



## Disentangling hominin and carnivore activities near a spring at FLK North (Olduvai Gorge, Tanzania)

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### ABSTRACT

FLK North is one of the densest concentrations of fossils found in Olduvai Gorge. A recent taphonomic re-evaluation of the collection excavated by Leakey at the site suggests that it was a palimpsest in which most of the animals were accumulated and modified by carnivores. The lithic tools therefore seem to have an independent depositional history from most of the fauna. The present study, based on new excavations, expands the evidence supporting this interpretation and demonstrates a thicker deposit than was reported by Leakey, including new archaeological levels. It also shows that in the few instances where hominins butchered carcasses, meat, not marrow, was their main target. This argues against passive scavenging hypotheses, which emphasize the dietary role of marrow, and instead underscores the importance of meat in the diet of early Pleistocene hominins.

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### Introduction

A taphonomic review of some of the most important early Pleistocene archaeological sites in Africa revealed that most sites that include indication of hominin behavior are also palimpsests (Domínguez-Rodrigo et al., 2007). Taphonomic and geological data for some of these palimpsests, which sometimes span impressive thicknesses of several meters of slowly deposited clays, indicate repeated occupation of the same place by hominins and other agents (e.g., carnivores) over hundreds and even thousands of years. The reasons why the same spots were visited recurrently by hominins remained unclear, however, as did the functionality of the sites and what they actually represent for the understanding of the origins of human behavior.

One of the most impressive palimpsests where hominins used the same place repeatedly, probably over several millennia, is FLK North (FLK N, Olduvai Gorge, Tanzania). There, an impressive accumulation of stone tools and bones was created over a long period of time

spanning >6 m of clays and tuffs. What drew hominins to the same spot for so long? What was special about that location, within a lacustrine floodplain, that caused hominins and other agents to overlap in the use of that space? Was the site a brief stop in the hominin foraging home range, and thus visited only for specific expedient activities, or was it used for something more complex that required a more prolonged stay? Our recent re-excavation of the site has aimed to address these questions.

FLK N is situated in uppermost Bed I. It is <100 m north of the famous FLK 22 *Zinjanthropus* (FLK Zinj) site. FLK N is the thickest early Pleistocene archaeological deposit currently known. Leakey (1971) uncovered three archaeological levels overlying Tuff IF, two in lowermost Bed II (FLK N clay with root casts and FLK N *Deinotherium* level) and one situated in the middle of Bed II (FLK N sandy conglomerate). Underlying Tuff IF, she excavated six archaeological levels (FLK N 1–6), which she interpreted as hominin “living floors” (levels 1–2 to 5) and the lowermost one (level 6) as an elephant butchery site (Leakey, 1971). Table 1 provides a geological description of these levels. The criteria that Leakey used for differentiating levels was mainly a change in the color or in the lithological properties of the sediments, although in some cases (e.g., levels 1–3) she separated the levels by their varying density of included materials and their differential vertical distribution within the same geological layer. A

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**Table 1**  
Description of the lithology of the archaeological levels.

Archaeological level	M. Leakey	TOPPP
Levels 1–2 and 3	A single 2–3 ft. horizon of a gray-brown silty clay	A light waxy clay deposit spanning a maximum of 80 cm
Level 4	A dark chocolate brown silty clay varying in thickness from 1.5 ft. to 3–4 in.	A dark waxy clay spanning 60 cm maximum
Level 5	A greenish-yellow clay with ferruginous bands and a fine-grained white tuff towards the base	Same definition as in Leakey (1971)
Level 6	A dark grayish-brown silty clay with white streaks about 1.5 ft.	Dark waxy clay with carbonate nodules and white streaks spanning between 20 cm and 50 cm
Level 7		Light-gray clay with white streaks spanning between 15 cm to 20 cm and containing large concretions
Level 8		Light-gray to yellowish clay spanning 13 cm to 18 cm separated from level 7 by a thin layer of white carbonate/limestone and a ferruginous band
Level 9.		Dark waxy clay between 16 cm to 31 cm. The lowest part shows an abundance of oncolites, underlain by a tuffaceous clay

recent taphonomic re-evaluation of Leakey's collections concluded differently from Leakey that most of the FLK N archaeological levels are (1) palimpsests that were accumulated almost exclusively by carnivores killing and/or consuming animals on the spot or (2) mixed assemblages where carnivores and hominins contributed independently (the latter in a much more marginal way) to the accumulation and modification of animal bones (Domínguez-Rodrigo et al., 2007).

