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Author
Maher, LA

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Persistent Place-Making in Prehistory: the Creation, Maintenance, and Transformation of an Epipalaeolithic Landscape

Lisa A. Maher[1]

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Abstract
Most archaeological projects today integrate, at least to some degree, how past people engaged with their surroundings, including both how they strategized resource use, organized technological production, or scheduled movements within a physical environment, as well as how they constructed cosmologies around or created symbolic connections to places in the landscape. However, there are a multitude of ways in which archaeologists approach the creation, maintenance, and transformation of human-landscape interrelationships. This paper explores some of these approaches for reconstructing the Epipalaeolithic (*ca.* 23,000–11,500 years BP) landscape of Southwest Asia, using macro- and microscale geoarchaeological approaches to examine how everyday practices leave traces of human-landscape interactions in northern and eastern Jordan. The case studies presented here demonstrate that these Epipalaeolithic groups engaged in complex and far-reaching social landscapes. Examination of the Early and Middle Epipalaeolithic (EP) highlights that the notion of "Neolithization" is somewhat misleading as many of the features we use to define this transition were already well-established patterns of behavior by the Neolithic. Instead, these features and practices were enacted within a hunter-gatherer world and worldview.

Keywords Human-landscape dynamics · Geoarchaeology · Micromorphology · Historical ecology · Human ecodynamics · Technology · Social networks · Practice theory · Hunter-gatherers · Southwest Asia · Epipalaeolithic · Jordan

✉ Lisa A. Maher
maher@berkeley.edu

[1] Department of Anthropology, University of California, Berkeley, 232 Kroeber Hall, Berkeley, CA 94720-3710, USA

Introduction

> "Human beings adapt not to their real environment but to their ideas about it, even if effective adaptation requires a reasonably close correspondence between reality and how it is perceived" (Trigger 1989, p. 261).

Most archaeological projects today integrate, at least to some degree, how past people engaged with their surroundings, including both how they strategized resource use, organized technological production, or scheduled movements within a physical environment, as well as how they constructed cosmologies around or created symbolic connections to places in the landscape. However, there are a multitude of ways in which archaeologists approach the creation, maintenance, and transformation of human-landscape interrelationships. This paper explores some of these approaches for reconstructing the Epipalaeolithic (EP, *ca.* 23,000–11,500 years BP; Fig. 1) landscape of Southwest Asia, using macro- and microscale geoarchaeological approaches to examine how everyday practices leave traces of human-landscape interactions in northern and eastern Jordan.

The EP period is conventionally subdivided into three main phases (Early, Middle, and Late), with each of these further differentiated into various industries or facies on the basis of differences in material culture and site features (Maher et al. 2011a). In particular, a distinction is usually made between the smaller, less obtrusive Early and Middle EP campsites and larger, so-called village sites of the Late EP Natufian, with the latter exemplifying stone-built and communal architecture, elaborated art and ornamentation, and early domestic plants and animals, among other things attributed as evidence for emerging Neolithic behaviors. Indeed, the earliest evidence for bread has just been ascribed to the Natufian (Arranz-Otaegui et al. 2018). Two case studies presented here demonstrate that Early and Middle EP groups, in particular, engaged in complex and far-reaching social landscapes, and contributes to a growing body of evidence suggesting that the notion of "Neolithization" (as the process(s) directly related to the presumed origins of food production and complex social lives) is somewhat misleading as many of the features traditionally used to define this transition were already well-established patterns of behavior prior to the Neolithic and, some of these, prior to the Late EP Natufian. Rather than viewing EP hunter-gatherers from the perspective of their behaviors as leading into a trajectory that results in "Neolithization," we can view these practices and behaviors as enacted within a hunter-gatherer world and worldview. Furthermore, I emphasize here that Early and Middle EP hunter-gatherers engaged in place-making practices traceable to us archaeologically through artifacts, features, and anthropogenic deposits themselves.

In order to investigate human-environment interrelationships in the EP, I employ geoarchaeological approaches, particularly micromorphology, to reconstruct on-site activities areas and use of space, understand site-formation processes and, more broadly, to build landscape reconstructions and explore past landscape use. The ultimate goal here is to understand the behavior of EP hunter-gatherers; namely, to explore the creation, transformation, and maintenance of social landscapes, as arguably all landscapes are, through an examination of evidence for aggregation and mobility, differential use of space, social interaction networks, and spatial and temporal patterns

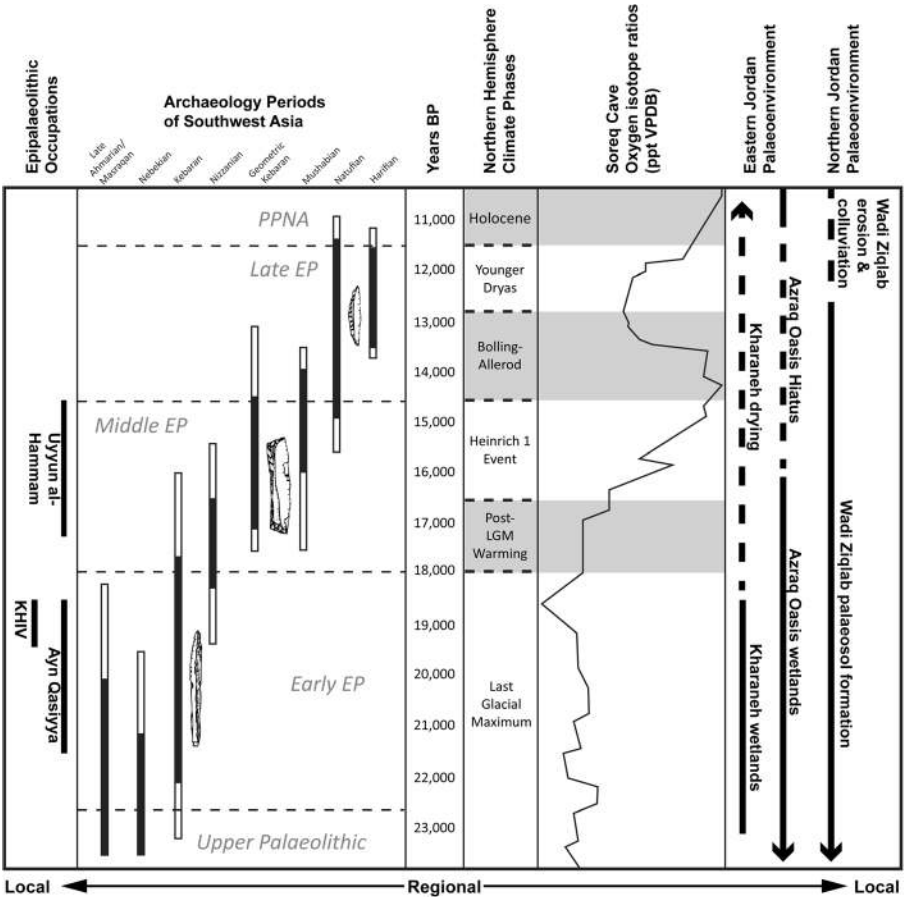


Fig. 1 Compilation of select regional and local records of palaeoenvironmental change and archaeological occupations, matched with major cultural-chronological frameworks for the EP period of Southwest Asia. Dates for the occupation of Uyyunn al-Hammam and Kharaneh IV, the two case studies discussed in the text, are on the far left. Reconstructions of landscape change for the areas surrounding these sites are presented on the far right (data compiled from Jones et al. 2016a, b; Maher et al. 2011a, a; Robinson et al. 2006)

in prehistoric technologies. Technology, as a part of the social life of things (*e.g.*, Appadurai 1988), is an important aspect of the creation of social landscapes. Employing a *chaîne opératoire* approach, and concepts of communities of practice and situated learning, material culture is key to enacting and communicating landscape use in the EP period.

The first part of this paper explores some of the different theoretical approaches to landscape in Southwest Asian prehistory specifically. The second part unifies some of these concepts with geoarchaeological methods to reconstruct evidence for the creation of social landscapes and place-making by EP people with two case studies from Jordan. However, it is important to recognize that just as we continually refine our approaches to the archaeological record, landscapes themselves are ongoing constructions, in ecological and social terms; thus, our archaeological narratives of these landscapes are always under revision.

The case studies presented here incorporate diverse research themes and include hunter-gatherer aggregation; interaction and mobility; ancient technologies (particularly lithic technologies); activities related to symbolic meaning-making, including prehistoric burial practices; and daily practice. However, all of these themes revolve around the broader topic of understanding human-landscape interactions. One could (and arguably should) characterize human-landscape interactions in a multitude of different ways. Specifically, I am interested in exploring the creation and transformation of landscapes, that is, how physical landscapes are integrated into social spheres and how they contribute to the creation, maintenance, and transformation of prehistoric societies. In order to better understand and contextualize the varied, complex, and nuanced human-landscape relationships, this approach employs geoarchaeological methods at multiple scales.

Reconstructing and Deconstructing Human-Landscape Dynamics

Early in the twentieth century, geographer Carl Sauer (1925) recognized the significance of cultural landscapes, yet landscape archaeology and related theoretical approaches to landscape (*e.g.*, historical ecology, human ecodynamics, cultural niche construction, human behavioral ecology) are relatively recent developments in anthropology (Ashmore 2002; David and Thomas 2008; Trigger 1989). Despite this, great strides have been made in trying to decipher human landscapes as defined in a multitude of different ways, sometimes emphasizing their physical features (as environment, ecology, habitat, *etc.*) and sometimes emphasizing their social and ideological roles in creating a sense of "being-in-the-world" (David and Thomas 2008). Archaeologists generally recognize that a landscape can simultaneously be both; yet, importantly, it is socially constituted and thus means different things to different people, in different times and places. Ingold (1993, 2000) and Whitridge (2004) both suggest that a landscape is experiential; it exists only in the eye of the beholder. Crumley (1994; Crumley and Marquardt 1990) focuses on the interactive and dialectical nature of human-environment relationships in the formation and identification of landscape, acknowledging the duality of the term where "landscape is the very manifestation of these relationships" (Crumley 1994, p. 6). Concerned primarily with the tangible traces of human activity in a landscape, Crumley's definition is particularly useful for contemporary research on human-landscape dynamics, including that presented here, because it recognizes the social construction of landscape while also upholding the value of tracing these relationships in the physical world through the integration of archaeological and palaeoenvironmental records. Indeed, Crumley might argue that these seemingly *two* lines of evidence are usually *one* and the same.

A consensus emerges that landscapes are complicated and experiential: they are socially and naturally constituted, and it is often impossible to extricate one of these things from another. They have dimensions of space and time, but are not necessarily linear; they are dynamic and mutable, even within the experiences of one individual at one time. Given the clearly entangled (Hodder 2012) nature of human social lives and natural features within a highly socialized landscape, perhaps it is more fruitful to think about how we might identify human activity (even taskscapes, *c.f.* Ingold 1993) within a landscape at multiple scales. Landscapes emerge as investments in locations with meanings that link people, places, and things. These seemingly intangible aspects of landscape are made tangible through the material culture and material contexts left as traces in the archaeological record of these social relationships.

The approaches to landscape (and citations within each) discussed here are far from exhaustive, but they represent those that relate most directly the present discussion of EP human-landscape dynamics in Southwest Asia. The goal here is not to provide an in-depth summary of each landscape approach, but to briefly review the tenets of some of these approaches specifically as they relate to the EP, and present two case studies that relate directly to these suppositions.

Approaches to Prehistoric Landscapes

The treatment of landscape in archaeological literature over the past several decades has been extensive (*e.g.*, Anschuetz et al. 2001; Ashmore 2002; Ashmore and Knapp 1999; Aston 1997; Barker 1995; Basso 1996; Bender 2001; Binford 1982; Bradley 2000; Carmichael et al. 1994; Chapman 1988, 2006; Clark 1977; Feinman 2015; Fleming 2006; Hirsch and O'Hanlon 1995; Layton and Ucko 2003; Llobera 2001; Rossignol and Wandsnider 1992; Thomas 2001; David and Thomas 2008; Ucko and Layton 1999; Wagstaff 1987, to name just a few), and these volumes provide excellent in-depth reviews of contemporary perspectives. Landscapes, according to Thomas (2001, p. 173), become "a network of related places, which [are] gradually [revealed] through people's habitual activities and interaction…causing them to be remembered or incorporated into stories." Emerging out of this literature is an emphasis on place-making. Those who study both contemporary and prehistoric hunter-gatherers in Australia have led the way for this type of approach (*e.g.*, Head 1994; Holdaway and Allen 2013; Littleton and Allen 2007; Lourandos 1997; Veth et al. 2008). Places can be uninhabited or inhabited, fleeting or "persistent places" (Schlanger 1992, p. 92), often blending the "real" and imagined (Whitridge 2004); in all cases, they have complex histories and biographies (see below for more on persistent places at the aggregation site of Kharaneh IV). Here, I use the term place-making and engage with recent work on prehistoric movements that suggest we can use the types and distributions of material culture to get at past place-making across broad geographical scales (*e.g.*, Collar et al. 2015; Coward and Gamble 2008; Coward and Knappett 2013; Fisher 2009; Gamble 1993, 1996, 1998; Rockman 2013). Thus, perhaps a holistic and realistic way to conceive of landscape experiences is to focus on place-making as "…a qualitative, historically emergent, experientially grounded mode of inhabiting or dwelling in the world that invests particular locations with personal and collective significance" (Whitridge 2004, p. 215). These past significances are presented to us today as archaeological residues.

Landscape archaeology today is a dialectic discourse that encompasses people's relationships and engagements with place and recognizes the role of places as meaningful contributors to social identity and interaction. All so-called natural places are culturally inscribed in social consciousness (Bradley 2000) and landscape archaeology attempts to decipher this sense of cosmological order. Ashmore (2002, p. 1172) suggests "…space is actively inhabited, and that social relations and spatial structure are linked recursively". She highlights that "decisions and depositions" can be detected through an examination of life histories of place at multiple scales (Ashmore 2002).

This life history approach allows the entanglement of multiple techniques and theoretical perspectives that each address slightly different aspects of the material record at different scales (the construction and re-surfacing of a plaster floor, the organization of space within a house, the arrangement of houses to provide differential access to particular spaces, the connections between sites noted in the movement of material goods). This approach addresses problems from different theoretical standpoints (practice theory, materiality, technology), but allows them to work in combination to provide unique "stories" or life histories of the material (and sedimentary) traces of human activity. This is a perspective recently taken up by others (*i.e.*, Boivin 2000; Langley 2013; Matthews 2012a, b) and to which I will return below.

Contemporary studies of landscape often incorporate research programs (*e.g.*, historical ecology, niche construction) that knit together humans, environments, and landscapes in various ways. Regardless, the main focus of study—landscapes—includes tangible physical features and intangible aspects of human place-making and meaning-making. David and Thomas (2008, p. 36), for example, note that contemporary practitioners of landscape archaeology recognize three key elements: (a) landscape is more than environment, (b) "being-in-the-world" is entangled in social process and is not reducible to environmental adaptions, and (c) an understanding that people and their social relationships are at the core of worldly engagement.

Recently, historical ecology and human ecodynamics have played prominent roles in the frameworks of many archaeological projects, and those case studies presented here are no exception. Historical ecology is an interdisciplinary research program taking a *longue durée* approach to the "temporal and spatial dimensions in the relationships of human societies to local environments and the cumulative global effects of these relationships" (Balée 2006, p. 75), where humans both adapt to and shape the environment. Agency and human decision-making play a prominent role in both defining landscape and developing explanatory frameworks for environmental change, highlighting that humans intentionally and unintentionally change their landscapes in culturally specific ways. Human ecodynamics starts from a similar theoretical standpoint as historical ecology, and some even use these terms synonymously (Crumley 1994; Kirch 2005, 2007; McGlade 1995). Like historical ecology, the "human ecosystem approach in archaeology privileges landscape as a core concept, asserting that there can be no environment or ecosystem detached from humans and their behavior" (Kirch 2007, p. 8). Landscape is, as such, the material manifestation of the relationships between people and their environment (Crumley 1994). Here, various multidisciplinary methods for studying landscape change are integrated to understand the complex interplay between interconnected biological and social processes (see also McGlade's 1995 illuminating appeal for human ecodynamics).

Landscape learning refers to the means by which human groups gather, share, and remember information about the nature and distribution of natural resources, including how this information is transmitted to other group members (Rockman 2003, 2013; Rockman and Steele 2003, and references therein). It could also include the processes by which places are made meaningful (Maher in press). It is not just how ecological knowledge is gained and taught, but how that ecological knowledge is culturally proscribed and becomes part of place-making. Landscape learning occurs in a number of different contexts, including the migration into or colonization of a new environment (Rockman and Steele 2003), as well as the ongoing use and sharing of information in an ever-changing inhabited environment. Both of these are relevant to EP groups, as local landscapes change over time and the movements of people and objects over long distances enact the creation, directly and indirectly, of new landscapes. It involves the creation of linked tangible and cognitive maps of the world (Golledge 2003; Ingold 2000) that combine ecological, technological, and social knowledge and, like any other aspect of past lifeways, can leave traces in the archaeological record: indeed, *sensu lato* Crumley (1994), the archaeological record can be interpreted as the manifestation of these complicated human-environment relationships. Rockman (2013) enumerates the archaeological traces of landscape learning, emphasizing the reuse of landscape features, including sites. Traces can include, for example, rock-art sites (McDonald and Veth 2012; McDonald and Harper 2016) or long-distance exchange of material culture (marine shell, ivory) or technological knowledge (tool form) (Maher 2016), all indicating connections between groups over long distances over time.

