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Human hunting and site occupation intensity in the Early Epipaleolithic of the Jordanian western highlands

Natalie D. Munro [a, *, 1], Michael Kennerty [b], Jacqueline S. Meier [a, 1], Siavash Samei [a, 1], Maysoon al-Nahar [c], Deborah I. Olszewski [d]

[a] Department of Anthropology, Unit 1176, 354 Mansfield Road, University of Connecticut, Storrs, CT 06269, USA
[b] Georgia Department of Audits and Accounts, Performance Audits Division, 270 Washington St., SW, Ste. 1-156, Atlanta, 30334, Georgia
[c] Institute of Archaeology, University of Jordan, Amman, Jordan
[d] Department of Anthropology, Penn Museum, 3260 South Street, University of Pennsylvania, Philadelphia, PA, USA

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ABSTRACT

We investigate the effects of the Last Glacial Maximum (~25,000–18,500 cal BP) on human hunting and settlement strategies through the study of faunal remains from four Early Epipaleolithic sites located in the western highlands region of Jordan. Human mobility is monitored by reconstructing site occupation intensity using zooarchaeological measures of dietary breadth and prey mortality. Our data reveal light occupation and a mobile human adaptation focused on the hunting of high-ranked adult ungulates and large-bodied tortoises. Despite their mobile strategy, the Early Epipaleolithic inhabitants clearly preferred particular locations on the landscape and reoccupied them repeatedly over time.

1. Introduction

Human-collected faunal assemblages originating from the arid regions of the southern Levant during the Last Glacial Maximum (ca. 25,000–18,500 cal BP) are essential for understanding the dynamics of human settlement, demography and flexibility during an active and potentially challenging period of environmental change. In particular, studies of the Early Epipaleolithic period enable important insight into human adaptability in the face of landscape changes triggered by the Last Glacial Maximum (LGM). We reconstruct human adaptations to LGM landscapes by examining the scale of human occupation and population mobility in the western highlands region of Jordan. Occupation intensity is investigated using zooarchaeological measures of prey relative abundance and mortality from four Early Epipaleolithic sites.

An active program of research in the Wadi al-Hasa over the last several decades has produced archaeological data from a number of Upper Paleolithic and Epipaleolithic sites (Coinman et al., 1986; MacDonald, 1988; Olszewski and Coinman, 1998; Clark et al., 2000). Unfortunately, the arid, open-air setting of many of these sites has resulted in poor preservation of zooarchaeological remains, which are dramatically under-represented in comparison to lithic assemblages. Thus, beyond the stone tool technology we currently know little of human hunting strategies in this region beyond the taxonomic representation of key hunted species. Thanks to renewed excavations as part of the Western Highlands Early Epipaleolithic Project (WHEEP) directed by Deborah I. Olszewski and Maysoon al-Nahar in 2009–2012, faunal samples from four Early Epipaleolithic sites in the Wadi al-Hasa and Kerak Plateau (Table 1) are now sufficient to enable an area synthesis. Ultimately, we connect the Early Epipaleolithic in this area to contemporaneous populations in the eastern and western Levant.

Current interpretations of Early Epipaleolithic adaptations in the southern Levant state that the LGM was a comparatively cold and arid episode (Bar-Matthews et al., 2003). Humans responded to environmental conditions by adopting a mobile settlement strategy that included frequent moves, low population densities and periodic seasonal aggregations of groups based on local resource abundance (Bar-Yosef, 1981; Goring-Morris and Belfer-Cohen, 1997; Olszewski, 2003; Kuhn et al., 2004; Maher et al., 2012a). In the Mediterranean Levant, the thorough use of ungulate carcasses and evidence for regional depression of the highest-ranked taxa such as wild cattle and red deer indicate intensified foraging strategies in comparison to the preceding Upper Paleolithic period (Stiner et al., 2000; Bar-Oz, 2004; Munro, 2009; Stutz et al., 2009). This shift is

* Corresponding author.
E-mail address: Natalie.Munro@uconn.edu (N.D. Munro).
[1] Tel.: +1 860 486 0090.

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Table 1
Sites, dates, and NISP values for Early Epipaleolithic sites in this study.

Site number	Site name	Date range	Excavation seasons	NISP	References
KPS-75	KPS-75	21,300–18,700 cal BP?	2009	1087	al-Nahar et al., 2009; Olszewski and al-Nahar 2016
WHS-1065	Tor at-Tareeq	21,800–18,300 cal BP	2000, 2012	636	Olszewski and al-Nahar 2016, 2014; Olszewski et al., 2000
WHNBS-242	Tor Sageer	<24,600–24,150 cal BP	1997, 1998	1110	Olszewski and al-Nahar 2016, 1997; Olszewski et al., 1998
WHS-784	Yutil-al Hasa	25,300–22,400 cal BP	1998, 2010	302	Olszewski and al-Nahar 2016, 2011; Olszewski et al., 1998

The dates for all sites but KPS-75 are based on radiocarbon determinations. The dates for KPS-75 are estimates based on typological similarities with radiocarbon dated Qalkan assemblages from the Azraq Basin following Byrd and Garrard (2013).

related to a change in the balance between resource abundance and human population size. In Jordan, small campsites with short-term occupations typify the Early Epipaleolithic period. Despite increased aridity across the region, the formation of shallow lakes and ponds in the Wadi al-Hasa and the Azraq Basin caused patchy distributions of preferred human resources (Schuldenrein and Clark, 1994; Cordova, 2007). Some of these patches, particularly those in lakeside settings, were well suited for human occupation. Two exceptional sites from the Azraq Basin, Kharaneh IV and Jilat 6, record unprecedentedly intensive occupation in similar lacustrine settings close to the steppic/desert boundary (Maher et al., 2012b; 2016). As the known range of Early Epipaleolithic adaptations in the eastern Levant expands (e.g., Byrd and Garrard, 2013) so does our need to understand the factors that caused foragers to invest more heavily in some locales than others.

