Journal of Human Evolution 97 (2016) 37–57

Contents lists available at ScienceDirect

Journal of Human Evolution

journal homepage: www.elsevier.com/locate/jhevol

Cutmark data and their implications for the planning depth of Late Pleistocene societies

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ARTICLE INFO

Article history:
Received 7 November 2014
Accepted 12 May 2016
Available online 16 June 2016

Keywords:
Zooarchaeology
Paleolithic
Carcass processing
Subsistence
Meat drying
Butchery

ABSTRACT

Cutmarks provide empirical evidence for the exploitation of animal resources by past human groups. Their study may contribute substantially to our knowledge of economic behavior, including the procurement of prey and the analysis of butchery sequences. Butchering practices can be investigated using cutmark illustrations recorded on bone templates. In this paper, quantitative data on cutmarks were derived from published and unpublished cutmark drawings for 27 French assemblages dated between the late Middle Paleolithic and the final Upper Paleolithic. The analysis of cutmark data on meaty long bones (humerus, radio-ulna, femur, tibia) highlights strong variations in cutmark length and orientation in the sample that potentially reflect significant shifts in meat processing strategies during the Late Pleistocene. The present study shows that long longitudinal cutmarks are considerably more frequent during the Late Glacial Maximum than in the early Upper Paleolithic. Although the number of studies is small, actualistic data generated in controlled settings indicate that long longitudinal cutmarks are commonly produced during filleting, an activity closely associated with meat preservation, as is the case with drying and smoking. Because they provide information on possible changes in the capacity for anticipation, these results have potentially important implications for the logistical and economic organization of Paleolithic hominins.

1. Introduction

Numerous studies have highlighted the significance of planning depth to the evolution of complex cognition and the emergence of linguistic abilities (e.g., Binford, 1978; Whallon, 1989; Botha, 2008; Bickerton, 2009; Roebroeks and Verpoorte, 2009). However, studying planning depth in the archaeological record poses significant challenges because archaeological signatures are equivocal. Extending the preservation of meat through drying, smoking, and other processes is of considerable theoretical relevance given that these activities entail anticipation of transport costs (through a reduction in meat weight and volume) and/or dietary needs at time scales varying between a few hours to months. Therefore, documenting how activities focused on meat preservation developed over time may yield critical insights into the biological evolution and social organization of past hominins. We focus here on cutmark data, as these constitute one productive window enabling the study of the emergence of meat preservation in the Plio-Pleistocene.

Cutmarks have received sustained attention in the last forty years because they provide valuable information on agency and foraging strategies (Binford, 1981; Lyman, 1994). An obvious starting point in cutmark research has been the problem of identification, with several studies addressing the issue of how cutmarks can be distinguished from superficial scratches caused by friction with sedimentary particles. Thanks to experimental replications and analyses of controlled data (e.g., studies of ungulate trampling marks and reports investigating marks observed at contemporary human campsites), several criteria have been shown to be diagnostic of cutmark production (e.g., Gifford-Gonzalez and Behrensmeyer, 1977; Potts and Shipman, 1981; Courtin and Villa, 1982; Shipman and Rose, 1983, 1984; Andrews and Cook, 1985; Behrensmeyer et al., 1986; Haynes, 1986; Olsen and Shipman, 1988; Andrews, 1995; Dominguez-Rodrigo et al., 2009; Thiébaut et al., 2010). Further experiments have emphasized variation in cutmarks, for instance by indicating that their frequency and morphology is influenced by the class of raw material and the

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http://dx.doi.org/10.1016/j.jhevol.2016.05.006
0047-2484/

aspect of the tool (e.g., with retouched edges or not) used during butchery (e.g., Walker and Long, 1977; Walker, 1978; Potts and Shipman, 1981; Olsen, 1988; Greenfield, 1999, 2006; Dewbury and Russell, 2007; de Juana et al., 2010).

More contentious has been the interpretation of patterns in cutmark location and orientation. Although the analysis of this type of data is not new (e.g., Henri-Martin, 1907), the ethnoarchaeological study conducted by Binford (1981) among the Nunamiut of Alaska has been particularly influential, as it provided cutmark criteria permitting the recognition of specific processing goals in a faunal assemblage. These data launched fertile discussions on the timing of access to the carcasses of large ungulates in the Paleolithic record (e.g., Binford, 1984, 1988; Marshall, 1986; Shipman, 1986, 1988; Bunn and Kroll, 1988; Lupo, 1994; Domínguez-Rodrigo, 1997; Lupo and O'Connell, 2002). Studies have since examined the behavioral context of cutmark production for a wide range of species, generally from an ethnoarchaeological (e.g., Binford, 1981; Gifford-Gonzalez, 1989; Lupo, 1994; Nilssen, 2000; Abe, 2005; Costamagno and David, 2009) or experimental standpoint (e.g., Jones, 1980; Bez, 1995; Laroulandie, 2001; Egeland, 2003; Domínguez-Rodrigo and Barba, 2005; Vigne, 2005; Padilla Cano, 2008; Lloveras et al., 2009; Mallye, 2011; Thiébaut et al., 2011; Val and Mallye, 2011; Dominguez-Rodrigo et al., 2012; Galán and Domínguez-Rodrigo, 2013; Egeland et al., 2014). Although the above studies have concluded that certain cutmarks are ubiquitous and non-diagnostic, a substantial number of cutmark types are arguably closely linked to specific butchering activities.

