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FwJj70 – A potential Early Stone Age single carcass butchery locality preserved in a fragmentary surface assemblage

Stephen R. Merritt[a,*], Silindokuhle Mavuso[b], Eleanor A. Cordiner[c], Kelly Fetchenhier[d], Elliot Greiner[c]

[a] *University of Alabama at Birmingham, Anthropology Department, United States of America*
[b] *University of the Witwatersrand, School of Geosciences, South Africa*
[c] *The George Washington University, Anthropology Department, United States of America*
[d] *Colorado State University, Anthropology Department, United States of America*

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ABSTRACT

The Okote Member (1.39–1.53 million-years-ago) of the Koobi Fora Formation preserves a rich and well-resolved lithic archaeological record, but comparatively little is known about the paleoecology of stone tool use during hominins' carnivorous foraging behavior. Archaeological butchery traces are typically found in fragmentary assemblages with well-preserved cortical surfaces that include multiple butchered individuals and carcass parts, but conclusions about butchery behavior, including skeletal element profiles and element and individual estimates may be impacted by specimen identifiability and differential preservation during palimpsest assemblage formation. Here we present an analysis of a fragmentary surface assemblage of fossil bone, designated FwJj70, that includes butchered and tooth-marked specimens and fragments of additional mammal carcasses to explore the archaeological visibility of carcass consumption at the lower boundaries of data quality – in particular, imprecise specimen identifiability and poor assemblage preservation. FwJj70 includes a similar composition of mammalian families and size classes in comparison with the fauna recorded along 400 m of the same stratigraphic horizon but possesses less weathered specimens with fewer post-fossilization and dry fractures, suggesting that bone specimens were rapidly buried. Excavation in search of an *in situ* origin of the surface assemblage recovered three specimens, but did not reveal a clear archaeological horizon. FwJj70 includes 40 identifiable specimens from at least 21 elements and six mammalian individuals. Eight specimens from a minimum of four elements and a single individual preserve evidence of hominin butchery and may come from a single size-three mammal carcass. However, poor specimen identifiability and *ex situ* context lead to a coarse estimate of the true number of butchered animals in the assemblage, blurring the distinction between a single carcass butchery episode and consumption of multiple animals, and masking the activity of carnivores. Despite this equifinality, the anatomical location of butchery marks at FwJj70 provides evidence of discrete aspects of hominins' tool-assisted carnivorous foraging niche, including early access to limb flesh packages, bone marrow consumption, and competition with other carnivorous consumers.

1. Introduction

The Koobi Fora formation, on the east side of Lake Turkana in Kenya, includes Plio-Pleistocene deposits that record hominin morphological and behavioral evolution and their surrounding paleoecological contexts *via* hominin fossils and archaeological remains. Diverse lines of evidence shed light on Okote Member (1.54–1.39 Ma) paleobiology, which preserves fossils of *Paranthropus boisei*, early genus *Homo* and *Homo ergaster* (Leakey and Leakey, 1978; Wood, 1991; Spoor et al., 2007), paleontological remains of terrestrial macromammalian faunal communities (Brown and Feibel, 1991; Brown et al., 2006; Harris, 1991), lithic archaeological assemblages (Isaac and Isaac, 1997), and zooarchaeological evidence of hominin carcass consumption (Bunn et al., 1980; Bunn, 1981, 1994; Pobiner et al., 2008; Merritt, 2017). During this time period, technological innovation from the Developed Oldowan to Acheulean and increasingly complex tool-assisted carnivorous foraging behavior are argued to underlie encroachment of the genus *Homo* into the carnivore paleoguild, evolutionary increases in brain size, and the extinction of *Paranthropus* (Anton and Snodgrass, 2012). Lithic archaeological deposits record a sophisticated

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[*] Corresponding author.
E-mail address: stmerr@uab.edu (S.R. Merritt).

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technological component of the hominin foraging niche including production of diverse lithic artifact types, tool transport, and raw material selectivity (Rogers et al., 1994; Braun et al., 2008). As well, archaeological sites can be tied into a paleoecological reconstruction of mammalian faunal communities in the eastern Turkana basin that include complex mosaics of open and wooded habitats that were influenced by paleogeography of axial and basin margin drainages along with intermittent standing water including oxbow lakes and marshes, (Isaac and Behrensmeyer, 1997; Patterson et al., 2017). When integrated with zooarchaeological data, these independent lines of evidence can be used to build a general interpretation of the hominin tool-assisted carcass consumption niche.

High-resolution (Binford, 1981) zooarchaeological occurrences require excellent preservation on the individual specimen and assemblage scales, and as such, are relatively rare in the Koobi Fora Formation. The Okote Member contains the most abundant and diverse lithic assemblages associated with butchered bones like FxJj20 and 50, which record repeated episodes of tool manufacture and carcass consumption at focal spots on the relatively wooded, floodplain habitats of the Karari Ridge (Bunn, 1997). Unfortunately, poor bone preservation, including small specimen size, weathered or otherwise degraded cortical surfaces, leads to small samples of butchery marks in the assemblage, and may skew other zooarchaeological metrics like minimum number of element (MNE) or individual (MNI) estimates, and skeletal part profiles, which rely on precise anatomical or taxonomic identification for individual specimens (Bunn et al., 1980; Lyman, 1994). Other large zooarchaeological localities like FwJj14 North and South in Ileret and GaJi14 on the Koobi Fora Ridge, include well-preserved bone assemblages in relatively more open, marshy habitats, and lack associated lithic remains. These localities are thought to represent butchery of multiple animals without on-site tool manufacture or discard, which may reflect their distance from tool material sources (Bunn, 1994; Pobiner et al., 2008). Despite carnivore ravaging after hominin discard which deleted limb ends, these localities preserve many specimens, including butchered bones that are identifiable to skeletal element and taxon, and a large assemblage of less-identifiable long bone shaft specimens that can be assigned to animal size – some of which bear traces of butchery (Merritt, 2017). Even though these assemblages offer a clearer view of hominin carnivory than the Karari Ridge sites, small specimen size likely introduced by carnivore activity and fragmentation during diagenesis, reduces identifiability and the reliability of assemblage metrics like MNE and MNI.

