

Molecular and isotopic constraints on early human land-use at Olduvai Gorge

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Food and water availability fundamentally impact modern human behavior, and also hold hypothetical importance during the course of early human (hominin) evolution. Ocean and lake sediments provide crucial context for understanding regional climate change, but cannot resolve local ecohydrologic details that ultimately shape evolutionary processes. Here, we present biomarker and stable isotopic signatures for organic matter preserved in syndepositional soil (paleosol) sediments from a ~0.25 km² area encompassing the iconic FLK *Zinjanthropus* (FLK *Zinj*) archaeological locality at Olduvai Gorge, dated to 1.839 million years ago. Leaf-wax $\delta^{13}\text{C}$ values vary from -19.4 to -33.1‰. Respective leaf-wax $\delta^2\text{H}$ values span nearly 40‰, but converge near -7‰ when corrected for differences in isotopic fractionation among plant functional types. Paired $\delta^{13}\text{C}$ - $\delta^2\text{H}$ values reveal sharp differences in (micro)habitat structure around FLK *Zinj* in which grassland surrounded discrete forest and wetland patches. Leaf-wax $\delta^2\text{H}$ values correlate with $\delta^{18}\text{O}$ values for attendant carbonate minerals, suggesting groundwater availability was a key influence on microhabitat distribution. Densest accumulation of hominin remains occurs within the confines of the forest patch, and we conclude hominins earmarked FLK *Zinj* because it afforded refuge and water in an otherwise harsh environment.