While I discuss *chaîne opératoire* below in reference to the social role of technology in understanding EP landscapes, it is also useful here for thinking about landscape learning. Since one landscape may be learned (and experienced) differently by new individuals, new groups, or even the same groups experiencing it from changing environmental needs or perspectives of place, archaeological data (objects and traces of landscapes) may contain information about several *chaînes opératoires* for learning a landscape (Rockman 2013, p. 101). How a landscape is made meaningful as a social place plays out through shared, and often repeated, performances or rituals marked visibly in the landscape. Recent archaeological literature on situated learning (Roddick and Stahl 2016) and the role of apprenticeship (Wendrich 2013, and references therein) is proving invaluable to our understanding of how cultural practices are transmitted within and between social groups. Landscape learning can be seen as an apprenticeship, where ecological and other environment knowledge is gained through observation, imitation, direct and indirect instruction, and practice within a social context. However, "[l]andscape learning is a unique type of apprenticeship compared to the traditional definition of master- to- pupil transmission because of the many types of knowledge involved, its ties to a large social network of environmental information, and the potentially very long time frames that can be required to collect relevant environmental information" (Rockman 2013, p. 101).

If we consider landscape learning more broadly in reference to place-making, then learning requires extensive social knowledge beyond the names and meanings of landscape features to the establishment and maintenance of social relationships enacted in this landscape, often over notable distances and involving individuals not necessarily in face-to-face contact but, nevertheless, a part of a social network of interaction with and within one or many "places" (see also social networks section below). Knowledge transmission gives collective "meaning" to places. "These result in a cognitive map of experience that is constantly updated as new information is added" (Rockman 2009, p. 56). Environmental knowledge itself could even be considered as a form of social currency, exchanged between individuals and groups, bonding them in various forms of social relationships (Gamble 1998).

Engagements with "storied landscapes" (Langley 2013; McBryde 1997; Murietta-Flores 2010), or the way in which humans interact with and imbue their landscape with social meaning and symbolism remind us that sites are not the only culturally meaningful places in a landscape and likely represent nodes of interaction, connected to each other by pathways and trails that were meandering (to us), variable, and complicated by kinship, alliances, resource distributions, and social contracts (Gamble 1993, 1996). These interactions with landscape are not entirely intangible to us today; many of these behaviors can be traced through micro- and macro-scale attention to the use of space, identifying activity areas within sites and tracing material connections between sites that should bring more attention to potential non-site landscape aspects of cultural significance and the pathways that connect them (see below).

Theoretical Approaches to EP Landscapes

Reconstructions of EP landscapes traditionally take one of two different approaches: (1) focusing on characteristics of material culture, especially stone tools, as proxies to track spatially bounded cultural groups and interactions between them or to identify movements across a landscape through the presence/absence of tools types, lithic raw material, or other resources, and (2) palaeoenvironmental reconstructions of geographic landscapes to denote "core or periphery" areas of possible occupation evidenced through the expansion or contraction of site distributions of the abovementioned cultural groups (see Goring-Morris et al. 2009; Maher 2010 for summaries). The former of these focuses predominantly on material culture variability, while the latter focuses on employing palaeoenvironmental datasets (and geoarchaeology) as proxies for ecological parameters that would permit (or not) occupation of specific areas to then explore site distributions and types (Fig. 1). While these approaches contributed foundational datasets on past environments and the nature of variability in EP material culture, often overlapping to do so (Bar-Yosef 1970, 1991; Goring-Morris 1987; Goring-Morris and Belfer-Cohen 1998; Henry 1995; Olszewski 2002), rarely have they incorporated alternatives to ecological or even optimal foraging determinants (see also Pirie 2004 for a discussion of the "construction" of EP prehistory).

Emphasizing the transformative role of humans, cultural niche construction theory argues that human modification of a landscape results in the creation and reification of our own environmental niche; this recursive relationship affects the selective pressures acting on our species such that the interplay between cultural practices and adaptation leads to evolutionary change (Laland et al. 2001; Laland and O'Brien 2010). Sterelny (2007, 2011) adds the role of cultural learning and the transmission of cultural knowledge (*i.e.*, symbolic life) to the picture, suggesting that these greatly impact the modified environment that one generation leaves for the next. This approach has been employed recently as an explanatory framework for the origins of agriculture in Southwest Asia (Kuijt and Prentiss 2009; Sterelny and Watkins 2015; see also Zeder 2009). Smith (2011, 2015) points out one important potential contribution of niche construction theory to these debates: it allows one to separate out archaeologically what were two independent phenomena: initial domestication and the emergence of agricultural communities. This has particular relevance here, where it is clear that initial domestication of some species occurred among hunter-gatherer communities many millennia before the emergence of Neolithic agricultural villages (*e.g.*, Asouti and Fuller 2013; Gray et al. 2010; Snir et al. 2015; Zeder 2011). Sterelny and Watkins (2015) explore, not the origins of domestication itself, but more holistically the process of Neolithization in Southwest Asia as a form of niche construction, focusing on the cognitive, symbolic, and social aspects of the transition from EP hunter-gatherers/

harvesters to Neolithic farmers. Critical of the evolutionary short-sightedness of the term, Watkins (2015) further argues for an emphasis on a cognitive-cultural approach to niche construction that links together the long-term co-evolution of human cognition, human societies, and landscape formation and change. For example, in attempting to link activities related to initial domestication versus the emergence of agriculturally dependent villages, Sterelny and Watkins (2015) suggest pathways based on the cumulative effects of small-scale landscape changes. Hunter-gatherers, thus, might "…enrich the local environment by seeding it with resources, and perhaps also managing those local patches to increase their value, for example, by concentrating leguminous plants such as lentils into dense patches, or using fire to clear weeds…[over time]…intensively exploiting wild resources in the local region would eventually have a deep ecological footprint" (Sterelny and Watkins 2015, p. 674). This is a theoretical framing that lends itself well to the type of microscale analyses discussed below. A key point about this approach here is that there is no one point in time when one can mark hunter-gatherers/harvesters as being farmers; these economic, technological, social, cosmological, and psychological changes happen individually over a protracted amount of time, and each can have differing causes and consequences. While this makes detecting the process of Neolithization more challenging, it also allows a much more realistic, nuanced reconstruction of the interaction of various behaviors, practices, mindsets, and actions within a dynamic hunter-gatherer's *or* farmer's landscape (or some combination of this).

While Sterelny and Watkins recognize these changes as nascent features of the EP and use niche construction to link the Palaeolithic and Neolithic through the EP, their approach still places an emphasis on explaining mechanisms for the revolutionary changes apparent at Neolithic sites. It also begs the question of why, for example, the scale and intensity of these "hyper-social and super-cooperative" societies (Sterelny and Watkins 2015, p. 677) ramped up in the Neolithic? While there may be a recognition that the Neolithic marks an evolutionary series of moments in prehistory, and that the magnitude and frequency of changes visible in the archaeological record from the Natufian and Neolithic are significant, there is simultaneously acknowledgement that earlier EP hunter-gatherers did have complex and symbolic investment in place, stayed put, had complex and long-distance networks of social interaction, and did start the process of domestication (*e.g.*, Goring-Morris and Belfer-Cohen 2002; Finlayson 2013; Finlayson and Warren 2017; Maher et al. 2012a; Maher 2016, in press; Snir et al. 2015), long before and without any intentionality to become Neolithic.

Watkins (2015) suggests that symbolic and social behaviors flourished in the Neolithic with denser concentrations of people because the participation in ritual performances, feasting, and other celebrations enacted through symbolic material culture (*e.g.*, architecture, sculptured stones, sign-bearing objects) created and reinforced "hyper-social" communities. While this is very likely the case in terms of the scale and magnitude of these activities, it is also important to emphasize that these, and other, behaviors were already emerging in the Early EP (and probably earlier). Their increasing presence in the EP (Grosman et al. 2008, Grosman and Munro 2016; Hovers 1990; Maher et al. 2012a, b; Snir et al. 2015; Yaroshevich et al. 2016) likely also served as a means of building and maintaining communities (see below). Microscale (and multiple-scale) examination of landscapes elucidates these more obtrusive EP traces of landscape change and use (see also Gamble 1998 for the European Palaeolithic). They are preserved in the ways a house is built, how space is organized within and outside of it, exploring which and how plants and animals were utilized in various contexts, looking at patterns of daily practice preserved in sediments (food prep areas, sleeping areas, flint knapping areas, high *vs.* low traffic areas), and tracing traditions and material objects across space and time.

In order to examine how prehistoric people in Southwest Asia created a social landscape and how we might identify it as such, I take cues from both historical ecology and human ecodynamics (Balée 2002; Crumley 1994; Kirch 2007; McGlade 1995) that suggest we see on-site and off-site spaces as a continuum that enmesh physical landscape aspects (trees, caves, streams, rocks, *etc.*) with economic and technological significance and include social/cosmological interactions with these spaces (Ingold 1993, 2000). Here, human culture cannot easily be differentiated from what Western epistemologies mean by "nature" (Descola 2013; Whitridge 2004). Humans both adapt to changes in their environment and modify the environment through actions, resulting in both temporary and permanent changes. My approach to EP human-environment interactions emphasizes this transformative role of humans in modifying the landscape and acknowledges that "landscape" in deep prehistory is simultaneously geographic and socially constructed. Everyday activities related to dwelling in a place over an extended time period accumulate as detectable material traces in the physical landscape or taskscape (Ingold 1993). For example, spatial reconstructions of the organization of activities and examining micro-scale traces of these activities through micromorphology have proven particularly useful (see below). Since the actions of daily life—building, food processing, knapping, hunting, cooking, eating—are informed by economic, technological, political, social, and ideological factors, the meaning behind human activity is preserved in the landscape within which it was performed (Ingold 2000). By examining the organization of on-site and off-site activities, we can explore human decision-making and its consequences within a socioecological landscape (*e.g.*, Barton et al. 2004). Following this approach, I focus on the nuanced, complex, symbolic, socially interconnected, and socially embedded landscapes of hunter-gatherer groups, much like Langley's "storied landscapes" (see below, Maher and Conkey in press, Langley 2013).

Tracking and Analyzing Human-Landscape Interactions I: Technology and Material Culture

During the EP, chipped stone tools are usually the most abundant material culture, thus forming a foundation for our reconstructions of behavior (Fig. 1). Traditional studies use the occurrence of particular tool types (*e.g.*, microliths types) to identify different "ethnic" groups and mark culture change (Goring-Morris et al. 2009; Maher 2010; Olzsewski 2011; Pirie 2004). More recently, technological studies and *chaîne opératoire* approaches have greatly improved our understanding of the decisions involved in the production and use of stone tools, through reconstructing the sequence of actions undertaken to manufacture and use material culture (Chazan 2009; Dobres 2010; Lemonnier 1992; Pelegrin et al. 1988; Phillips 2003; Schlanger 1994; Sellet 1993; Soressi and Geneste 2011). Indeed, a debate on its effectiveness played out recently in *World Archaeology* (Audouze et al. 2017; Delage 2017a, b). Building on the generally recognized efficacy of a *chaîne opératoire* approach, I take an integrative approach to chipped stone, and other technologies, that explores theories of social practice (Dobres 2010; Lemonnier 1992) and communities of practice (Wenger 1998) to understand why specific technological traditions came to dominate in specific times and places. As the EP continues to be defined as an archaeological entity on the basis of its material culture (including site features), an attempted reconstruction of the EP (social) landscape must explore how things were made and used, especially if we are to assess the life histories (Chapman and Wylie 2014; Hoskins 1998) and the less-tangible "meaning" of these objects and, thus, their contributions to the "life histories of places."

This framework provides a rich context to evaluate the connections between different social groups as identified by differences in material culture and to trace networks of interaction between people over a landscape. By expanding from the typologically based definition of social groups (*e.g.*, Kebaran *vs.* Nebekian; see also Bar-Yosef 1991; Belfer-Cohen and Goring-Morris 2002; Maher and Richter 2011; Olszewski 2002; Olszewski 2006; Richter 2011) and focusing specifically on technology as a social process, I examine the role material objects played in the creation and transformation of EP interactions where techniques and styles of making and using stone tools are transferred between members of a group who create a community of knappers (or stone tool makers). A knapping community is a flexible, fluid community—perhaps even an imagined one (Anderson 2006)—that can exist within and between groups. It is situational and can include members from the local community or thousands of miles away. It consists of participants with various skill levels, from master to apprentice, and the traces of these skills can be detected in the products and byproducts of knapping (Pigeot 1990), as well as the traces of use imprinted onto a tool's surface (Macdonald 2013). Change in the structure of these communities is reflected in the processes of knowledge transmission in stone tool production, including the appearance of craft specialization, industrial-scale production, and large-scale networks of exchange for raw materials. This approach emphasizes the social aspects of technological learning, and includes gender relations (Gero 1991), as well as the role of objects in this process (*e.g.*, Knappett 2005; Knappett and Malafouris 2008; Malafouris 2013; Miller 2005; Wylie 2002). It allows us to incorporate multiple scales of analysis, from the organization of space within a structure (possible households), to relationships within and between communities within a site (knapping communities), to interactions between communities between sites and across the landscape (trade and exchange).

Thus, the technological perspective to understanding EP material culture taken here incorporates a *chaîne opératoire* approach (Chazan 2009; Leroi-Gourhan 1964; Soressi and Geneste 2011) that attempts to elucidate the social experience of being a transformative part of the material world (Dobres 2001). Putting together elements of how technology relates to landscape (see above) involves detailed qualitative and quantitative data on artifact "life histories" and shared technical processes (Pelegrin et al. 1988) through study of the entirety of the technological process of making stone tools, and not just final tool form. This is particularly relevant for Kharaneh IV (see below) as both Early and Middle EP occupations contain deposits or caches representing individual flint knapping events, where we can trace the manufacturing process and link the final products (usually remaining in the caches) with earlier stages of production. This approach allows one to integrate the intersecting social and material aspects of people making things (Dobres 2010; Dobres 2001; Ingold 2001; Kingery 2001; Pfaffenberger 1992, 2001). Incorporating communities of practice and concepts of situated learning (Lave and Wenger 1991; Wenger 1998) provides a framework for understanding larger social landscapes of prehistoric tool makers and learners (and the communities they participated in) and the ways these social landscapes may have influenced choices and decisions during aggregation and dispersal events. The *chaîne opératoire* approach thus benefits greatly from analytical frameworks that incorporate concepts of skill, learning, and communities of practice (Bamforth and Finlay 2008; Crown 2007; Lave and Wenger 1991; Minar and Crown 2001; Sassaman and Rudolphi 2001; Wallaert-Pêtre 2001, Wallaert 2013; Wenger 1998).

Archaeologists generally recognize that long-distance social interaction networks are established and maintained through the exchange of material culture; this material culture embodies social information and thus provides a mechanism for the creation and maintenance of both direct and indirect social relationships between groups (*e.g.*, Knappett 2011, 2014; Malafouris 2013). These archaeologically traceable mechanisms allow the construction of symbolic communities, even when dispersed in space and time, maintained through extended networks and alliances (and, I would add, intergenerational knowledge of places such as locations of aggregation sites or flint sources) in deep prehistory (*e.g.*, Gamble 1998). One way in which these interactions can be traced is through social network analysis. The relevancy of a social network approach to constructing human-landscape dynamics has been discussed by Knappett (2011, 2013) and Broodbank (2000) and, more directly related to the case studies below, by Coward (Coward 2010; Coward and Gamble 2008; Coward and Knappett 2013) to address the role that social networks played in the EP-Neolithic transition in Southwest Asia. Here, the distribution of material culture types (*e.g.*, sickle blades, anthropogenic figurines, communal structures) are used as proxies for social relationships (the nature of which are often unknown) and the movement and exchange of material objects allows us to trace these relationships between sites and across space to create a sense of the EP landscape of interaction at any one point in time, or, although not yet addressed, potentially to identify sites and landscapes.