The present study aims to analyze new archaeological and paleontological data from FLK N to test this new palimpsest hypothesis, and to further refine the reconstruction of hominin roles in each of the archaeological levels. We aim to define the lowermost boundary of FLK N site, which could not be investigated earlier by Leakey (1971), who finished her excavation after the removal of the materials from level 6 because the underlying and overlying sediments (depending on the area) were highly compacted limestone (Leakey, 1971, 64). We also provide higher resolution spatial information on the position of archaeological materials in order to ascertain if Leakey's (1971) division of archaeological layers is supported. Finally, we investigate whether the vertical dispersion of archaeological materials in each level was due to the continuous occupation of the site, with multiple depositional events, or to more discrete depositional intervals but with trampling or vertical migration of materials.

## Methodology and sample description

### *The characteristics of the new trenches and the excavation*

When Leakey excavated FLK N in 1960, she opened five trenches of variable dimensions according to level (no level was exposed for more than 100 m<sup>2</sup>). We, as part of The Olduvai Palaeoanthropology and Palaeoecology Project (TOPPP), opened two archaeological trenches, separated by a 1 m wall, at the back of Leakey's trenches, continuing from near the back wall of Leakey's trenches IV (which showed the highest density of remains in level 1–2), III and a small part of II (Fig. 1). The location of the new trenches was also determined in part by multiple trenches opened by OLAPP

(Olduvai Landscape Palaeoanthropology Project) in Bed II sediments on both sides of our excavation, which we agreed not to reopen. Trench 1 measures 2 × 3 m and is situated approximately to the south of Leakey's Trench IV. Trench 2 measures 4 × 2 m (Fig. 1D) and is situated to the south of Leakey's Trenches III and part of II. One of our trenches exposed a deeper stratigraphic sequence than exposed by Leakey (1971) (Fig. 2) and yielded comparable and higher densities of archaeological materials as the densest areas excavated by Leakey (1971). This indicates to us that the bulk of the site was not completely excavated by Leakey and that an extensive area of it is still unexcavated. We also opened a 1-m-wide geological step-trench ~25 m to the east of the site to expose its boundary (Fig. 3A), which is described in more detail in Ashley et al. (2010a).

Initially, excavation in both trenches proceeded from the "clay with root casts" level in Bed II through Tuff IF. Given the high density of remains in level 1–2, the different excavation seasons (Trench 1 was initiated in 2007 and Trench 2 in 2008) and the size difference between the trenches, Trench 1 was further excavated through levels 1–2 to 6 and then, after removing the tuffaceous limestone, excavation proceeded deeper, uncovering three more archaeological levels (Fig. 2), described below and in Table 1. Trench 2 is still in the process of being excavated and will be presented separately. Analysis of the faunal and lithic remains from level 1–2 is found, respectively, in Bunn et al. (2010) and Diez-Martin et al. (2010). We ceased excavation in Trench 1 after reaching level 9, not because the deposit became sterile, but because the small size of the trench did not allow us to continue any further without compromising the quality and safety of the excavation.

Excavation was carried out systematically with the aid of small tools. We used large picks only when digging through Tuff IF, cemented sections, and the tuffaceous limestone separating the first five levels from the lower ones. The term "level" is applied here following the same definitions established by Leakey (1971) in her excavation of the site; that is, it mainly follows geological criteria and identifies each level according to its lithological properties. The exceptions are the upper three levels, which, following Leakey, are based on changes in the densities of artifacts and fossils and a partial sedimentary hiatus in between vertical concentrations of materials, which we have done for the sake of comparing the retrieved materials from Leakey's and our excavations. All sediment was sieved through 5-mm mesh. Each fossil and artifact ≥2 cm was plotted with a laser total station and each level was drawn, following Leakey's example. The total station was used to plot individual archaeological items.

The spatial plots shown in this work do not present horizontal long shapes (produced by plotting the ends of each item), which may be potentially useful to infer paleosol topography, because most levels have been identified in geological layers that lack paleosols, and also because bones with a clearly defined long axis (length >3 times width) showed a variety of degrees of vertical tilting. This phenomenon has been experimentally documented in clay contexts where the sediment is either periodically wet and dry and/or trampled (Domínguez-Solera, 2010). This ample range of vertical tilting would prevent the documentation of the shape of any paleosurface accurately. The use of the total station, though, allowed a three-dimensional reconstruction of the deposit, which is an improvement of the two-dimensional information provided by Leakey for each archaeological level that she excavated by showing the vertical location of each artifact and fossil. This has been shown to be important when considering the diachronic deposition of materials (especially when comparing lithics to fossils) prior to making any functional inference of their spatial association (Domínguez-Rodrigo et al., 2009) because it can contribute to detecting depositional histories of materials that appear more closely associated if displayed on a two-dimensional plot.

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