Analysis of butchered bone in these assemblages suggests broad, flexible behavioral patterns characterized Okote Member hominin carnivory (Merritt, 2017). Hominins engaged in diverse paleoecological strategies of tool assisted-carnivory including early access to large and small mammals, consumption of late-stage carcass resources like marrow, brains, and meat scraps which may have been scavenged from carnivore kills, and sub-basin scale spatial scheduling of stone tool manufacture and use in accordance with local lithic material availability (Pobiner et al., 2008).

But critical examination should review whether our paleoecological conclusions are compromised by uncertainties introduced by taphonomic overprinting during assemblage formation. Individual carcass consumption events and incidental butchery trace production may have been blurred, impartially recorded, or distorted during archaeological or landscape-scale assemblage formation, so how should we detect and interpret instances of carcass consumption behavior, and moreover how do we infer paleoecologically meaningful patterns of carnivorous foraging behavior?

Landscape archaeology and taphonomy (Isaac and Harris, 1980; Blumenschine et al., 1994; Stern et al., 1993; Bunn, 1997; Behrensmeyer et al., 2000) provide an analytical framework for studying traces of behavior in the Early Pleistocene fossil assemblages. Although primarily developed for highly visible, large lithic assemblages and to distinguish carnivore and hominin activity during potential central place assemblage formation, this research program explored the archaeological visibility of individual behaviors (Isaac, 1981). For instance, if refitting lithic fragments represent instances of knapping behavior, could distinct butchery or carcass consumption behaviors be detected in the zooarchaeological record and how could these behavioral traces be reliably distinguished from background scatter of landscape-scale paleontological assemblages, or geological-scale taphocenoses (Stern, 1994; Kroll, 1994)? When we consider patterns of butchery behavior drawn from assemblages comprised of many animals that potentially differ in size, taxon, amount of flesh available to hominin consumers, or on a broader scale, when we describe patterns in carcass consumption behaviors across localities or through geological time, we are making inferences that summarize instances of butchery behavior. Therefore, it is important to identify the fundamental archaeological unit of butchery behavior.

Perhaps butchery of a single carcass should be considered the fundamental behavioral unit that is observable in the zooarchaeological record – typically a sequence of consumers interacts with a complete animal. Experimental butchery and archaeological analysis of single carcass localities suggest that butchery of a complete animal generates many identifiable skeletal specimens including antimeres and articulating elements, which makes specimen identification less problematic, even in poorly-preserved, comminuted assemblages (Crader, 1983; Rabinovich et al., 2008). Unfortunately, single carcasses butchery assemblages are rare, and their detection and interpretation is complicated because: 1) most archaeological evidence and actualistic models for interpreting single carcass butchery behavior center on megafaunal carcass processing, and the skeletal distribution of butchery traces, fragmentation patterns, and taphonomic processes that impact specimen survival and identifiability, including human transport of carcass parts, may not be generalizable to fauna of all sizes (Delagnes et al., 2006), and 2) although they are often presented as single carcass butchery events, transport of carcass parts may have occurred, and most localities include highly fragmentary assemblages with spatially associated faunal material of other animals, usually interpreted as time-averaged background assemblages or recent concentration of fossils on modern erosional surfaces (Domínguez-Rodrigo et al., 2010; Norton et al., 2007; Mussi and Villa, 2008). For example, the Koobi Fora locality FxJj3 from the KBS Member was initially called the "Hippo Artifact Site" (Bunn, 1997). It contains 227 fragments of a single hippo carcass in association with Oldowan flakes and was described as one of the earliest examples of hominin butchery of a large animal carcass. However, the link between the bones and artifacts is tenuous since most hippo specimens are weathered and do not preserve cortical surfaces that can be examined for butchery marks, only a few limb, axial, and dental specimens were recovered, suggesting the complete carcass was never present, and the assemblage includes fragments of 10 other individuals from a variety of taxa. Bunn identified these analytical barriers and concluded that taphonomic biases masked any potential evidence of hominin or carnivore behavior.

Perhaps a portion of the individual animal, the carcass segment is the fundamental unit of carcass consumption behavior – it is acquired by hominins in a state of completeness that reflects human-carnivore interaction, subsequently butchered by hominins, and potentially shared between individuals. Butchery will impart cut and percussion marking on certain skeletal portions, but fragmentation and other taphonomic processes transform carcass segments into skeletal assemblages where many less-identifiable specimens cannot be conclusively attributed to MNE or MNI sets, potentially providing a poor-resolution reconstruction of butchery behavior (Merritt and Davis, 2017).

With these issues in mind, we describe the results of an archaeological sampling strategy that focuses primarily on documenting well-preserved traces of butchery and contextualizing them using neotaphonomic interpretive methods to support inferences about the behavioral, ecological, and geological processes that acted during assemblage formation. Throughout this analysis we critically examine the