Social relationships traced over space create social landscapes as they do not exist just within “places”; just as material objects acquire biographies, identities, and life-histories of their own, places become part of these relationships and do the same. Networks are created in three-dimensional perspectives, maintained as people, place, and things enact together as part of a social and physical world. This is significant for at least one case study (Kharaneh IV) presented here that traces the movement and exchange of stone tool technological knowledge and marine shells between the site and other places. Individual practices—the movement of objects or movement of ideas or knowledge, with or without the movement of people—allow us to make connections between sites otherwise “isolated” in the EP landscape (Maher and Conkey in press). For example, a social network analysis performed by Coward (2010) for the EP and Neolithic periods of Southwest Asia demonstrated that, over time, networks (measured as connections between material culture types between sites) grow in size and become more dense, and the mean strength of ties between sites becomes stronger (Coward, 2010; Coward and Gamble, 2008). While there are differences between the strength and centralization of networks between EP and Neolithic sites, it is clear that the entire EP period is characterized by hunter-gatherers engaged in far-reaching and complex social interactions that transcend the foraging ranges of individual groups (Bettinger et al. 2009, 2015; Kelly 1983, 2013; Winterhalder and Smith 1981), and these can be tracked in the movements of material culture across the landscape. While we cannot yet discern different kinds of networks or social relationships through forms of material culture, this may be possible in the future. EP researchers have always been challenged to understand and explain the meaning of spatial and temporal variability in microlith tool assemblages (geometric *vs.* non-geometric, trapezes *vs.* triangles, microburin production or not, *etc.*). Recognizing that these differences relate in some way to distinct cultural or social traditions, borne out as choices in final tool shape and the larger technological processes of knapping (differing *chaîne opératoires*), if we assume that these microliths (and likely other aspects of material culture too) were being used to signal group identity, then tracking the movements of tools and technological knowledge over space through these networks of exchange and interaction can provide valuable insights into landscape use and how these EP groups created places.

The social role of technology is of great interest to archaeologists (Dobres 2000, 2010; Dobres and Hoffman 1992; Gero 1989, 1991; Hurcombe 2007; Miller 2007; Schiffer 2011; Schlanger 1994; Sillar and Tite 2000) and is included here for two reasons. First, any reconstruction of a *chaîne opératoire* requires understanding the potential ecological knowledges with direct bearing on a technological process. This ranges from the locations of raw material sources, to pathways to collect or trade for materials, to “places” appropriate for flint knapping or other activities related to production. Second, while technologies can inclusively refer to both material culture as well as intangible, performative activities (Leroi-Gourhan 1964; Lemonnier 1992), reconstructing the social context of material culture production involves attention to how knowledge is transmitted between individuals and groups within communities of practice and through situated learning, apprenticeships, and other learning models (*e.g.*, Creese 2013; Lave and Wenger 1991; Miller 2013; Sassaman and Rudolphi 2001; Wendrich 2013; Wenger 1998). That technologies are enacted within social landscapes has bearing on the case studies presented below, especially for Kharaneh IV, where stone tool technological knowledge is a form of social currency, possible moving with individuals and groups through the landscape, and helping to establish and maintain connections or social networks between groups over long distances. Stone tool production is thus better thought of as a technological experience that shaped many aspects of these hunter-gatherer lifeways, including the construction of social landscapes.

Technology and Place-Making

Both entanglement and entrainment theories highlight the articulation of people and things, but emphasizing different aspects of these relationships. Bauer and Kosiba (2016) employ the concept of entrainment to think about how objects play social roles, where examining the physical and social properties of the object can shed light onto the types of social relationships in which they were invested. This approach has relevance to human-landscape dynamics because material culture (and material context, see below) are central to the creation of valued places as well as the constitution of identity. Much like human ecodynamics, an entrainment approach advocates the necessity of an in-depth understanding of both ecology and archaeological context in order to identify and “evaluate connections between the cultural values that people attributed to particular places, materials, and practices, and the ways that these cultural values interacted with material processes to influence social differences and inequalities" (Bauer and Kosiba 2016, p. 132). This approach provides a way to link together people, places, and things (albeit not on equal footing), and also points to specific methods, like geoarchaeology or the *chaîne opératoire* approach to technology, for deciphering these linkages. As explored below, the role of various analytical techniques as ways to "interrogate" material culture as the residue of human action is highlighted because social information is embedded in the composition, form, alteration, and of objects *and* places.

Entanglement (Hodder 2012), on the other hand, focuses on interdependencies created between people and things through the social interactions and production of material culture in daily life. Entanglement implies interdependence as humans depend on things, things depend on other things, and things depend on humans to have socially constituted meaning. Since things and humans are constantly changing (often as a result of interaction), yet continue to interact, their "being-in-the-world" depends on reference to each other. If we add culturally constituted "places" to this interdependency, assuming that their very being depends on human experience and human social life depends on the creation of places to "be-in-the-world," then the relevance of entanglement to the creation of EP landscapes is apparent and incorporated into the discussion below. Whether focused on how material culture articulates social relationships or how it is enmeshed or interdependent with the people who create it, both entrainment and entanglement forefront the inseparability between people and things (and, I would add, places).

This brief discussion emphasizes that the key to understanding human-landscape interactions revolves around understanding the cultural contexts within which people engaged with each other, material culture, material context (see below) and places. The remainder of this paper attempts to show how some of these mutually inclusive approaches work together through particular archaeological and geoarchaeological methods to address people-place-thing dynamics. It bears reiterating here that the theoretical approaches discussed above are not meant to be exhaustive of those that deal with landscape or place-making. Instead, they are discussed here because they are complementary to the main goal of this paper; they contribute to an integrated approach to deciphering the social importance of space and place in the EP record. They also share a common tenet: the landscape is best understood as a social place(s), created and transformed continuously through the everyday practices of its inhabitants whose actions, gestures, performances, and relationships to each other and their material world shape their existence, creating "life histories of place" (Ashmore 2002). This can be accomplished because these relationships leave material traces that we can detect and decipher (or at least partially decipher) through geoarchaeological methods, especially those that integrate macro- and microscale work.

Tracking and Analyzing Human-Landscape Interactions II: Geoarchaeology and Geo-ethnoarchaeology

This approach to understanding EP landscapes focuses on employing geoarchaeological and other palaeoenvironmental methods to reconstruct past environments, at multiple scales, in order to assess local ecological conditions and permit reconstructs of past EP movements and resource use (see also Bar-Yosef 1990, 1996; Cordova 2007; Garrard et al. 1994a, b; Garrard and Byrd 2013; Goldberg 1981; Goldberg and Bar-Yosef 1982; Goring-Morris and Belfer-Cohen 1998; Goring-Morris and Goldberg 1990; Goring-Morris et al. 2009; Henry 1995; Marks 1976; Price and Bar-Yosef 2011; Rosen 2007). When put together with regional palaeoclimatic records (see, for example, Maher et al. 2011a, and references therein), a relatively nuanced picture of Late Pleistocene geographies is available. However, much of this earlier work was focused on identifying the boundaries of a Natufian "homeland" or a core area for Neolithic cultural developments, especially the distributions of incipient domesticates (*e.g.*, Belfer-Cohen and Bar-Yosef 2000). As these approaches, employed to reconstruct the physical aspects of past EP landscapes, are integral to understanding the nature of EP occupation across space and time, the application of current geoarchaeological theory to these issues is explored below.

Outside of Southwest Asia, many approaches to landscape focus on the nuanced and inextricably linked relationships between physical spaces and social places, noting both an inseparability of these things and the role humans did and continue to play in this dynamic. In this way, it can be difficult to make clear distinctions in many archaeological and contemporary situations between natural and cultural landscapes (see, historical ecology, for example) and this becomes emphasized on the smaller scale with attempts to resolve causality between what Schiffer called natural and cultural transformation processes (Schiffer 1987; Shahack-Gross 2017), highlighting at both scales the challenge of separating humans from landscape or environment.

Bearing this in mind, how does one actually go about realizing these landscapes in the archaeological record? Archaeologists acknowledge that humans invest social and symbolic meaning into material objects in many different ways and at many different levels. For example, Conkey (1980) reminds us that this meaning is constituted and manifest in the many things we now consider archaeological data: occupation sites, art forms, artifacts, clothing, structures or architecture, and features such as hearths. The study of stone tool technologies, for the rich social meaning that is transmitted in the making and, especially, learning to make, stone tools, as well as their use, is but one example of how to identify and situate this meaning and to trace social networks over space (Maher 2016; Maher and Macdonald 2013). Beyond this, we can engage with social meaning in the archaeological record in other ways too—by examining the traces of both symbolic and quotidian activities preserved in landscapes, artifacts, *and* archaeological deposits through geoarchaeological techniques.

This paper attempts to build on recent work that situates the role of various microscale techniques, namely micromorphology and geochemistry, in geoarchaeological investigations (Friesem 2016, and references therein; Maher in review; Shahack-Gross 2017, and references therein). Not only are these techniques key for microscale geoarchaeological research, but they demonstrate the importance of conducting geoarchaeological research within a theoretical perspective, or perspectives, that frame questions within social or situated contexts that recognize the complexity of relationships between people, places, and things, and are integral to any broader understanding of human-landscape dynamics.

Geoarchaeology is now an established and well-known sub-discipline of archaeology, with research questions and methods of sampling and analysis built into most contemporary research designs (*e.g.*, French 2003, 2015; Goldberg and Macphail 2006;

Hill 2005; Maher 2017a; Rapp Jr and Hill 2006; Weiner 2010), including in Southwest Asia (*e.g.*, Ames et al. 2014; Cordova 2007; Davies 2005; Garrard and Byrd 2013; Henry 1995; Hill 2001; Maher 2011, 2017b; Matthews et al. 1997; Rech et al. 2007; Rosen 1986, 2007; Shahack-Gross et al. 2003, 2005, Shahack-Gross and Finkelstein 2008). Geoarchaeology involves the study, at all scales, of the direct interrelationships between past humans and their landscape/environment, including the social, economic, technological, and ideological aspects of these interactions (Maher 2017a). It covers a wide range of topics that deal directly with material culture, cultural attitudes and perceptions of landscape, landscape modification, and issues of subsistence, settlement, daily activities, and sustainability (*e.g.*, French 2015; Garrison 2016; Goldberg and Macphail 2006; Maher 2017a; Weiner 2010). Landscape-scale methods of analysis are well-known and summarized in several excellent reviews (*e.g.*, Butzer 1982; Conolly and Lake 2006; French 2015; Holliday 1992; Parcak 2009; Pollard 2007; Waters 1992). Here, I focus on lesser-studied micro-scale analyses and the arguably overlooked, but valuable, role of the middle range theory in geoarchaeological research.

Geoarchaeologists are increasingly recognizing the role that ethnoarchaeology plays in shaping the direction and questions of geoarchaeological research, helping us understand what is knowable and what is not in the archaeological record (*i.e.*, Goldberg and Whitbread 1993; Middleton and Price 1996). Ethnoarchaeology, as "a [field of] study embodying a range of approaches to understand the relationship of material culture to culture as a whole, both in the living context and as it enters the archaeological record" (Friesem 2016, p. 146) stems out of the middle-range theory approaches advocated by Binford (1978, 1982, 2001) and Kent (1987, 1990, 1991). Kent's work, in particular, exemplified the value of ethnographic data for identifying activity areas and reconstructing the organization of space in prehistory (see also David and Kramer 2001). The primary objective of ethnoarchaeology is to critically (cf. Raab and Goodyear 1984) employ the insights provided by studying the material culture and non-material lifeways of ethnographic populations as archaeological analogues, or near analogues, to aid in deciphering and reconstructing the lifeways of past people as preserved in the archaeological record. It involves in-depth understandings of the daily practices of contemporary populations as well as study of the natural and cultural processes involved in the deposition, modification, and destruction of archaeological material and traces (*i.e.*, taphonomy and site-formation processes).

Recently, Friesem (2016) advocated for a renewal of a research program that integrates geoarchaeology and ethnoarchaeology, or geo-ethnoarchaeology (as originally defined by Brochier et al. 1992). He defines it as "a research strategy applying geological principles and methods in an ethnoarchaeological context in order to link human activities (i.e., within sites and human interaction with the environment) and the formation of archaeological sites and landscapes. The main goal of geo-ethnoarchaeology is to facilitate interpretation of archaeological materials and contexts from a geosciences perspective" (Friesem 2016, p. 146). The approach has emerged out of recent work by several geoarchaeologists who emphasize "the importance and usefulness of using the ethnoarchaeological context to study recently abandoned sites as opposed to sampling only living contexts - *in order to form a near-archaeological setting to better simulate archaeological site formation processes*" (Friesem 2016, p. 146, emphasis mine). In particular, we can better reconstruct past behavior by better understanding how the archaeological record is created. This approach highlights the usefulness of multiple methods of microstratigraphic and geochemical techniques, including micromorphology, X-ray fluorescence (XRF), inductively coupled plasma atomic (or optical) mass spectrometry (ICP-AES/OES), and Fourier transform infrared spectrometry (FTIR). These methods are particularly powerful when used in combination to identify anthropogenic contributions and understand the spatial arrangements, distributions, and compositions of anthropogenic deposits (*e.g.*, elemental make-up, mineralogy, anthropogenic inputs, *etc.*).

In "Geo-ethnoarchaeology in action," Friesem (2016, Fig. 1a) presents a schematic approach to archaeological research, showing how ethnoarchaeology is incorporated into traditional research design. With geoarchaeological methods becoming increasingly mainstream in contemporary research programs, this schematic can easily be modified to represent a geo-ethnoarchaeological approach. To do this, I take the role of geoarchaeology (and geo-ethnoarchaeology) a bit farther, suggesting that it is not just material finds (material culture, in all its forms) that are of concern for study, but also *material contexts*—the anthropogenic sediments that preserve traces of human behavior at multiple scales, all the way down to the molecular level. Essentially, as suggested by R. Shahack-Gross (2017), we should consider archaeological deposits *as artifacts themselves*. As a product of human creation (through technology, perception and interpretation), they are an extension of the body, they are human experience embodied; they have a social life, a life history, a story to tell. They are landscapes made manifest (see above). In Hodder's (2012) view of entanglement, they could be included in a wider definition of things, or, arguably more appropriate, as traces of *places* and, as such, are integral to relationships of interdependency. They preserve evidence of human behavior, and thus social relationships, in the same way as we consider traditional artifacts, and we can subject them to the same textual, descriptive, referential, and material analyses. These analyses, accompanied by archaeological study of ethnographic remains, allow us to decipher how these materials act on humans and provide an integrative approach to human-landscape interactions.

Thus, it seems geoarchaeology can be particularly well-integrated with ethnoarchaeology because of its ability to (a) identify and examine activity areas to get at daily practices, especially among those societies whose activities leave few obtrusive traces (*e.g.*, hut floors, cooking areas) and (b) reconstruct past landscapes (geographic and social) to understand the complex and nuanced way people created, used and "lived-in" places. Both involve thinking about complex human-landscape interactions at multiple scales, as well as the materials enacted in these spaces, and focus on how people create and transform landscapes into social places.

Connecting Micro- and Macro-scales in Geoarchaeology

The approach taken here examines the relationships between people and landscapes through geoarchaeological methods at multiple scales. The case studies presented below integrate both macro-scale and micro-scale levels of analysis. At broad regional scales, they involve site-based and off-site survey methods, landscape reconstruction, and mapping and prospection work, heavily informed by historical ecology and human ecodynamics that does not privilege the importance of social knowledge over ecological information: for example, we need to know soil fertility

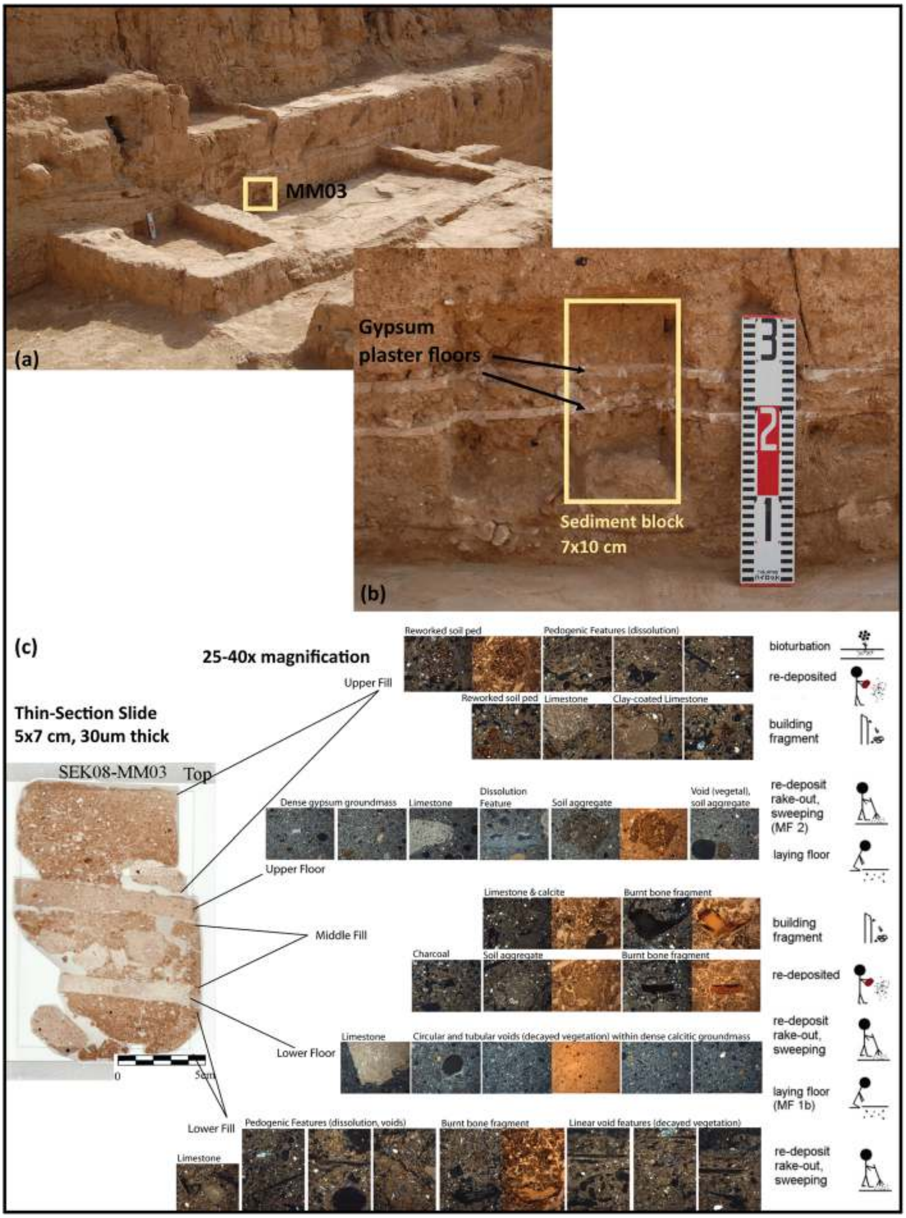


Fig. 2 The importance of maintaining context at various scales in geoarchaeological analyses is emphasized when making interpretations of human behavior by tracing relationships between material culture and material context within sites and features from the macro- to the microscale. This includes linking samples from large-scale site features, such as houses (a), to features within houses, such as floors (b), to thin section slides of these contexts examined at multiple levels of magnification (c) to make interpretations about human activities that leave traces at all these scales (Modified from Maher 2017a: Neolithic Seker al-Aheimar, Syria; courtesy of Yoshihiro Nishiaki, University of Tokyo Museum)

(and changes in it), as well as agricultural practices, as the two are inextricably linked. However, much of this work relies on the rich datasets provided by microscale and microstratigraphic techniques, like micromorphology and geochemistry, and integrating these with macro-scale analyses (Fig. 2).