The behavioral implications of changes in cutmark distribution and orientation patterns have been investigated in an original analysis of the Southwest Asian Pleistocene record (Stiner et al., 2009). The abundant and frequently randomly-oriented cutmarks observed on ungulate long bones in the Lower Palaeolithic from Qesem Cave led Stiner et al. (2009) to hypothesize that this pattern may be indicative of the processing activities of a relatively large number of individuals involved in meat removal, whereas those of the Middle and Late Pleistocene samples would reflect more focused tasks performed by one or a few individuals. However, well-controlled datasets have shown that the relationship between a given pattern of orientation and the number of individuals involved in meat removal is difficult to interpret because several factors (e.g., variation in skill and experience, whether a carcass is processed all at once or over several episodes) may result in randomly oriented cutmarks (Speth, 2012; Egeland et al., 2014). In southwest France, a study of several ungulate assemblages found in Upper Paleolithic contexts has also explored long-term shifts in cutmark patterns (Soulier, 2013). This last study found provisional support for change in cutmark orientation over time. However, a lack of quantitative data precluded a fuller appreciation of the economic and social ramifications of the suspected pattern. Thus, a renewed investigation of the significance of cutmark variation may shed further light on the potential implications of the diachronic patterns uncovered in these studies.

In this paper, we first examine the context of production of various types of cutmarks in controlled settings to assess patterns of cutmark variation in distinct carcass processing activities. Cutmark quantitative measurements from actualistic butcheries are then compared with those from a large set of French Paleolithic assemblages. This dataset provides a framework for exploring changing attitudes toward meat exploitation during the Late Pleistocene.

2. Cutmark variation in actualistic contexts

Numerous actualistic studies have analyzed cutmark production during butchery activities. The information presented here draws on the most detailed and best illustrated of these studies (Binford, 1981; Bez, 1995; Nilssen, 2000; Abe, 2005; Vigne, 2005; Costamagno and David, 2009; Thiébaut et al., 2011; Galán and Domínguez-Rodrigo, 2013). The information discussed below is limited to a general description of cutmarks examined according to five main classes of processing activities: skinning, sinew removal, dismembering, defleshing, and periosteum removal. This survey of the actualistic record is critical for our purpose, as it provides a control against which the archaeological samples can be compared. Note that, in this survey, the emphasis is put on the behavioral contexts in which longitudinal cutmarks are made, as these may inform the analysis of a hypothesized increased representation of longitudinal cutmarks during the Upper Paleolithic (Soulier, 2013). Because our analysis focuses exclusively on ungulates, other taxa are not considered here.

According to actualistic studies, skinning cutmarks occur on bones where the soft tissues are thinly distributed or where the skin is in direct contact with the bone. As a result, skinning cutmarks typically prevail on the skull, mandible, metapodials, carpals, tarsals, phalanges, vestigial phalanges, and caudal vertebrae (e.g., Binford, 1981; Bez, 1995; Nilssen, 2000; Costamagno and David, 2009; Thiébaut et al., 2011). Longitudinal cutmarks resulting from skinning are sometimes present on the distal shaft of the radio-ulna and tibia (Nilssen, 2000; Thiébaut et al., 2011). However, experimental and ethnoarchaeological data suggest that these cutmarks are uncommon.

Dismemberment cutmarks are, by definition, confined in their distribution to the articulations and immediately adjacent bone regions (e.g., Binford, 1981; Bez, 1995; Nilssen, 2000; Vigne, 2005; Costamagno and David, 2009; Thiébaut et al., 2011; Galán and Domínguez-Rodrigo, 2013). These cutmarks are generally deep and short (Binford, 1981; Bez, 1995; Nilssen, 2000; Thiébaut et al., 2011). Contrary to early claims (Binford, 1981), dismemberment cutmarks are not always transverse. Rather, their orientation appears to be directly influenced by the position adopted by the butcher when holding the skeletal elements during the dismemberment process (Bez, 1995; Nilssen, 2000; Thiébaut et al., 2011). Because defleshing requires sectioning tendons and ligaments located on the long bone extremities, some cutmarks initially considered diagnostic of disarticulation are now known to overlap with those resulting from meat removal (Nilssen, 2000; Thiébaut et al., 2011; Costamagno, 2012; Galán and Domínguez-Rodrigo, 2013).

Sinews are present on most skeletal elements. Nonetheless, in a majority of cases, they are short and arguably of limited use. In actualistic contexts, the long sinews and tendons near the spine and those in the distal limb elements are preferentially selected, generating short, transverse, and deep cutmarks on metapodials and phalanges (Costamagno and David, 2009; Thiébaut et al., 2011). Some experiments have reported the production of long longitudinal cutmarks in the grooves of metapodials, and less frequently, on the distal shaft of the radio-ulna and tibia, during sinew extraction (Vigne, 2005; Thiébaut et al., 2011; Costamagno, 2012).

Removing the periosteum using a cutting tool may generate longitudinal cutmarks, as reported by Costamagno and David (2009) in their study of reindeer herders in Russia. However, the use of an axe during marrow cracking, combined with evidence suggesting that longitudinal marks were produced for 'cultural' as opposed to strictly 'functional' reasons (Costamagno, pers. comm., 2014), raise some concern about the general significance of these observations for Paleolithic contexts. Nonetheless, it seems possible to distinguish this activity from meat removal in the archaeological record by considering several lines of evidence. In meat removal, longitudinal cutmarks should coincide with large muscle masses, and therefore, are expected to be more abundant on the meatiest bones (humerus and femur). In contrast, longitudinal cutmarks