

Reconstruction of vegetation and habitat at an early Acheulean site using leaf-wax lipids and isotopes: Thiongo Korongo (Olduvai Gorge, Tanzania)

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Early Acheulean sites at Olduvai Gorge show the complexity and variability of the *Homo erectus* behaviour. The highest concentration of early Acheulean sites recorded in Bed II at Olduvai Gorge allows the analysis of the *Homo erectus* behaviour during the early stage of Acheulean in a confined geographical frame. To comprehend this behaviour it is necessary to understand the habitat of hominin. A strong, positive correlation between technological innovations and landscape (ecosystem) change is considered to be a main driver of human evolution. Here, we focus on an important Bed II locality – Thiongo Korongo (TK) – that has some of the highest concentrations of autochthonous Acheulean stone tools at Olduvai Gorge, in an attempt to unravel key patterns in coeval landscape change and resource distributions via robust ‘biomarker’ molecular and isotopic analyses.

TK is situated 2 km east from the junction of the main and side gorges at Olduvai and stratigraphically is located in the Upper Bed II; TK is related to Tuff IID which has been dated by $^{40}\text{Ar}/^{39}\text{Ar}$ to 1.353 ± 0.035 Ma [1]. TK is one of the sites with the highest concentrations of autochthonous preserved Acheulean lithic tools. The remains are principally situated in two paleo-surfaces, named TK Lower Floor (TKLF) and TK *Sivatherium* Floor (TKSF) [2,3] that are stratigraphically close; there is not significant temporal diachrony [2]. However, the technological advancements of manufacturing the tools show strong differences amid the lithic industry and faunal remains between the two paleosurfaces.

Here, we report lipid biomarker of the TK sedimentological section ($n = 12$), including both TKLF and TKSF layers. We analysed the total lipid extract of these sediments, including n-alkanes, fatty acids (FAs), and stable carbon and hydrogen isotopic composition of lipids ($\delta^{13}\text{C}$ and $\delta^2\text{H}$). Plant leaves n-alkanes results show that the compounds were abundant and well preserved in the sedimentary section. Carbon preference index (CPI) values and average chain lengths of n-alkanes (ACL) show a prevalence of short-chain lengths, reflected in the aquatic index Paq (0.39 to 0.9). This means that the environment was dominated by submerged/floating macrophytes. All samples show abundant fatty acids, and the prevailing ones are C18:0, C16:0, and C22:1 FAs. Preliminary isotopes data suggest that the vegetation was characteristic of a wet environment dominated by aquatic plants.

These data provide the earliest evidence of early hominin technological advancements in relation to available plant resources and riverine environments.

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References: [1] Domínguez-Rodrigo, M., Pickering, T.R., Baquedano, E., Mabulla, A., Mark, D.F., Musiba, C., Bunn, H.T., Uribealrrea, D., Smith, V., Díez-Martín, F., Pérez-González, A., Sánchez, P., Santonja, M., Barboni, D., Gidna, A., Ashley, G., Yravedra, J., Heaton, J.L., Arriaza, M.C., 2013. First Partial Skeleton of a 1.34-Million-Year-Old *Paranthropus boisei* from Bed II, Olduvai Gorge, Tanzania. PLoS ONE 8, e80347. <https://doi.org/10.1371/journal.pone.0080347> [2] Rubio-Jara, S., Panera, J., Santonja, M., Pérez-González, A., Yravedra, J., Domínguez-Rodrigo, M., Bello, P., Rojas, R., Mabulla, A., Baquedano, E., 2017. Site function and lithic technology in the Acheulean technocomplex: a case study from Thiongo Korongo (TK), Bed II, Olduvai Gorge, Tanzania. Boreas 46, 894–917. <https://doi.org/10.1111/bor.12275> [3] Santonja, M., Rubio-Jara, S., Panera, J., Pérez-González, A., Rojas-Mendoza, R., Domínguez-Rodrigo, M., Mabulla, A.Z.P., Baquedano, E., 2018. Bifacial Shaping at the TK Acheulean Site (Bed II, Olduvai Gorge, Tanzania): New Excavations 50 Years After Mary Leakey, in: Gallotti, R., Mussi, M. (Eds.), The Emergence of the Acheulean in East Africa and Beyond. Springer International Publishing, Cham, pp. 153–181. https://doi.org/10.1007/978-3-319-75985-2_8