Microscale archaeology, or microarchaeology (*e.g.*, Weiner 2010), deals with the materials that macroscopic remains are made from as well as the sedimentary matrix in which artifacts are buried. Micromorphology, as one of many microscale methods that link the archaeological record to human activity, has proven to be a particularly useful microscale technique, largely because it is a contextual technique (*cf.* Shahack-Gross 2017) where strict context is maintained from the field to laboratory. Small blocks of *in situ* sediment or soil are collected in the field from contexts of interest, impregnated with a hardening agent (usually a clear epoxy or polyester resin), and cut into thin sections 30 μm in thickness for examination under a petrographic microscope. The advantage of this technique over other types of analyses is that samples are collected to preserve the spatial relationships of all components; they are analyzed in the exact same relative orientation and arrangement as they were found in the field, preserving archaeological context at the microstratigraphic level (and usually including a sample of any larger artifacts found within the same layer). There is a large body of literature on the role and contributions of micromorphology to reconstructing prehistoric site organization and activity areas that will not be reviewed here (*e.g.*, Berna et al. 2007, 2012; Courty et al. 1989; French and Whitelaw 1999; Friesem 2016, and references therein; Goldberg 2001; Goldberg and Berna 2010; Goldberg et al. 2009, 2017; Kadowaki et al. 2014; Karkanas 2006, 2007; Karkanas and Goldberg 2008, 2010; Karkanas et al. 2007; Macphail et al. 1997; Macphail and Goldberg 2000; Mallol and Henry 2017; Matthews et al. 2000; Matthews 2005, 2012a, b; Milek 2012; Rosen 1989; Shahack-Gross 2017; Shahack-Gross et al. 2005, Shahack-Gross and Finkelstein, 2008; Shillito and Ryan 2013; Tsatskin and Nadel 2003), with notably less on the methods of sample treatment and guidelines or protocols for their analyses (Arpin et al. 2002; Carpentier and Vandermeulen 2016; Courty et al. 1989; Fitzpatrick 1970; Goldberg and Macphail 2003; Kubiena 1938; Shillito et al. 2009; Stoops 2003; Stoops et al. 2010). These works reflect the great leaps made in developing the interpretive power of the technique in the hands of specialists, arguably at the expense of making it a more widely accepted (and understood) technique, and its data more "readable" to non-specialists.

Occupation deposits themselves can then be seen as artifacts that capture evidence of human activity. Both daily, repeated practices and more ephemeral traces of human behavior are preserved in these deposits and can be identified, analyzed, and interpreted. In this respect, microscale approaches allow us to tease out of these anthropogenic traces the practices of everyday life. Micromorphological analyses provide evidence for activities related to mudbrick architecture, earthen and plaster floors, animal dung (*e.g.*, to identify stabling areas), as well as food preparation, discard or waste disposal patterns, combustion features, and differentiating high- and low-traffic areas such as those related to trampling (*e.g.*, streets) or sleeping (*e.g.*, bedding) or storage (see Friesem 2016, and references therein). The detection of these types of activities highlights the high-resolution scale of analysis that can be attained, especially in identifying and tracking repeated activities. Recent work at Çatalhöyük, for example, highlights the type of data that can be attained (Matthews 2012b; Shillito et al. 2011a, b; Shillito and Ryan 2013). We know from the practice theory approaches that space is endowed with meaning through practice (Bourdieu 1977, 1990; Giddens 1984; Hendon 1996, 2009; Ortner 2006), those repeated acts, regular or daily activities that leave physical material traces. And, different activities leave different, often diagnostic, traces (*e.g.*, Boivin 2000; Matthews 2012a; Matthews et al. 1997). This approach to reconstructing human practice becomes even more powerful when integrated with other lines of microscopic evidence, such as phytolith analysis or isotopes, as well as macroscale analyses. If we view archaeological deposits themselves as traces or artifacts of human behavior, then we can see this material context as similar to material culture—as the socially meaningful embodiment of the human experience of "being-in-the-world" (Maher in review). In other words, within the framework of the practice theory, geoarchaeological (and geo-ethnoarchaeological) techniques for analyzing the daily activities of past people have great interpretive power for reconstructing the use of space within sites (and features) as well as deciphering the social relationships between people, places, and things in a broader socially constituted landscape. These interpretations depend on both understanding landscapes as cultural constructs, as well as deciphering the physical traces of their constituents. I return to this point below when discussing the earthen floors at Kharaneh IV. Further, this approach allows one to better understand overlapping site formation and anthropogenic processes and to establish a scientific framework on which to base the interpretation of archaeological sites, materials, landscapes, and human behavior or agency. In this way, geoarchaeology is just as focused on the making of landscape, marking of landscape, and moving of landscape (*e.g.*, trade/exchange, transported landscapes) as it is of identifying activity areas or locating sites.

Reconstructing Epipalaeolithic Landscapes in Southwest Asia: Case Studies in Persistent Place-Making

The following case studies illustrate the value to Southwest Asian prehistory (Fig. 3) of a research program that integrates macro- and micro-scale analytical techniques with anthropological theory on landscape and place-making and technology (including materiality) to explore how material culture and material context shape EP people's interactions with the world around them. These case studies explore the reconstruction of the life histories of two "places," created and negotiated through on-site social relationships and larger networks of interaction, creating and reinforcing, in turn, a socialized landscape and affording us a window into the lifeways of EP groups. This is not to say that integrative, science-based approaches have not been accomplished here before (Enzel and Bar-Yosef 2017, and references therein; Cordova 2007; Rosen 2007, to name just a few), but instead I attempt to provide a synthesis on emerging and developing approaches to place-making and assess them with macro- and micro-scale datasets from two EP sites in notably different (but possibly interconnected) landscapes. The hope is that this work contributes to an emerging synthesis of later hunter-gatherer social landscapes in Southwest Asia, in particular, and provides a framework for simultaneously studying broadly, and with nuance, hunter-gatherer social landscapes through geoarchaeological methods, in general.

The case studies address specific debates in Southwest Asian prehistory, as well as broader approaches hunter-gatherer archaeology. At the macro- or regional scale, they explore correlations, or a lack thereof, between climate change and culture change,

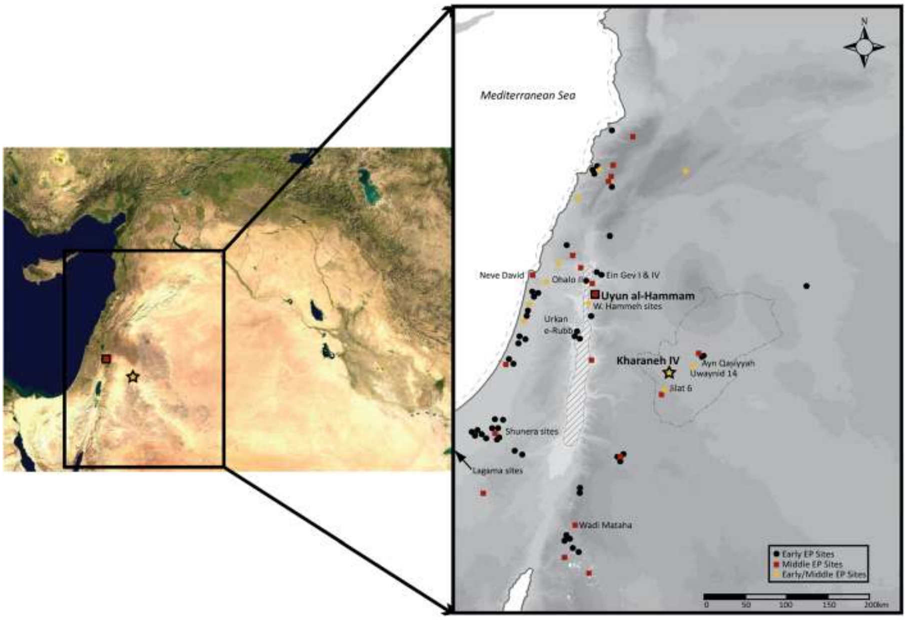


Fig. 3 Google Earth image of Southwest Asia (left), with the area under discussion in the text (the Southern Levant) outlined and blown-up to the right. The Middle EP site of Uyyun al-Hammam and Early/Middle EP site of Kharaneh IV are marked by an exaggerated square and star, respectively (left: Google Earth 2012; right: modified from Maher et al. 2012a)

specifically deconstructing the long-held assumption that changes in climate either pushed or pulled EP groups towards the domestication of plants and animals (see also Maher et al. 2011a; Price and Bar-Yosef 2011; Zeder 2008, 2011). Critical assessment of the correlations between regional climatic events and radiocarbon dates from archaeological sites spanning the EP and early Neolithic periods highlights a lack-of-fit where, in some cases, the onset of cultural periods does not correlate with the particular climatic events that are purported to have caused them (Fig. 1). On a more local scale, palaeolandscape reconstruction in northern and eastern Jordan tells us that the climate here was "optimal" before the Bølling-Allerød "climatic optimum" (*e.g.*, Severinghaus and Brook 1999; Weaver et al. 2003) and that it supported substantial settlement prior to the Natufian—the last phase of the EP period immediately preceding the Neolithic and characterized by socially-complex hunter-gatherers.

At the meso- and micro-scales, these case studies demonstrate through in-depth exploration of the material finds and geoarchaeology of two EP sites that hunter-gatherers created, maintained, and transformed their landscape in complicated ways and, as a result, this landscape was both highly socialized and changed over time. The first site is a substantial Middle EP home base (*c.f.* Rolland 2004) camp in northern Jordan called Uyyun al-Hammam, also an open-air cemetery with evidence for elaborate mortuary treatments involving humans and animals. The second site is the multi-component, Early and Middle EP site of Kharaneh IV in eastern Jordan, a large and dense site with early evidence for hunter-gatherer aggregation, long-distance social interaction, and persistent place-making (Maher 2016; Maher and Conkey in press; Maher et al. 2012a, b; see also Olszewski and al-Nahar 2016).

Together, these sites suggest a longer chronology for 'socially-complex' hunter-gatherer behaviors and complex human-landscape interactions prior to the appearance of the Late EP Natufian culture. In the Late Pleistocene, Early and Middle EP groups had highly complex, knowledgeable, and dynamic relationships with their local landscapes. These sites show clear evidence for on-site organization of space and place-making, long-distance interaction networks, and connections to other sites and other places between sites (making real and imagined communities) documented by the movements of marine shell and stone tool technological knowledge (see also Maher and Macdonald 2013; Richter et al. 2011). These groups created and lived in complicated social landscapes, where landscape was a place of dwelling (*c.f.* Ingold 1995) and communities engaged in situated learning to contextualize this landscape, fore-fronting the role of material culture and context and technology in elucidating human-landscape interactions.

Place-Making and Persistent Places

The identification of prehistoric "places" within a palaeolandscape is admittedly a challenging endeavor, and several Palaeolithic researchers have suggests the best way to do this is to look for persistent places (Littleton and Allen 2007; Olszewski and al-Nahar 2016; Schlanger 1992; Shaw et al. 2016), or what Conkey et al. (2003) refer to as places of many generations. These are sites that document repeated reuse and revisitation over long (inter-generational) periods of time. These are sites, whether habitation or for some other purpose, that "structure the use and reuse of the larger landscape" (Schlanger 1992, p. 92). Persistent places, according to Schlanger, can be identified through three key features: (1) they exhibit unique qualities particularly suited to certain activities/behaviors, (2) they exhibit features that focus re-occupation and structure subsequent uses, and (3) they are formed through extended use and repeated re-occupation. As sites with long, well-stratified sequences of occupation, these places have been key to reconstructing Palaeolithic activity as they result from the repeated accumulation of material culture and, thus, document spatial and temporal patterns of change that we label as traditions, industries, and tehcnocomplexes (Shaw et al. 2016, p. 1). Revisited below, Littleton and Allen (2007) even suggest that burials may be understood in terms of persistent places, where the interment of someone structures the use of space, provides a focal point for activity, and invites future visits. Both of the case studies here (see below), as sites re-occupied over several generations and reused as both structured habitation sites and to bury the dead, thus, fit these criteria. Place-making, thus, involves persistence and active maintenance.

Shaw et al. (2016, p. 1) explicitly link the creation of persistent places to the creation of landscape, where "[t]he appearance of persistent places demonstrates that hominin niche construction is both a culturally constituted and ecologically informed activity: persistent places act as an index for…familiarity with, and enculturation of, landscapes.", suggesting they play a key role in structuring our engagement with landscape and are one (of several) defining features of our species. The very use of these places, especially when compounded over time, is a form of landscape modification where the physical environment is "built" or structured and becomes culturally meaningful; persistent places are thus consistent with the tenets of human ecodynamics and niche construction (see above). Further, since landscapes change in response to human (and other) actions, the fact that prehistoric groups create fixed or "persistent" places in a changing landscape is what allows us to explore culturally constructed landscapes in deep time (Shaw et al. 2016, p. 3). In prehistory:

> [p]ersistence reflects humans becoming increasingly habituated within landscape: of particular paths being used, and places visited, more frequently—depositing more material at them. Thus persistent places are those at which humans leave material over geologically perceptible timeframes, irrespective of climate-driven change in local ecology and topography. Long-term persistence enables the *changing use of fixed places with fixed affordances* to be linked with *changing landscapes and changing affordances* in a given region. Thus it enables the identification and reconstruction of changes in how early humans *structured their use of place and landscape* (Shaw et al. 2016:3-4).

The Epipalaeolithic Period in Southwest Asia

The EP period spans from approximately 23,000 to 11,500 years BP and can be divided into Early, Middle, and Late phases (Fig. 1). Each of these main phases can be further subdivided into various entities, industries, or facies, with both spatial and temporal distinctions based on a combination of radiometric dating and material culture, especially through changes in stone tool technologies and differences in the nature of settlement and economy. There remains great debate about how to explain spatial and temporal variability in the EP archaeological record, namely, how to define various EP entities and what social implications these entities have on our understanding of lifeways, social identity, ethnicity, and culture groups (Bar-Yosef 1991; Goring-Morris 1989; Goring-Morris et al. 2009; Maher 2010; Maher and Richter 2011; Olszewski 2002, 2006; Pirie 2004).

Despite these debates and clear evidence for cultural continuity throughout the EP, the Early and Middle EP have generally received less attention than the later Natufian phase (Maher et al. 2012a), in part because these sites have been more difficult to detect, are often disturbed or underlie more substantial Natufian occupations (*e.g.*, el-Wad, Hayonim Terrace, Wadi Hammeh 27, Rakefet Cave, *etc.*), or are much smaller in scale than Natufian ones. Bar-Yosef (1970) provided a wealth of information on these periods from a number of small occupation sites in coastal, northern, and central Israel. Goring-Morris (1987) greatly added to our understanding of Early and Middle EP occupations in the Negev and Sinai, and Henry (1995) did the same for southern Jordan. In the Jordan Valley, Edwards (2001) and Edwards et al. (1996) documented several small Early and Middle EP sites. In the Wadi al-Hasa, southwestern Jordan, a rich repertoire of Early and Middle EP lifeways were tied to substantial wetlands and palaeolake deposits (Coinman 1998; Olszewski 2016; Olszewski and al-Nahar 2016). A similar situation was noted in eastern Jordan (Betts 1998; Garrard and Byrd 2013), including at Kharaneh IV (Muheisen 1983). Some sites exhibit substantial occupations and are the focus of longer-term or renewed projects, such as Neve David (Kaufman 1989; Yeshurun et al. 2013), Rakefet (Lengyel 2009), Ohalo II (Nadel 2000; Ramsey et al. in press; Snir et al. 2015; Weiss et al. 2005), Wadi al-Hasa (Coinman 1998; Olszewski and al-Nahar 2016), Jilat sites (Garrard and Byrd 2013), and Kharaneh IV discussed below, to name a few.

