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Unraveling hominin behavior at another anthropogenic site from Olduvai Gorge (Tanzania): new archaeological and taphonomic research at BK, Upper Bed II

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ABSTRACT

New archaeological excavations and research at BK, Upper Bed II (Olduvai Gorge, Tanzania) have yielded a rich and unbiased collection of fossil bones. These new excavations show that BK is a stratified deposit formed in a riverine setting close to an alluvial plain. The present taphonomic study reveals the second-largest collection of hominin-modified bones from Olduvai, with abundant cut marks found on most of the anatomical areas preserved. Meat and marrow exploitation is reconstructed using the taphonomic signatures left on the bones by hominins. Highly cut-marked long limb shafts, especially those of upper limb bones, suggest that hominins at BK were actively engaged in acquiring small and middle-sized animals using strategies other than passive scavenging. The exploitation of large-sized game (*Pelorovis*) by Lower Pleistocene hominins, as suggested by previous researchers, is supported by the present study.

Introduction

Recent taphonomic re-analyses of all the Olduvai Bed I sites have shown that with the exception of FLK Zinj, all sites were palimpsests with minimal hominin input in the accumulation and modification of archaeofaunas (Domínguez-Rodrigo et al., 2007). An extension of this analysis to all Bed II sites has also shown that, with the exception of BK, all faunal assemblages were either too poorly preserved to evaluate, or accumulated by biotic agents other than hominins (Egeland and Domínguez-Rodrigo, 2008). A taphonomic review of all sites older than 1 Ma (Domínguez-Rodrigo, 2008a) stresses the scarcity of sites of anthropogenic origin in all of the Lower Pleistocene, in which a functional link between stone tools and fauna can be established. Therefore, archaeologists are faced with the following questions: were the butchery and meat-consumption behaviors inferred from sites such as FLK Zinj marginal or common in Plio-Pleistocene hominins? Is there any other Plio-Pleistocene site where the faunal assemblage could be identified as completely (or mostly) accumulated and modified by hominins?

The fact that many sites are now understood to be palimpsests underscores the need to increase samples of faunal assemblages that might be attributed to hominin behavior, and thoroughly analyze them with modern taphonomic techniques so as to understand hominin behavioral variability. A recent study of the BK faunal collection stored at the National Museums of Kenya (Nairobi) showed some affinities with FLK Zinj that deserved further scrutinizing (Egeland, 2007; Egeland and Domínguez-Rodrigo, 2008). This prompted our re-investigation of the BK site.

The BK (Bell's Korongo) site was found in 1935 at the top of Bed II in lateral connection with a tuff (Tuff IID) that was dated to 1.2 Ma (Leakey, 1971; Hay, 1976). The clays, silts, and sands that contain the archaeological deposit represent the fillings of a riverine system responsible for the erosion of Tuff IID, which the site overlies. Several visits, minor excavations, and selective surface and *in situ* collections were carried out in 1952, 1953, 1955, 1957, and eventually in an extensive and less selective excavation in 1963. These excavations (totaling 10 trenches) revealed a very rich assemblage of stone tools and bones amounting to over 6,800 lithic

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pieces, including 652 whole flakes, 721 tools, and almost 400 pieces of utilized material (Leakey, 1971). This assemblage was classified as belonging to the Developed Oldowan B complex (Leakey, 1971, 1976). Approximately 2,900 faunal remains were also unearthed, of which Bovidae, Equidae, and Suidae are the most abundant groups. Pieces of ostrich eggshell were unusually plentiful.

A striking feature of this site was the presence of a minimum of 24 individuals of the large buffalo-like bovid *Pelorovis*, found in the same area of the old excavation (Trench 5-6-7 set). One of them was found virtually complete and lying in a silt deposit, which had been interpreted as a swamp. Leakey (1971) offered this discovery as proof of the butchering of *Pelorovis* carcasses by hominins, possibly after having forcefully driven them into the swamp. If true, this would be the oldest recorded episode of megafaunal hunting and butchery. The site was initially interpreted as a hominin camp situated adjacent to a river or swamp, with part of its contents having been washed into the river channel (Leakey, 1971).

The bone assemblage excavated by Leakey (1971) was first taphonomically analyzed by Monahan (1996), and then by Egeland (2007). Monahan reported a low frequency of hominin-imparted marks in the assemblage (<5%), including 46 cut-marked and 49 percussion-marked specimens out of a NISP of 1078, which is substantially lower than the frequency of tooth-marked specimens (7.7%) he identified. He interpreted the site as a hominin-carnivore scenario, in which hominins butchered carcasses prior to the intervention of carnivores, although he remarked on the paucity of hominin-imparted marks when compared to either human-carnivore experimental scenarios or to other anthropogenic sites such as FLK Zinj.

