evidence is essential. Here, we present the use of phytoliths and lipid biomarkers to provide further insights into the C3/C4 vegetation distribution on the peninsula, and consequently act as proxies for palaeoclimate and palaeovegetation. Both techniques can provide more detailed information on vegetation structure, whilst lipid biomarkers also offer increased spatial resolution. However, similar to isotopic reconstructions, uncertainties exist within both of these techniques. For example, differential production rates of phytoliths can produce biased records, whilst terrestrial reconstructions using lipid biomarkers favour lowland vegetation. Despite this, by comparing ongoing work from the three proxy records, a more accurate and robust reconstruction of palaeoclimate on the Homa Peninsula can be obtained.