Models for the emergence of social complexity (however defined) traditionally argue for its appearance at the very end of the EP with the appearance of Natufian foragers, who are commonly held as socially complex hunter-gatherers or emergent forager-farmers (*e.g.*, Bar-Yosef 1998, 2002; Bar-Yosef and Valla 1991, 2013; Belfer-Cohen and Bar-Yosef 2000; Byrd 2005; Goring-Morris and Belfer-Cohen 2010; Henry 1995; Verhoeven 2004). In contrast to the campsites of Early and Middle EP groups, Natufian foragers lived in substantial, possibly semi-permanent villages, with evidence for the construction and rebuilding of stone architecture, cemeteries, elaborate art and ornamentation, and intensified plant and animal use, among other things (*e.g.*, Bar-Yosef 1998). Significant for our current discussion, the social landscape of Natufian groups center around a "homeland," or core area of cultural development that serves as a focal point for the establishment of early village life (Belfer-Cohen and Bar-Yosef 2000). In contrast, Early and Middle EP sites are generally smaller, less dense, and less "persistent," occupied temporarily by highly mobile hunter-gatherer bands. However, recent work at a number of Early and Middle EP sites (*e.g.*, Ohalo II, Neve David, Ein Qashish, Tor at -Tareeq) shed light onto the complicated, knowledgeable, and highly social relationships between people and their landscapes, enacted through various aspects of material culture, including newly emerging relationships with plants and animals pre-dating the Natufian (*e.g.*, Maher et al. 2011b; Ramsey et al. 2016, 2018; Snir et al. 2015), evidence for substantial investments in place (Maher 2016; Maher and Conkey in press; Olszewski and al-Nahar 2016) and the rich symbolic lives of these groups (Kaufman et al. 2017; Maher et al. 2012a; Yaroshevich et al. 2016).

Since the earliest identifications of this "in-between" Palaeolithic and Neolithic phase of Southwest Asian prehistory (Garrod 1957; Perrot 1966), emphasis has been placed on understanding the contributions and connections (or lack thereof) of EP groups to the origins of the Neolithic (*e.g.*, Finlayson 2013; Richter and Maher 2013b). Features we traditionally used to define the Neolithic (emerging from Childe 1942, 1951, but changing greatly over the decades) focused on the sudden and late appearance of social complexity, sedentism, and large-scale interaction networks at the end of the Pleistocene (beginning with the Natufian) encouraged by changing environmental conditions. Indeed, although there are many theories for the causes of social complexity, sedentism, and food production, the most enduring of these are some form of human-environment dynamic where prehistoric people were pushed to reduce economic risk during periods of environmental stress or pulled into taking advantage of abundances during periods of climatic amelioration (Bar-Yosef 1996; Bar-Yosef and Meadows 1995; Binford 1968, 2001; Braidwood 1951, 1960; Byrd 2005; Grosman and Belfer-Cohen 2002; McCorriston and Hole 1991; Munro 2003). However, recent research is demonstrating that this picture is far from clear-cut (*e.g.*, Arranz-Otaegui et al. 2018; Asouti and Fuller 2013; Fuller et al. 2010, 2012; Price and Bar-Yosef 2011; Sterelny and Watkins 2015; Zeder 2008, 2011). In addition, ongoing research continues to show us that these "stage-setting" features used to define socially complex Natufian groups are not part of a "Neolithic package" (Allaby et al. 2008); they are being found independently and earlier and earlier, suggesting that a search for the earliest example of a particular feature or a "revolutionary" explanatory framework for its appearance is unreasonable and unattainable (see also Gamble 2007). The case studies discussed here are but two examples of this dramatically changing perspective and reinforce the consensus emerging that, much like we had the Upper Palaeolithic "Revolution that

Wasn't" (McBrearty and Brooks 2000), it seems that the Epipalaeolithic-Neolithic transition may be best seen in this same light (Maher et al. 2012b).

More recently, we discuss the "process of becoming Neolithic," or Neolithization (Belfer-Cohen and Goring-Morris 2011; Goring-Morris and Belfer-Cohen 2011; Sterelny and Watkins 2015), evidenced by a number of archaeological correlates including the intensified use, management, and domestication of plants and animals accompanied by significant changes in landscape use and modification (*e.g.*, overgrazing); sedentism (settling in) and the construction of a built environment as seen through large and dense sites, with a high diversity of material culture (and aggregation); complex architecture, site organization, and the construction of houses and villages as homes and communities; increasing art and symbolic behavior; and long-distance trade networks and social interaction (*e.g.*, information exchange). However, as I argue here, and others have done elsewhere (*e.g.*, Asouti and Fuller 2013; Fuller et al. 2010; Zeder 2011), when we consider each of these features individually, we see that (a) they each have their own complex, independent trajectory of development, and (b) they all appear prior to the Neolithic (even domestication, Botigue et al. 2017). The case studies presented here demonstrate that many behaviors well-established in the Neolithic make an earlier appearance, sometimes 10,000 years earlier, in the preceding EP phases. While continuity from the EP (especially with the intervening Natufian period) to Neolithic is widely accepted (Goring-Morris et al. 2009; Goring-Morris and Belfer-Cohen 2010; Maher et al. 2012a, 2016; Olszewski 2006; Olszewski and al-Nahar 2016), it is worth highlighting that the features we use to define "Neolithization" were already nascent patterns of behavior (as inferred from their widespread, patterned, homogenous occurrence in the archaeological record), so if we want to understand their emergence, we must go back earlier to the EP period, at least. I want to emphasize here that I am not arguing that Neolithic lifeways were not distinct from EP lifeways, nor do I intend to downplay the cultural contributions, in social and economic developments, documented in the Natufian towards these Neolithic lifeways. I acknowledge the higher magnitude and frequency of changes witnessed in the Neolithic and recognize that they represent significant *moments* in human prehistory. I simply highlight here that their emergence was a long and windy path, with lots of stops and starts, and was not linear or inevitable. And, importantly, these features and practices began, for the most part, within a hunter-gatherer world.

Macro-Scale Human-Environment Interactions at the Epipalaeolithic-Neolithic Transition(s)

Palaeoenvironmental reconstructions at the global and regional scales that cover the last 10,000 years or so of the Pleistocene epoch are numerous and well-documented in several recent publications (*e.g.*, Alley 2000; Alley 2003; Bar-Matthews and Ayalon 2003; Bar-Matthews et al. 1997, 1999; Bartov et al. 2003, 2007; Bond and Lotti 1995; Enzel et al. 2003, 2008; Frumkin et al. 1999; Geyh 1994; Johnsen et al. 2001; Lowe et al. 2008; Maher et al. 2011a; Robinson et al. 2006; Severinghaus et al. 1998; Weaver et al. 2003) (Fig. 1). Since Childe (1942), climatic determinism in one form or another always has been prevalent in models for cultural change in the Near East, especially in the transition from EP hunter-gatherer to Neolithic farmer (Maher et al. 2011a).

However, more recently, improved palaeoclimatic reconstructions, and better dated archaeological sites have allowed us to critically re-evaluate these claims (Asouti and Fuller 2012; Grosman 2003; Grosman and Belfer-Cohen 2002; Hunt et al. 2004; Jones et al. 2016a, b; Richter et al. 2013), even noting that the clear-cut boundary between hunter-gatherer and farmer is problematic (*e.g.*, Asouti and Fuller 2013; Boyd 2006; Finlayson and Warren 2010; Finlayson and Makarewicz 2013; Watkins 2010, 2013).

Having long suspected that these causal links were not so straight-forward, especially those between the Natufian and Bølling-Allerød (see below), critical testing of these models has proven illuminating (Blockley and Pinhasi 2010; Maher et al. 2011a; Robinson et al. 2006). In particular, our most common method for constructing models of cultural succession in the EP show abutting relationships; one phase begins as the point at which the previous one ends (Maher et al., 2011a, Table 1). These models do not allow for protracted transitions or non-linear "development" or change. While it is generally recognized that human behavior does not operate in such a way and that these models are artificial constructs of the archaeologist, usually necessitated by the incomplete nature of the archaeological record, still they pervade our interpretations of past human behavior and form the basis of how we analyze the material culture record. A site is "dated" through radiometric methods (preferably) within a range of temporal parameters, which when compared to the material culture characteristics of the site then form the basis of categorizing the cultural assignation(s) of the site. Accomplishing this for several sites within a region (however defined) allows us to group together sites by similarities in material culture and overlapping dates of occupation to provide temporally and spatially bounded cultural groups. While imperfect, continuingly increasing resolution of radiocarbon dating techniques and the ways in which we model them with culture, as well as the theory and methods we employ to link material culture to human behavior, are continually improving our ability to provide high-quality, nuanced understanding of the past.

Employing the online radiocarbon calibration software BCal (Buck et al. 1999), which employs Bayesian calibration and analytical tools, to model various scenarios of cultural succession to compare well-dated climatic events with calibrated radiocarbon dates from sites spanning the EP and Neolithic of the southern Levant, Maher et al. (2011a) tested several hypotheses regarding the relationship between well-recognized cultural periods and the onset, duration, and termination of climatic events. Maher et al. (2011a) discovered that based on current evidence (radiocarbon, palaeoclimatic, and archaeological) there is, in fact, no *simple* cause-and-effect relationships between rapid climate change events and cultural changes throughout the EP and Neolithic transition(s). Simply put, that climate was a trigger for shifts in adaptation and material culture change is not supported by available data. This does not exclude climatic instability as a context for the lengthy transition from hunter-gatherer to farmer in Southwest Asia, but suggests that the dynamic interaction between shifting environmental conditions and innovations in technology, subsistence, and social organization had much more nuance than currently allowed. It also reminds us that equating forms of mobility and economy—mobile Early and Middle EP hunter-gatherers and sedentary Natufian foragers and Neolithic farmers—needs to be reconsidered. In fact, in almost every case, the onset of the cultural period appears to have preceded the climatic event, in some cases by several centuries (Maher et al. 2011a). For example, even if we were to accept the Natufian as the first appearance of social complexity afforded by

Table 1 Summary of geochemical analyses of on-site sediment samples from Area A (Middle EP) and Area B (Early EP), and off-site geological sections at Kharaneh IV. Mean values ± 1 standard deviation are shown (from Jones et al. 2016a, b)

Sample locations	Carbonate content % weight loss at 550 °C	Carbonate content % weight loss at 925 °C	Magnetic susceptibility	MgO%	Al_2O_3%	SiO_2%	K_2O%	CaO%	Ti%	Fe_2O_3%	Sr%
Area A (*n* = 11)	9.0 ± 3.5	10.7 ± 2.6	440.7 ± 100.8	6.2 ± 1.4	9.6 ± 1.0	46.8 ± 3.4	1.2 ± 0.1	26.0 ± 3.7	0.7 ± 0.1	7.3 ± 1.0	0.3 ± 0.1
Area B (*n* = 24)	8.5 ± 2.3	11.3 ± 2.8	224.4 ± 157.6	5.1 ± 0.7	10.7 ± 1.2	46.0 ± 6.0	1.4 ± 0.3	26.2 ± 7.4	0.8 ± 0.1	9.2 ± 1.3	0.2 ± 0.1
Off-site (*n* = 17)	7.8 ± 2.3	13.7 ± 5.3	74.5 ± 15.9	3.8 ± 0.4	9.8 ± 1.5	39.9 ± 5.5	1.0 ± 0.4	35.8 ± 8.3	0.7 ± 0.1	8.2 ± 1.1	0.3 ± 0.2

sedentism, the Early Natufian begins several hundred years *before* the Bølling-Allerød begins, undermining the idea that social complexity was either afforded as Natufian groups settled down during a period of climatic amelioration or triggered by some environmental change necessitating a shift to less mobility and, indeed forcing the separation of social complexity and sedentism cause-and-effect relationships.

Climate change thus cannot be seen as a "causal" factor in all cases of culture change, but rather as one of the many likely contributing factors to shaping the context of past lifeways, for example affording opportunities as well as providing hindrances. This approach seems far more realistic than any deterministic model, be it environmental or cultural. It also highlights that meaningful relationships between environmental and archaeological datasets must integrate both local and regional scales of analysis. Some phenomena, like sedentism or domestication, can only be marked by the ever-changing "first" instance known to date and likely will never be narrowed to specific points in time or place as a result of their ambiguous and debatable natures. The relevance of this for our understanding of human-landscape interactions cannot be overstated; high-resolution, local-scale data on palaeolandscape change integrated with studies of material culture and material context are integral to understanding these dynamics. Global and regional models are important and valuable for putting together the big picture of past populations, but it is clear that to get high-resolution datasets on which these big pictures are based, we need local records of climate and landscape change alongside carefully dated and studied archaeological sites.

Case Study 1: Uyyun al-Hammam in Wadi Ziqlab, Northern Jordan

Local Palaeolandscape Reconstruction in Northern Jordan

Geoarchaeological research in Wadi Ziqlab, northern Jordan (Fig. 4) from 2000 to 2005 focused on reconstructing the relationships between landscape change and settlement location throughout prehistory, as well as studying site-formation processes and evidence for on-site activity areas (Maher 2005, 2011). Reconstructing the history of landscape change in Wadi Ziqlab demonstrated two important points: (a) understanding changing settlement history depends heavily on knowledge of the valley's local sedimentary history, and (b) landscape change has a significant impact on the preservation of the archaeological record. This work has led to a better understanding of the role of geomorphic processes in filtering and preserving the archaeological record; a purposive survey of ancient river terraces and buried soils resulted in the discovery of > 50 new sites, many from underrepresented time periods, such as the EP site of Uyyun al-Hammam, and it has shown that even prior to the Bølling-Allerød warming, the LGM climate here was quite suitable for substantial occupation of the river valley. Thus, our interpretations of hunter-gatherer behaviors within any landscape depends on local, on-the-ground geoarchaeology integrated with regional datasets.

Purposive survey and sampling in Wadi Ziqlab involved using a combination of aerial photograph and groundwalking prospection to identify and examine all ancient terraces, colluvial slopes, springs, and channel confluences, with the aim of identifying ancient and buried land surfaces, particularly palaeosols as indicators of past land surface stability (Maher 2011). It also included the testing of known and newly

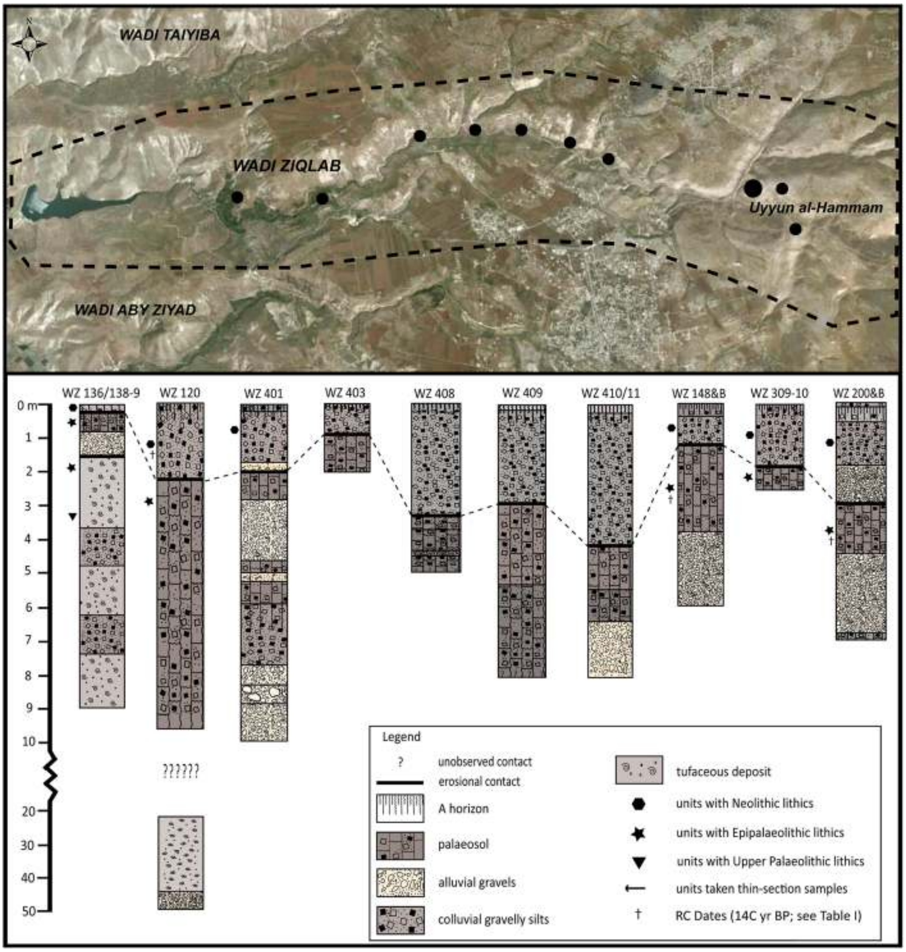


Fig. 4 Upper: Aerial photograph of the main Wadi Ziqlab drainage system, showing the location of a modern reservoir to the west and the Middle EP site of Uyyun al-Hammam to the east (enlarged circle). Other sites and geological locales represented in stratigraphic sections below are marked by smaller circles. Lower: Stratigraphic sections from archaeological sites and geological locales throughout the main Wadi Ziqlab basin, correlated through a combination of episodes of palaeosol formation, archaeological deposits, and radiocarbon dates. Uyyun al-Hammam is also known by designation WZ148 (modified from Maher 2005, 2011)

discovered archaeological sites to reconstruct the chronology and nature of prehistoric occupation and collecting column samples from representative geomorphological and archaeological deposits. This work was fruitful for locating a palaeosol, or ancient buried soil, that once comprised a relatively continuous soil cover throughout the main river valley during the late Pleistocene during occupation of several Early and Middle EP sites. Fifteen geological and archaeological sections located throughout the river valley provided a detailed stratigraphic record of sedimentological events in the wadi from the Middle Pleistocene to the present-day. The palaeosol was sampled at every occurrence for sedimentological, microscopic, and geochemical examination (discussed below and in Maher 2011). Not every section provided a complete stratigraphic record for the valley, but correlating these sections across space (Fig. 4) allowed the documentation of changes in deposition and erosion throughout in the valley. In general, a consistent depositional sequence was noted and, in particular, the deeply buried palaeosol was traced throughout the valley and through stratigraphic and radiometric methods dated to the Late Pleistocene. It also demonstrates that occupation of the river valley in the EP occurred under very different climatic conditions than today, or even than throughout the Holocene.