This study examines the ecological footprint left by human foragers inhabiting the Wadi al-Hasa and Kerak Plateau during the Early Epipaleolithic period. Following a behavioral ecological framework, foragers are expected to remain in a given patch until the cost effectiveness of foraging there becomes greater than the cost/benefits of foraging in another region minus the costs of moving (Charnov, 1976; Kelly, 1995). Thus forager mobility and site occupation intensity are related to the relative resource abundance of particular locations on the landscape.

2. Zooarchaeological measures of site occupation intensity

Human landscape use is examined by measuring site occupation intensity at the western highlands sites using zooarchaeological data. To do so, we apply ecological models previously used in similar investigations of site occupation intensity in the western Levant (Stiner et al., 2000; Munro, 2004, 2009; Stutz et al., 2009). Human occupation of archaeological sites is expected to have an increasing impact on local resources over time (Tchernov, 1993). Because humans are expected to maximize cost effectiveness when hunting, they should initially cull the highest-ranked taxa (Stephens and Krebs, 1986). However as the length of site occupation and/or the number of people occupying a site increases, the availability of high ranked prey may decline either through extirpation, increased mortality, or changes in prey escape behavior (Lyman, 2003). At this point, lower-ranked (smaller-bodied or costly to capture) species will enter the diet (Stephens and Krebs, 1986). The balance between high-and low ranked animals or human foraging efficiency is thus a useful relative measure of site occupation intensity. High-ranked taxa are the most cost effective prey and include large-bodied animals and prey with low capture costs, while low-ranked prey include smaller bodied animals or those with high capture costs.

Site occupation intensity is measured using four indices that compare the abundance of high and low ranked game: 1) an ungulate index that examines the relative contributions of ungulates in comparison to carnivores and smaller prey; 2) a large ungulate index that examines the proportion of large ungulates relative to smaller ungulates; 3) a slow small game index that examines the relative abundance of slow to fast-moving small game taxa; and 4) an adult gazelle index that examines the relative abundance of adult to juvenile gazelles. High-ranking animals are expected to be more common when site occupation is low and decline in abundance in relation to low-ranked taxa as site occupation intensity increases. Thus total ungulates, large ungulates, slow, small prey and adult gazelles should be most abundant during periods of low occupation intensity and decline in relation to small game, small ungulates, fast-small prey and juvenile gazelles respectively as site occupation intensifies.

We also investigate average tortoise body-size using the minimum humeral breadth as a proxy measure (Stiner et al., 2000; Munro, 2004; Stiner, 2005). Because tortoises grow continually through life, body-size correlates with age, and thus the longevity of the population. Increased mortality reduces average longevity (Caughley, 1977) and thus sustained hunting is expected to produce smaller-bodied death assemblages.

3. The western highlands of Jordan in the LGM

Three of the four Early Epipaleolithic assemblages investigated here derive from the Wadi al-Hasa (Tor Sageer, Tor at-Tareeq, Yutil al-Hasa), while the fourth (KPS-75) is located on the adjacent Kerak Plateau in the middle of the western highlands region of Jordan (Fig. 1; Table 1; Olszewski and al-Nahar, 2016). All of the sites were inhabited during and immediately after the peak of the Late Glacial Maximum (ca 25,000–18,500 cal BP). Here, we focus only on the Early Epipaleolithic occupations. The four sites are described in detail in al-Nahar and Olszewski (2016) and Olszewski and al-Nahar (2016), but briefly, KPS-75 is a small rockshelter located within a rocky outcrop on the Kerak Plateau. Occupation extended to the flat area immediately outside the shelter. The remaining sites are located within the Wadi al-Hasa, a major drainage of Jordan's western highlands region that terminates south of the Dead Sea. Tor Sageer, a rockshelter, is located in the Wadi al-Khasra tributary, about 2.5 km from the junction with the Wadi al-Hasa. Similarly, Tor-at Tareeq is an open-air site located on the upper slope of a minor tributary close to its junction with the Wadi al-Hasa. The site contained several hearths and represents the accumulation of repeated human occupations along the shore of a possible paleolake (Neeley et al., 1998). Finally, Yutil al-Hasa is located on the steep southeast slope of the Wadi al-Hasa. This site encompasses at least one collapsed rockshelter.

The LGM was a significant cooling and drying event with global impact, although it had a less dramatic effect on the eastern Mediterranean than more northern regions (Bar-Matthews et al., 2003). Nevertheless, the amount of water tied up in the ice sheets translated into lower annual precipitation and thus greater aridity in the Levant. Despite these conditions, fluctuations between wetter and drier periods undoubtedly occurred within the LGM and the western Highlands was surprisingly well watered, especially compared to today (Cordova, 2007). Standing water from the potential paleolake Hasa, springs and annual streams provided reliable access to permanent water sources in the Wadi al-Hasa and