EARLY HUMAN BEHAVIOUR REVEALED THROUGH PLANT BIOMARKER DISTRIBUTION PATTERNS

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Introduction

Disentangling the influence of environment on human evolution is essential for understanding early hominin behavior (Kingston 2007). However, traditional landscape reconstructions associated with key early hominin archaeological sites have been based on regional or global records underestimating the effect of local-scale conditions (Winterhalder 1980; Potts 2012). Recently, work by Magill et al. (2013a, 2013b, 2016) showed that lipid biomarkers and isotopic signatures can afford a better understanding of ecosystem variability from a local perspective as well as unveil the distribution of plant foods, refuge and water influencing the hominin microhabitat. Although this spatial approach has yielded a great deal of important information about early hominin microhabitat, it is also limited in the sense that the temporal resolution in geological stratigraphy is sometimes far from the small time scale in archaeological stratigraphy necessary to investigate human behavior.

Here, we present high temporal resolution meter scale vegetation patterns suggested by plant biomarkers in the newly discovered 1.84 Ma site of DS (Bed I, Olduvai Gorge). This important new early human archaeological site has provided several hominin remains and has already exposed 370 m^2 of the same discrete archaeological level. This area, bigger than that excavated at FLK Zinj (Leakey, 1971), which until now has been the biggest open window to the African Early Pleistocene, showed a substantial concentration of fossil bones and stone tools. To assess the spatial pattern of plants and its correspondence with the remain densities in the DS site we collected, throughout 370m^2, nearly 100 samples correlated with the four geoarchaeological layers (22a, 22limo, 22b, 22CHT) comprised in the Level 22 or Zinj (Uribelarrea et al., 2014), that was previously study as a single level (Magill 2016).

Our preliminary GC-MS and GC-IRMS results define a microhabitat landscape eminently influenced by water and highly variable through the level 22. P_{aq} (Ficken et al., 2000) and $\delta^{13}C$ values suggest a habitat dominated by aquatic macrophytes with isolated wooded patches that correlate with the areas of higher densities of archaeological remains. These patches change their position depending on the layer analyzed evidencing the variable conditions of the site during the Level 22. The abundance of long chain alkan-2-ones suggests a wetland dominated by sphagnum; while some samples showed shorter alkan-2-ones that would point to the presence of ferns, also identified by Magill et al. (2016). The chain-length contrast with the n-alkanes indicates that these ketones cannot be the product of microbial oxidation of n-alkanes. Our results support the importance of these edible plants for the early hominin subsistence that were also pointed by Magill et al. (2016).

Conclusions

This study presents a continuous record of plant lipid biomarkers and isotopic signatures correlated with four geoarchaeological layers from the level 22 (1.8 Ma) from Olduvai Gorge. Our results indicate a variable microhabitat that potentially shaped the way in which hominins occupy space. Our high temporal resolution approach enables us to address the correlation with the archaeological spatial distribution in a time scale sufficiently accurate to uncover patterns that could convey behavioral information. These patterns, resulting from non-random human decisions, are the result of regularities in the spatial materialization of those behaviors (Dominguez-Rodrigo et al., 2016). The analytical approach presented here can potentially contribute to the understanding of aspects beyond ecosystem variability and into the realm of hominin behavior at sites.

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