Palaeosols are particularly useful palaeoclimatic indicators as they form only during periods of land surface stability (*e.g.*, Birkeland 1999; Bronger and Catt 1989; Hall and Anderson 2000; Wright 1986). The longer a landscape is stable, the deeper and better developed its soils. Not surprisingly, stable land surfaces are excellent locations for prehistoric settlement. There were three major episodes of pedogenesis or soil formation in Wadi Ziqlab, but only one during the late Pleistocene (Maher 2011). Photomicrographs (or digital images of magnified portions of thin section slides) of the Late Pleistocene palaeosol traced at various archaeological sites and geological sections throughout the river valley show features formed under a climatic regime very different to the subsequent Holocene, when temperatures were somewhat stable throughout the year and it was consistently wetter on a seasonal and overall basis (Field and Banning 1998; Maher 2011). This moist regime supported an abundance of flora and fauna which, in turn, supported numerous Early and Middle EP sites (themselves reflecting a wide diversity of locally available flora and fauna; Maher 2005).

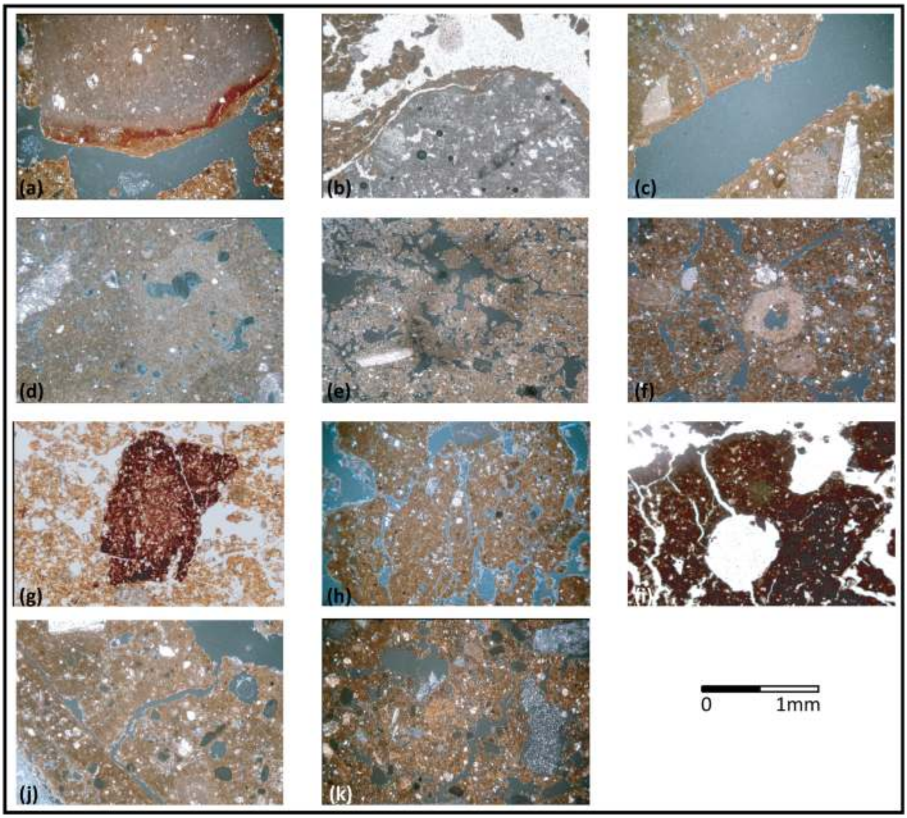
Figure 5 shows some of the diagnostic features of the palaeosol, visible through micromorphological examination, that are generally lacking from comparative Holocene and modern day deposits (Maher 2011). Layered clay coatings on limestone, as well as one clay coating superimposed on an iron coating, indicate formation under wet conditions, when percolating groundwater (precipitation) is available regularly or year-round such that infiltration occurs at depth, or when there is increased groundwater levels allowing water transport within the soil-forming B horizon (Becze-Deák et al. 1997; Bullock 1985; Fedoroff and Courty 1999; Fenwick 1985; Fitzpatrick 1993; Holliday 1994; Kemp 1999; McCarthy et al. 1998; Stoops 2003; Stoops et al. 2010). Iron- and clay-enriched water infiltrates the soil and collects around large components, such as limestone fragments or anthropogenic materials like lithics or bone. With continued deposition over time, the surface of the component appears stained as it is coated with iron, or as clay settles out around the boundary between the component and surrounding matrix. Multiple layered coatings indicated multiple, repeated episodes of iron- and clay-rich infiltration and accumulation. Similar coatings forms along the walls of void spaces as suspended clay settles out of the soil water transported through the void.

Well-developed secondary carbonate features, such as hypo-coatings, intercalations, nodule formation, and localized areas of enrichment and depletion within a fine matrix are also highly distinctive of soil-forming processes (*e.g.*, Becze-Deák et al. 1997; Machette 1985; Stoops 2003; Wieder and Yaalon 1982). They form cumulatively over time as carbonate-enriched or depleted groundwater moves through a soil, depositing into or leaching carbonate minerals from the fabric of the deposit. In Fig. 5, the light-colored areas in the groundmass are concentrated in calcium carbonate, while the darker-colored areas are visibly depleted of it.

Soil development, especially water infiltration, leaching, and seasonal cycles of wetting and drying over time, produce a strong blocky to prismatic structure in a soil fabric, often with many visible voids resulting from decayed plant material and other forms of bioturbation (earthworm burrowing). This palaeosol exhibits these features, along with reworked *terra rossa* soil aggregates incorporated into the blocky microstructure (Fig. 5). The internal fabric of these soil aggregates is distinct from the surrounding soil, with an even darker red color and high quartz silt content. They represent even older soil fragments, inherited from earlier episodes of soil formation (Farrand 1979; Fisher et al. 1966; Vita-Finzi 1969; Yaalon 1997), and their high iron content help to give this palaeosol its distinctive red color (Maher 2011). This strong structure, deep red color, and high degree of bioturbation are common to more mature soils, where soil accumulation and development occurred concurrently and slowly over time, and the developing soil was exposed to surface processes for long durations so these features could accumulate over time. They are so well-preserved because the soil was rapidly buried by several mass movement events and ongoing colluviation with the onset of the Holocene (Maher 2011), preserving both these soil-forming features and the abundant evidence of anthropogenic activity accumulated on this stable, soil-forming land surface. In several locations, including at Uyyun al-Hammam discussed below, the palaeosol exhibits a combination of pedogenic and cultural input, the latter including small microflakes of chert, charcoal, fragmented animal bone, ash, and phytoliths—all characteristic of occupational and refuse deposits (Courty et al. 1989; Goldberg 1992; Goldberg and Berna 2010; Goldberg et al. 1993, 2009; Karkanas and Goldberg 2008; Stoops et al. 2010).

All of the features mentioned above are consistent with long-term soil formation under a climatic regime very different from today; one with higher available moisture on a more regular basis, increased biological activity (vegetation and soil microfauna), and a notable lack of evidence for mass movement events that cause large-scale erosion or rapid burial (Maher 2011). The palaeosol features are remarkably similar in each location it was examined, indicating its suitability as a Late Pleistocene marker horizon. Dating the onset and length of soil formation (here or elsewhere) is notoriously difficult because of its long-term and cumulative nature of development. In Wadi Ziqlab, several Early and Middle EP sites (and only these) are found deeply buried in the palaeosol and radiocarbon dating and material culture analyses of these sites provides a rough bracket of time for the *onset* of soil formation of at least between 17,250 and 22, 000 years BP, although given the degree of expression of these pedogenic features a much older date is most likely (Maher 2011). The overprinting of pedogenic features on Middle EP artifacts and deposits at Uyyun al-Hammam indicate that pedogenesis continued concurrent with occupation of the site, and likely until the rapid onset of the Younger Dryas, where the entire region experienced dramatically changed climatic regimes and pedogenesis halted.

Regional reconstructions suggest a notably cool and dry Last Glacial Maximum (LGM) between 25,000 and around 16,500 years BP, followed by a warmer and moist Bølling-Allerød interstadial c. 16,500 to 12,900 years BP (the Heinrich I event is not well-documented in the Southern Levant), with a rapid return to cool, arid conditions with the Younger Dryas (c. 12,900–11,500 years BP) and a return to warm conditions in the Holocene (onset c. 11,500 years. BP). However, not all local climatic records are in agreement with this scenario (*e.g.*, Jones and Richter 2011; Jones et al. 2016a, b). Here, in Wadi Ziqlab, we see conditions conducive to soil formation began during the Last Glacial Maximum and continued throughout the Bølling-Allerød climatic



amelioration. The Younger Dryas is marked sedimentologically by large-scale, wadi-wide erosion and halted soil formation. Precipitation becomes more seasonally intensive and there is a notable increase in mass movement events (Field and Banning 1998, Maher 2011). This correlates archaeologically with a complete lack of Late EP (Natufian) and early (PPNA) Neolithic sites throughout the valley; perhaps, it was not a favored locale for occupation during this time. Subsequent Holocene occupation of the river valley then occurred within a notably different climatic regime with intensified erosional events brought on by more limited, seasonal rainfall (mass movements brought on by human activities like forest clearance and overgrazing of sheep and goat—trends continuing today). Thus, the local record paints a slightly more nuanced picture than the regional record, and reminds us that while regional records are synthetically valuable, we first need local data to build high-resolution landscape reconstructions and make interpretations of prehistoric activity at the site level.

Local landscape datasets also aid in finding sites of other time periods. In Wadi Ziqlab, we find Palaeolithic sites restricted to hilltops and the highest terraces, and younger and younger sites at successively lower elevations as a result of increased valley incision over time, interrupted occasionally by river terrace aggradation and palaeosol formation, where all EP sites are located. Understanding the relationships between site location and landscape change tells us that survey designed to target sites of specific time periods should focus on those locations most likely to contain deposits

◀ **Fig. 5** Compilation of micromorphological features of the Pleistocene palaeosol from Wadi Ziqlab (for section locations, see Fig. 5). **a** WZ148: Layered clay coating on a fragment of limestone superimposed on an iron coating (XPL). Internal iron staining is also visible in the clast, indicating that the iron was inherited from near-surface weathering processes prior to deposition. The clay coating is composed of the same material as the surrounding groundmass, suggesting it formed as clay suspended in infiltrating water collected around large clasts and peds and was not inherited prior to deposition of the clast. **b** WZ120: Layered clay coatings on weathered limestone and surrounding peds within Unit 1 (palaeosol, EP), formed as clay translocated, suggesting pedogenesis prior to burial. Here, the coating lines a channel bounded on one side by a fragment of weathered limestone (PPL). **c** WZ401: Intact clay coatings lining chamber walls formed during pedogenic clay translocation are common in Unit 6 (XPL). **d** WZ120: Unit 1 (paleosol, EP) displaying well-developed secondary carbonate features, including hypocoatings, intercalations, and incipient nodule formation (center) within the groundmass (XPL). **e** WZ310: A matrix pedofeature from Unit 2 (palaeosol) consists of a localized area depleted in calcium carbonate (light-colored) within an otherwise carbonate- and calcite-enriched, red, clayey groundmass (XPL). Pedogenic carbonate features, evidence of bioturbation, and textural features are common to this red palaeosol. **f** WZ200: Unit 3 (paleosol) consists of a red, clayey soil with calcite and quartz silt with well-formed secondary carbonate forming incipient nodules (light area in center) and a subangular blocky ped structure. Planes and hypocoatings are extremely common (XPL). **g** WZ401: Reworked soil aggregates incorporated into a new microstructure are common in the palaeosol (PPL). The reworked soil aggregates have an internal fabric distinct from the surrounding groundmass and consist of dark-red clay with higher quartz silt content and a comparative absence of calcite or calcium carbonate. The platy structure of the reworked ped is still visible and silt grains appear aligned along their long axis. It is embedded in a reddish-brown clay matrix with some quartz silt and an abundance of inherited and pedogenic calcite. Pedogenesis has produced a subangular blocky structure. **h** WZ409: Unit 2 (palaeosol) is stratigraphically correlated with Unit 2 at WZ408 and WZ410. Formed from reworked soil, the upper portion of the welded soil at this location also exhibits a strong, subangular blocky ped structure and the formation of areas depleted in carbonate and calcite crystal growth from another phase of soil formation after redeposition (XPL). **i** WZ120: Unit 1 consists of reddish-brown clay with fine, silt-sized quartz, calcite crystals, and amorphous organic matter. The coarse fraction is composed of fragments of limestone, flint, charcoal, and burnt and unburnt bone. Soil development is evident by the subangular blocky structure and a microstructure dominated by chambers, fissures, vughs, and vesicles (PPL). **j** WZ410: Unit 2 consists of dense, reddish-brown clay with silt-sized calcite, quartz, amorphous organic matter, chert, charcoal flecks, and bone fragments (XPL). Organic components and evidence for bioturbation are more abundant in the uppermost horizons of the deposit. Soil-formation processes (especially leaching and cycles of wetting and drying) have produced a strong, subangular blocky structure clearly visible in these images. A coating of dusty clay, composed of fine reddish-brown clay similar to the matrix material but lacking silt-sized grains and surrounding a piece of chert is also shown in the bottom left. **k** WZ200: Unit 3 is pervasive with calcium carbonate and contains evidence of Late Kebaran occupation with a coarse fraction consisting of chert, bone fragments, faunal excrement, and other amorphous organic matter representing a midden deposit (XPL) (modified from Maher 2011)

of the appropriate age and that are likely to be preserved. Here, to find EP sites, I needed to locate and examine ancient river terraces, accompanied by subsurface testing at locations most likely to contain traces of palaeosols. The river valley has changed dramatically over time through the interplay of natural factors and human use. Better understanding geomorphological changes helped to identify buried land surfaces and increase the discovery of sites of underrepresented periods, as well as predict the location of archaeological sites in less intensively surveyed areas, especially when paired with GIS predictive models (Hitchings et al. 2013).

Uyyun al-Hammam: a Middle Epipalaeolithic Base Camp and Cemetery in Northern Jordan

The Middle EP site of Uyyun al-Hammam sits on an ancient river terrace exposed by modern road construction (Fig. 6a). Here, thick deposits (over 2 m) of the Late Pleistocene palaeosol discussed above contain extremely dense concentrations of

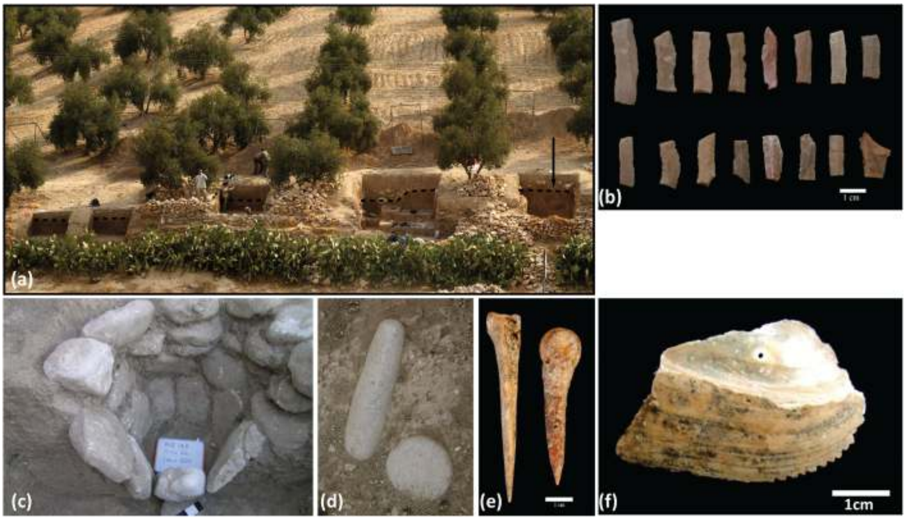


Fig. 6 The Middle EP site of Uyyun al-Hammam (**a**) sits on an ancient river terrace approximately 5–10 m above the modern wadi bed, and is truncated by the construction of a paved road (foreground) (modified from Maher et al. 2011b). Site features include two stone-lined and stone-filled pits (**c**). Examples of the most common tool type, highly standardized trapeze/rectangles, are shown in **b**. Groundstone (**d**), worked bone tools (**e**), and modified marine shell (**f**) are also found at the site

occupational debris that accumulated with the repeated occupation of the site, all representing one Middle EP cultural phase—the Geometric Kebaran. Six seasons of excavation have exposed the extensive remains associated with these occupations, with a wide diversity of artifacts including groundstone mortars and pestles, modified marine shell, worked bone, and an abundance of lithics and fauna. These remains are accompanied by a variety of features, including refuse middens rich in fire-cracked rock, trampled/earthen surfaces, and several stone features that may represent some form of architecture, storage pits, or lined hearths (Fig. 6c). Five radiocarbon dates place the use of the site between 14,500 and 17,250 years BP (Maher et al. 2011b).