Egeland (2007) also reported a low frequency of tooth-marked specimens in the assemblage (<10%) and a similarly low number of cut-marked fragments ($n = 33$). Egeland documented a lower number of percussion-marked specimens ($n = 19$) than Monahan. Despite this, he also interpreted BK as a hominin-carnivore assemblage, the result of hominins repeatedly butchering carcasses in the same spot. Egeland (2007) stressed that, despite the strong hominin signal, the great depth of the deposits cautioned against interpreting the entire assemblage as hominin-derived. In Egeland's (2007) analysis, it became clear that the taphonomic properties of the assemblage differed from those documented in most Bed I and Bed II sites (Domínguez-Rodrigo et al., 2007; Egeland and Domínguez-Rodrigo, 2008). The anthropogenic factor seemed to have been more important–as initially reported by Monahan (1996)–than at the other Bed II sites, which instead represent natural palimpsests. This key difference warrants further investigation of the faunal remains from BK.

The present research introduces the first unbiased bone assemblage (where all specimens irrespective of preservation and size were retrieved) from BK, with clear contextual information and a thorough taphonomic analysis. Leakey's (1971) original interpretation of the site will also be re-evaluated in light of this recent research. This is the first publication of renewed archaeological research in the form of large-scale excavation at any of the Olduvai sites excavated by M. Leakey almost 50 years ago.

The excavation of BK

In the summer of 2006, an international team headed by M. Domínguez-Rodrigo and A. Mabulla resumed excavations at BK. One 10 m × 3 m trench was opened between Leakey's Trench 4 and the Trench 5-6-7 set (Fig. 1a, b). Trench 4 contained the remains of what was once an open-air exhibit created by Leakey, showing a dense concentration of bones and stone tools. More than 90% of the original exhibit, along with the building constructed to shelter the archaeological assemblage, had disappeared (Fig. 1c, d). The remaining fossils were slowly eroding out of their context and sliding down the outcrop. We decided to salvage these valuable fossils to enable their study. Therefore, these fossils were plotted, collected, and analyzed in the same fashion as the fossils derived from the excavation of our trench.

Leakey's original excavations lacked crucial information regarding the vertical distribution of materials at BK. Since it has been shown that most of the Bed I sites are palimpsests (Domínguez-Rodrigo et al., 2007), having both vertical and horizontal control of the materials in any new excavation is essential. Thus, recent excavations used a total station to document the spatial distribution of all excavated materials and map the intricate stratigraphy of the site. Small hand tools were utilized during the excavation of the fossiliferous levels and larger tools were used in the sterile sections of the sequence. Sediments were completely sieved, with every visible fragment collected. These procedures retrieved more than 6,000 bones and 1,500 flaked stone specimens; this is many more faunal remains than Leakey recovered in all her trenches combined, suggesting the selective collection of materials by prior excavators, given that our trench was situated in between the trenches excavated by Leakey (1971).

Leakey reported that the average thickness of the archaeological deposit at BK was 5 ft (~1.5 m). In our excavation, the overall depth of deposit was documented as 3 m, almost twice that previously reported (Fig. 2). Furthermore, three clearly differentiated archaeological levels were detected during excavation. A possible fourth level, represented by Leakey's exhibit level in the adjacent trench, did not occur in our trench because it rests on the main body of the channel at the exhibit level. If we consider this a separate level, then we can initially distinguish four archaeological levels. We do not know if the exhibit level is different from what we identified as the *Pelorovis* level in our trench. It certainly occurs above the *Pelorovis* level, and the channel sediments in which it is embedded barely contain any fossils in the excavated part of our trench. For the sake of objectivity, and given that it was not located in our trench, we keep the exhibit level separate in the present analysis.

The bottom level (BK4), with vertically scattered materials, corresponds to Leakey's *Pelorovis* level. Faunal materials in this level were more intensively affected by carbonation and soil humidity, in contrast to the well preserved materials in the overlying levels (see below). The carbonation consisted of carbonate concretions adhered to fossils and sediments, which reacted to acid. The origin is unknown, but they could result from carbonate deposited by lake transgressive cycles after burial, which resulted in the cementation of the soil. It is difficult to classify Leakey's BK collection according to these newly-documented levels, but it likely comprises the lowermost two–the *Pelorovis* level (BK4) and the exhibit level (BK3)–since they span 1.5 m in depth as reported by Leakey (1971) and have similar taphonomic properties as those levels documented by our field research. Furthermore, both levels contain a high density of faunal remains belonging to animals larger than Bunn's (1982) size 3, especially in BK3 where they comprise almost one-third of the specimens retrieved.

Each of the three levels we excavated showed a different density of materials. This is not the result of excavating different dimensions in each level, with the lower section of the stratigraphy having a larger area exposed, since even though smaller areas could potentially be excavated higher up in the sequence (given that the trench was cut into a steep slope; see Fig. 3), our excavation strategy involved creating steps, which exposed similar areas in all the excavated levels. We created a step immediately after reaching the level where Leakey's exhibit level (BK3) should have appeared, where we found the main body of the channel instead. This makes the excavated levels–given that BK1 and BK2 were stratigraphically