The chipped stone assemblage is notably rich, dominated by microliths shaped into trapezes and rectangles (Fig. 6b). Despite a high density of lithic artifacts distributed over several uses of the site, there is no clear evidence for technological or typological changes in production (Macdonald 2007; Maher 2005). The stone tool technological repertoire is clearly defined by the production of microliths, or small bladelets, less than 5 cm in length and shaped into a variety of different forms. They form more than 76% of the tool assemblage, with 70% of these being some form of trapeze or rectangle. This is a clear Middle EP assemblage associated with the standardized production of geometric microliths as part of composite multi-purpose hunting and food processing tools. Endscrapers on blades, multipurpose tools, and burins are also particularly common tools in the assemblage. The cores are highly variable; blade cores are largely absent and there are many small subpyramidal and broad-faced bladelet cores (often with cortex) too small to have ever produced blades of the size of the blade tools in the assemblage. This suggests different *chaînes opératoires* for the production of blade tools and microliths, possibly with initial blade blanks being produced off-site. Debitage frequencies and type, as well as the use of predominantly local raw materials, indicate knapping occurred on-site, excepting preliminary blade production (Maher and Macdonald 2013). An emphasis was clearly placed on core maintenance, rather than initial core shaping, and the technological process documented here, as well as the final tools, are notably similar to other nearby Middle EP sites outside of Wadi Ziqlab, suggesting both movement of the site occupants around the landscape and shared lithic technological knowledge and ways to go about achieving similar ends in microliths production between groups within the local area (Maher and Macdonald 2013; Macdonald 2013). Geometric morphometric analyses of a sample of trapeze/rectangles indicate that these tools are highly standardized, angular in shape and with straight to slightly concave backing, with only minor variability expressed in the elongation of the final pieces (Macdonald 2013). Two hundred microliths were selected from the site for detailed use-wear analysis, with 42% of these showing clear traces of wear (Macdonald 2013). These microliths were used for a variety of functions, primarily as projectiles and to perform activities requiring longitudinal motions (such as cutting), but there was no clear correlation between type of wear and microliths type, indeed, most showed traces of more than one type of wear.

A detailed analysis of the abundant faunal remains from the site is illuminating. Analysis suggests a relatively broad species breadth, but with a clear preference for deer (Everhart 2018; Maher 2005; Maher et al. 2001). Yet, the occurrence (and abundance) of both deer and gazelle confirms vegetation reconstructions of an ecotonal landscape, with the occupants having access to both more forested and open habitats within easy hunting range. This is confirmed by the presence of other species, such as ibex, wild boar, aurochs, equid sp., red fox, wolf, and jackal. Tortoise occurs in notable frequencies but, surprisingly, bird bones are extremely rare and fish are absent. The bones, like all material from the site, are heavily concreted in calcium carbonate from palaeosol formation. However, painstaking cleaning of these surface deposits have yielded evidence for cutmarks and other processing-related modifications (Everhart, pers. comm.), indicating extensive and intensive butchering of the carcasses, including for marrow extraction. Burning is common to all species and elements.

Marine shell, worked bone, and groundstone occur less commonly, but are found in all deposits from the site (Fig. 6d–f). Groundstone implements include bowl and mortar fragments, grinding slab fragments, narrow elongated pestles, and oval and round hand stones, made of non-local basalt, but also local siliceous limestone. Worked bone is rare and includes several complete and incomplete bone points or awls, always highly polished and usually partially or completely burned. There are several bone beads (and one stone bead). The marine shell objects are predominantly highly fragmentary mother-of-pearl, usually modified by denticulating the edges of the shell. Except the groundstone, worked bone, beads, and marine shell occur distributed throughout midden and occupational deposits.

Activity Areas and Site-Formation

Reconstructing the occupational sequence at Uyyun al-Hammam is somewhat challenged by pedogenesis concurrent with (and likely continuing after) occupation, overprinting or obscuring cultural activities, except at the smallest scale (see below). The earliest occupations of the site are noted by features related to food processing and other aspects of daily life, such as a large hearth area and adjacent hearth clean-out filled with dense concentrations of fire-cracked rock, burnt lithics and fauna, and ash. There are also clear midden deposits and other areas with notably lower densities of debris that might indicate living areas or earthen "floors"; however, that interpretation must remain tentative. The later uses of the site are notably different. After habitation, it seems the site was reused multiple times as a burial ground or cemetery (see below). In addition, at some point during habitation, two substantial stone-lined and stone-filled pits were dug into pre-existing deposits, both to a depth of just over a meter (Fig. 6c). Both pits are carefully constructed of large, flat slabs that would have had to have been brought up from the wadi, or beyond. Both pits have open bottoms and are filled with the same palaeosol (also showing features of *in situ* pedogenesis). The function(s) of these pits remains unknown: they may have been storage pits or perhaps they reached below the Pleistocene water table here and served as wells; however, the site is located on the bank of the wadi. One of these pits was reused, with a secondary burial placed in its uppermost deposits and sealed with large stones. In any case, it is clear that the site was used multiple times and for multiple purposes, perhaps occupied repeatedly on a yearly or seasonal basis at first, and re-visited as needed for burial of the dead.

A rigorous program of micromorphological sampling was conducted during each excavation season to reconstruct site-formation processes and identify activity areas in the deep and highly compact palaeosol in order to better understand the site's features and integrate this data with palaeolandscape reconstruction throughout the river valley. Every deposit and feature was sampled. Analysis of the micromorphological samples documents a wide range of activities, including flint knapping areas, construction of stone features (two stone-lined pits), butchery and food preparation, living surfaces, refuse disposal, and symbolic use of space, all consist with a base camp occupation (Maher 2005). These occur as macro- and, especially, micro-scale traces in the form of butchery debris, middens, trampled earth surfaces, caching and possible food storage, and the activities of commensals. Many of these features are heavily modified and obscured macroscopically as a result of pedogenesis and, thus, visible only through micromorphological analyses. Figure 7 shows some of these features at the microscale, including a trampled surface visible as a thin, highly compacted layer with a linear and laminated organization, as well as burnt bone, charcoal fragments, ash and fire-cracked rock from a hearth cleaning, and highly fragmented bone and chert micro-flakes from a midden deposit. Small commensals and other soil microfauna living at the site probably scavenged much of this debris and are represented in the microfaunal assemblage, as well as identified in thin section through excrement, burrowing, and more directly through identification of their remains, such as the small carnivore molar in Fig. 7. Similar debris, although in lower densities, is visible as other Early and Middle EP sites found also in the red palaeosol elsewhere in the river valley (*e.g.*, Tabaqat al-Buma; Maher 2005). They all reinforce the notion of a stable land surface with soil cover that clearly promoted substantial and repeated occupation of the valley during the LGM and Bølling-Allerød. At Uyyun al-Hammam, in particular, we have strong evidence for a repeatedly used base camp whose occupants exploited diverse resources in the local landscape and engaged in a wide diversity of activities on-site (see also below). While current models suggest repeated and substantial occupation of sites was not a regular feature of the EP prior to the Natufian (although Ohalo II is a clear exception; Weiss et al. 2004), palaeosol formation at Uyyun al-Hammam, and elsewhere, confirm conditions amenable for substantial occupation here prior to Natufian.

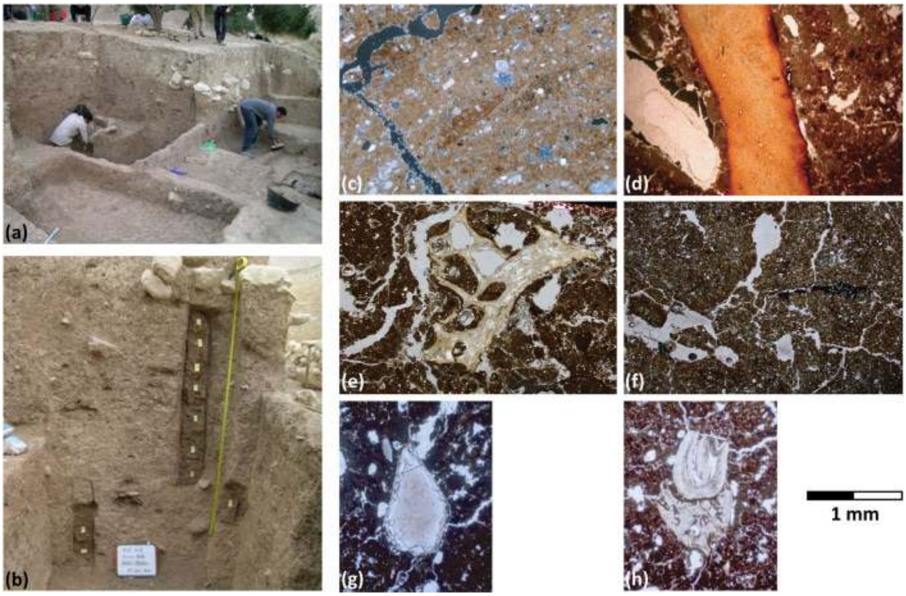


Fig. 7 Images (**a**) and **b** document the macroscopic features of the red-colored, compact Pleistocene palaeosol as noted during excavation. Example of an on-site section sampled for micromorphological analysis is shown in **b**. **c**–**h** illustrate features of the Middle EP artifact-bearing Pleistocene palaeosol (modified from Maher 2005, 2011). **c** A fragment of a trampled surface within Locus 007 consisting of a compact, laminated, carbonate-enriched (lighter areas) groundmass cementing lithoclasts and soil fragments within the matrix (PPL). Pedogenic calcite crystal growth can also be seen lining a plane void on the left side of the image. **d** A large fragment of burnt bone from Locus 008 (PPL). Highly fragmented charcoal fragments appear as small black flecks embedded in the iron-rich (reddened) groundmass. Lithics, fauna, and other cultural material were found throughout the palaeosol. **e** Burnt and unburnt bone fragments are particularly common from both midden and occupational deposits at Uyyun al-Hammam, occurring within the palaeosol with a strong subangular-blocky microstructure, marking the continued pedogenesis concurrent and after occupation (PPL). **f** The dense, subangular blocky microstructure is visible here, with highly fragmented cultural input. The darkened streak center right shows the highly fragmented nature of charcoal within the palaeosol, a result of ongoing post-depositional pedogensis and bioturbation (PPL). **g** A highly fractured piece of chert micro-debitage from Locus 008 (XPL). **h** A small carnivore molar found in association with lithics, groundstone, and other fauna within Locus 008 (XPL)

Human Burials and Human-Animal-Landscape Relationships

After repeated use of the site as a base camp, the site was reused as a cemetery (and possibly also as a short-term campsite) by Middle EP groups, with the interment of 10–11 individuals in eight graves (two graves containing at least two individuals, having been re-opened and reused) (Fig. 8). There are also isolated teeth and mandibular fragments from other contexts that likely represent disturbed burials (the site is truncated by road construction). The mortuary behaviors documented at this small cemetery substantiate an earlier foundation for the elaborate symbolic behaviors characterizing Natufian villages and cemeteries (Maher et al. 2011b), corroborating evidence from other pre-Natufian burials (Ohalo II, Ein Gev I, Ain Qassiya, Neve David and Wadi Mataha; Maher 2010). All burials were found stratigraphically within the Late Pleistocene palaeosol deposits and radiocarbon dating of the skeletons and deposits sealing the graves, as well as typological


Grave VIII
N
Grave I
Femur D
Femur B
Femur A
Femur C
0
50 cm
Human bone (Burial A)
Human bone (Burial B)
Human bone (Grave VIII)
Red ochre distribution
Fox remains
Modified animal bone
Articulated tortoise (2 carapaces)
Approx. grave boundaries (determined by artefact distributions)
Animal bone (unmodified)
Lithic/groundstone
Rock (unmodified & waterworn)

◀ **Fig. 8** Human burials from Uyyun al-Hammam are predominantly adult individuals buried as single, primary interments in extended position (upper row; modified from Maher et al. 2011b). However, two burials (Graves I and VIII) are notable exceptions (lower images). Discussed in detail in the text, these two graves exhibit multiple episodes of re-opening and reuse, with the intentional movement of a partial fox skeleton between them (bottom row: right during excavation, second from right after conservation), as well as the burial of individuals with a wide range of grave goods, including bone tools (bottom row: far left), and red ochre (second from left)

analysis of the chipped stone in associated deposits, place them clearly within the Middle EP (Maher et al. 2011b).

By far the most common type of interment is a single adult individual buried in an extended position, and often with grave goods, such as flint tools, groundstone tools, or the partial remains of animals, such as fox, gazelle, or deer (Fig. 8). Most graves are dug as shallow earthen pits into pre-existing Middle EP deposits; therefore, items considered as grave goods are conservatively restricted to those in clear direct association with the skeletons (*i.e.*, strategically placed on or beside the interred individual). For example, one contains the remains of a male adult individual with several gazelle phalanges placed in the neck region, while Grave VII is that of an adult female with a large flint blade placed on her chest. Other graves (*i.e.*, Grave II) have some form of grave installation or marker, such as Grave II, where the secondary burial of a gracile young adult female individual was placed within the top of a stone-lined and stone-filled pit. Several individual were intentionally buried with large unworked stones, either directly underneath, wedged in beside, or placed on top of the bodies (*e.g.*, Grave III). All burials were primary interments, excepting two where, after decomposition, only select long bones and the skull were buried, including one of a gracile young woman placed inside the stone pit (Grave II) and another with a partially articulated gazelle skeleton placed beside the skull and long bones of an individual of indeterminate sex (Grave V). The stone-lined and stone-filled pit is particularly interesting as neither the pit feature nor a burial in this context have any parallels in the Early or Middle EP, but are found in the Natufian (Belfer-Cohen 1988; Grosman et al. 2008). In addition, there is another pit exactly the same as this one only 2 m away, but it does not contain a burial, and since both pits show careful construction almost 1 m below the level of the burial, it seems the pits served some other primary function (perhaps storage—although the pits are not lined on the bottom—or water access) and then one was reused as a grave.

The two most complex burials are also the most interesting for our understanding of EP mortuary practices and so I discuss these here in a bit of detail (see also Maher et al. 2011b; Fig. 8). Grave I is the partial remains of an adult male individual buried with several flint tools, two fragments of groundstone, a bevel-edged bone "dagger," and the complete, articulated skull and right humerus of a red fox, all of which were intentionally placed on a clearly delineated layer of red ochre (Maher et al. 2011b). This grave was later re-opened and partially disturbed by the interment of a second individual, an adult female with no grave goods. Less than two meters to the west is another grave, Grave VIII, which contained the highly fragmented and disturbed remains of an adult male individual and some post-cranial elements of a second individual, both associated with several large, flat rocks (perhaps forming part of a grave installation); flint tools; a deer antler; a wild goat horn core; a worked bone "spoon"; two partial, articulated tortoise carapaces; and a complete, articulated fox skeleton missing its skull and right humerus (and associated with small fragments of red ochre). Although we may never be able to determine with certainty, the fox skull and skeleton split between the two graves show no overlap in skeletal elements and are of a consistent age and size, strongly suggesting they are one individual split between two graves (Maher et al. 2011b). Similarly, the complementary nature of skeletal elements, as well as age and sex and size, between the adult male individuals in Graves I and VIII suggests it is possible it was one individual whose (partial) remains were intentionally moved (and carefully placed) elsewhere shortly after decomposition commenced (Maher et al. 2011b). However, it is also possible that the human remains from each grave are different individuals. The fragmentation of both human and animal remains placed in association with human burials is not unique and may be significant (Chapman 2000); however, this is, so far, the first instance of this type of mortuary practice pre-dating those known from the Natufian burials (Belfer-Cohen 1988; Bocquentin 2003; Byrd and Monahan 1995; Grosman et al. 2008) and, as of yet, the only instance of a single animal fragmented and intentionally placed in clearly symbolic association with two individuals.

Among all the burials, there is no clear evidence for trauma or any other type of pathology that would indicate any kind of mass death event (J. Stock, pers. comm.). In addition, the clear re-opening and reuse of graves indicates that the interred were buried individually over time. It seems that, like its repeated occupation as a base camp, the site was subsequently used as a cemetery, revisited several times to inter the dead.

The re-location of the fox skull and humerus between two graves is notable and most likely symbolically important to either the interred, or those doing the interring. It seems that the fox was more than a grave adornment, but had some kind of special relationship to the human(s) in these graves, perhaps as a pet or companion, or even totem. The human(s) and the fox show striking parallels in post-mortem treatment, with Grave I re-opened and body parts moved between graves shortly after first burial. It is clear that the fox was (perhaps killed) and buried alongside one individual (Grave I) when the human died; later, when the grave was re-opened, these links were remembered and maintained when bones were moved so that the dead person would continue to have the fox close by, perhaps for in the afterlife. Although we cannot be sure of the sequence of events, it seems clear that the intention was to maintain in death a connection between the person (or people) and the fox, marking a relationship that was also important in life. Further reinforcing the social significance of the fox, it is the only articulated and relatively complete animal skeleton from the entire site, in any context, highlighting its treatment as similar to the humans connected to this place. In Grave I, it was carefully placed at the feet of the deceased person, much like the puppy at the hands of an individual from Ain Mallaha (Davis and Valla 1978), or the two dogs buried with an individual in Hayonim Terrace (Tchernov and Valla 1997). Both the fox and human were laid to rest on a "bed" of red ochre and accompanied by other items like worked stone and bone. However, disarticulated fox remains are also found in other, non-burial contexts at Uyyun al-Hammam. It seems here that there was a dual existence for the fox; some foxes were considered prey and their remains treated as such, while others were viewed and treated as ideologically different from other animals. Indeed, this appears similar to the treatment of foxes, early dogs, and other animals from Natufian sites (Tchernov and Valla 1997; Yeshurun et al. 2009, 2013). At Uyyun al-Hammam, the fox was buried complete, associated with other symbolic actions like staged placement on a layer of red ochre, associated with grave goods, and had its head removed and moved elsewhere. Interestingly, Mesolithic European sites of Ertebølle, Skateholm, and Vedbaek document several instances of burial associations between humans and animals (Fowler 2004). These practices foreshadow several well-known Neolithic mortuary practices for the treatment of the dead in cemeteries and in association with houses (see Kuijt 1996; Verhoeven 2004). Although the fox was never domesticated, it appears in increasing numbers and an increasing diversity of symbolic contexts throughout the EP and, especially, into the Neolithic (Goring-Morris and Belfer-Cohen 2002; Goring-Morris 2005; Kuijt 1996; Morey 2006; Peters and Schmidt 2004; Verhoeven 2004; Yeshurun et al. 2009), and its prominence in mortuary, as well as domestic contexts in the Natufian and Neolithic, makes its meaning here even more intriguing.

There has been a great deal of recent work on dog domestication, focused primarily on tracing the genetic relationships of the earliest domesticated dogs to one European (Botigue et al. 2017; Germonpré et al. 2011) or multiple (Frantz et al. 2016; Gray et al. 2010; Larson et al. 2012) centers, or exploring the behavioral changes of domestication (Dugatkin and Trut 2017; Udell et al. 2010; vonHoldt et al. 2017), rather than on the seemingly elusive mechanisms of domestication that involved complicated and entangled human-wolf/dog relationships. Research on domestic dogs in the Near East suggests they were small (*e.g.*, Clutton-Brock 1995; Dayan 1994; Gray et al. 2010). Behavioral research on dogs and Siberian silver foxes (*e.g.*, Hare et al. 2005; Trut 1999; vonHoldt et al. 2017) suggests foxes are easy to tame and share many sensory and other features with wolves and dogs that might make them amenable to domestication. Thus, it is not unreasonable to think that foxes, with similar body sizes and behavior, could have been considered as potential domesticates to prehistoric people. It seems likely that foxes could have shared a similar type of relationship with humans as wolves/dogs did, even if they were never truly domesticated. The inclusions of foxes in burials evidence emotional and/or spiritual ties between humans and foxes, which may parallel other types of social or economic relationships (*i.e.*, as pets, hunting companions, guards, *etc.*). They highlight that the Uyyun al-Hammam burials provide both important insights into the appearance of cemeteries and the nature and timing of newly developing relationships between people and animals prior to the appearance of domestic dogs in the Natufian.

Peopling the EP Landscape in Northern Jordan

Uyyun al-Hammam reinforces that cemeteries, as repeated locales of burial, with elaborate burial practices are not strictly Natufian features. The remains of at least 11 individuals, interred in eight graves, greatly increase the number of known human burials for the Early and Middle EP combined. In light of the elaborate nature of Natufian burials (*e.g.*, the Hilazon Tchatit shaman; Grosman et al. 2008), these findings provide strong evidence that key aspects of these complex mortuary traditions occurred earlier than previously thought. First, Natufian mortuary practices have their origins in the earlier EP and they highlight continuity in cosmology and symbolic behavior throughout the EP; these behaviors have a long chronology of development and we see an early appearance of cemeteries as persistent places within a social landscape. Second, there are clearly significant connections between people and the place of

Uyyun al-Hammam. Substantial and repeated occupation of the site attests to intensive use of the local landscape (raw material, plants, and animals). The burial ground was clearly part of a larger social landscape and people's relationships with particular "places" were more dynamic and persistent than previously thought. Both of these concepts are further developed and elaborated on in the second case study below.

Case Study 2: The Azraq Basin, Eastern Jordan

Local Palaeolandscape Reconstruction in Eastern Jordan

The Azraq Basin and Oasis Palaeolandscape

The Epipalaeolithic Foragers in Azraq Project (EFAP) is a collaborative, interdisciplinary, long-term research project based in the Azraq Basin of eastern Jordan, operating at multiple scales and involving several archaeological sites, with the aim of reconstructing the complex and nuanced aspects of hunter-gatherer settlement, landscape use, and human-environment relationships throughout the Late Pleistocene. The Azraq Basin is a substantial drainage system in eastern Jordan, encompassing approximately 12,500 km^2, from the northern reaches of the Wadi Sirham Depression in the south to the foothills of the Jebel Druze in the north (Fig. 3). At the center of this basin is the Azraq Oasis, a large wetland fed by several aquifers, springs, and networks of run-off and groundwater from throughout this extensive basin. Until recently, it provided a lush permanent water source to sustain a rich diversity of local and migratory wildlife and flora. Today this basin, and the oasis itself, sit at the boundary between the semi-arid steppe and desert proper, with precipitation throughout the basin ranging considerably from 50 to 200 mm/year. A geological and geomorphological history of the basin has been presented in several publications (Ames et al. 2014; Copeland and Hours 1989; Cordova et al. 2013; Garrard et al. 1994a, b; Jones and Richter 2011; Jones et al. 2016b; Maher 2017b), and is not repeated here. Human occupation of the basin was more or less continuous throughout the EP, but shifted from locality to locality, also varying in density and habitation type (Richter and Maher 2013a). Palaeoenvironmental datasets suggest that this was, at least in part, due to a complex landscape of changing local environments. For example, the sedimentary record from ‘Ayn Qasiyya, a spring site on the edge of the Azraq *Qa* (or playa), provides a well-dated sequence through the last glacial–interglacial transition and shows that the wettest period preceded the LGM and was characterized by marly lake deposits, followed by marsh formation during the LGM (24,000–19,000 years BP) associated with Early EP occupation of the area. Drying in the oasis and western reaches of the basin commenced during the Bølling-Allerød climatic optimum, intensified during the Younger Dryas, and eased somewhat in the Holocene. Natufian sites are unknown from the oasis and the western reaches of the basin, yet extensive occupations are known from the basalt desert to the north (Richter 2014; Richter and Maher 2013a) and seem correlated with local palaeoenvironmental reconstructions where increased trans-evaporation rates during the Bølling-Allerød warming elsewhere in the basin might have concentrated groups in the north where seasonal playas from the Jebel Druze provided reliable water sources for longer throughout the year (Jones et al. 2016a). Elsewhere, previous work in the region has documented numerous Palaeolithic, EP, Neolithic, and later sites (Ames et al. 2014; Betts 1998; Copeland and Hours 1989; Cordova et al. 2013; Garrard and Byrd 2013; Jones and Richter 2011; Jones et al. 2016b; Nelson 1973).

Kharaneh IV Palaeolandscape

Since 2008, EFAP has focused contextualizing the 20,000-year-old aggregation site of Kharaneh IV within the larger Azraq Basin landscape (Fig. 9). Despite the presence of several prehistoric sites, the eastern Jordanian landscape has generally been considered a wide-open desert space (Maher et al. 2016), peripheral to the cultural developments occurring to the west (Richter 2014). With Kharaneh IV extending over 21,000 m^2 and exhibiting an incredibly high density of material culture, and given the sparse, desert landscape of today, our work prompts the questions of why people chose to “settle” here and what types of activities created such a site?

To understand the local context of occupation at Kharaneh IV in relation to the numerous well-known EP sites to the west in the Mediterranean zone, we must understand the nature of occupation at the site within the surrounding palaeolandscape (Fig. 9). Recent projects in Southwest Asia have provided us with refined palaeoenvironmental datasets of climate, moisture, precipitation, and temperature changes over the last several hundred thousands of years (Bar-Matthews 1997; Enzel et al. 2008; Eren 2012; Rohling et al. 2013; Torfstein et al. 2013). These data have been used to interpret palaeoclimatic changes (and their impacts) over the larger region. Yet, as today, during the EP, the region was a mosaic of microenvironments and climates (*e.g.*, Belfer-Cohen and Goring-Morris 2011; Goring-Morris et al. 2009). Thus, the resolution of our current palaeoclimate reconstructions is generally too coarse to resolve the impact of regional environmental variability on local habitats throughout the EP period (Jones et al. 2016a; Maher et al. 2011a). Recent work in the Azraq Basin is proving particularly enlightening on this front; work by EFAP (*e.g.*, Jones and Richter 2011; Jones et al. 2016a, b; Richter et al. 2013) and others (Ames et al. 2014; Cordova et al. 2013; Garrard and Byrd 2013) indicates the Azraq Basin palaeoenvironment did not always follow the same pattern of warming and cooling or wet and dry cycles documented elsewhere. The purported models for culture change based on these regional climate models—focusing on developments within a core area in the Mediterranean zone to the west (Bar-Yosef 1998; Belfer-Cohen and Bar-Yosef 2000)—may need to be reconsidered based on the Azraq Basin geoarchaeological record. The key, it seems, to understanding the relationships between prehistoric people and their creation and use of a landscape starts with the high-resolution datasets available from on-site excavation paired with the small-scale and nuance of local palaeoenvironmental records.

Geomorphological evidence for the environmental setting within which Kharaneh IV was occupied are based on a combination of detailed analyses of on-site deposits paired with off-site survey to target and examine particular landforms illustrative of Late Pleistocene environmental conditions. The nature and stratigraphy of the on-site deposits is clearly differentiated from surrounding off-site sediments, marked visually as well as by other quantitative measures of sedimentology, such as having higher magnetic susceptibility values and silica content (Jones et al. 2016a) (Table 1). OSL

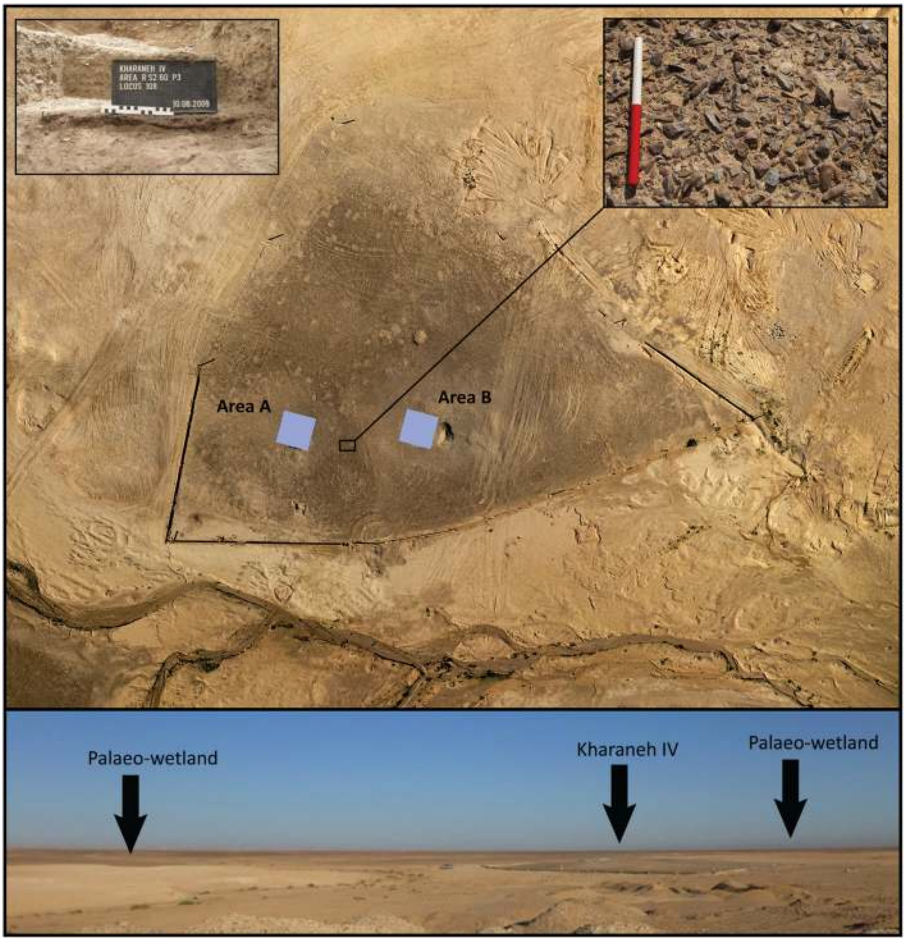


Fig. 9 Aerial photograph of the Early/Middle EP site of Kharaneh IV (center), with excavations areas A and B marked. A close-up of the high density of artifacts on the site's surface is found in the upper right inset and some of the *in situ* subsurface features, such as hearths, are illustrated in the upper left inset. The lower image shows the location of Kharaneh IV in the surrounding landscape amid areas reconstructed as wetlands

dating and analysis of off-site sediments from adjacent terraces, that preserve portions of what was once a relatively continuous land surface, show that a significant wetland existed at the site prior to and, shrinking somewhat, adjacent to the site during occupation (~23,000–18,600 BP) (Fig. 9). On-site, several deep trenches have documented marl- and clay-rich lake deposits at the base of the earliest occupations of the site and, in some areas, the cultural layers are interstratified with the lake deposits, suggesting that people were living directly adjacent to the lake during low water levels, likely periodically abandoning the site during period of high water levels, until a shrinking of the wetlands left the site permanently above the water table, and adjacent to the wetland's rich freshwater resources.

Experiencing a notable positive water balance just prior to ~20,000 years ago (Jones et al. 2016a), the visible "palaeoshoreline" of the wetland deposits were very extensive and extended about 300 m around the site; yet, they began to dry up around

19,000 years ago, during occupation of the site. A series of U/Th series and OSL dates link lake deposits off-site to the time of site occupation. The wetland deposits show a massive structure, and little vegetation in these ostracod-rich greenish marls in areas suggest some open water areas. These are overlain by loess, indicating an extensive and rapid shift to wind-blown deposition with changes in precipitation and evapotranspiration (Jones et al. 2016b). In the Early and Middle EP, Kharaneh IV was situated in a lush grassland habitat, with abundant wildlife and several seasonal (and possibly permanent) rivers, lakes, and playas. The local environment was clearly able to sustain large numbers of people, repeatedly, for prolonged periods, and during multiple seasons over a relatively short span of the EP. By 18,000 years ago, during a warm and wet period to the west, conditions at Kharaneh IV were dry enough (with increased evaporation) to force abandonment of the site, probably as water and wildlife resources dwindled. This marks the beginning of the present-day dry, desert conditions documented at the site. Late EP groups relocated elsewhere, predominantly in the Jebel Druze area, taking advantage of higher rainfall and more reliable water sources in this area (Richter and Maher 2013a). It seems that throughout the Late Pleistocene, the Azraq Basin was an important and central landscape for EP groups.

A detailed program of multi-element analyses, alongside micromorphology, to compare the nature of off-site and on-site deposits (as well as reconstruct on-site activity) areas remains ongoing (Table 1). Geochemical analyses of on-site and off-site deposits show a number of clear differences in these deposits (Jones et al. 2016b). Magnetic susceptibility is notably higher in all on-site deposits, likely resulting from repeated episodes of burning (including several *in situ* hearths) as iron oxide concentrations do not vary on- and off-site. Silicon dioxide (SiO_2) and calcium oxide (CaO) clearly dominate the geochemical make-up of on-site and off-site deposits; however, they appear negatively correlated. The on-site occupational deposits are higher in SiO_2, and we suggest this results from a combination of inheritance from the local limestone bedrock and from silica dust introduced during flint knapping—a common and ubiquitous practice on-site. In contrast, off-site silts and marls and on-site lake deposits are higher in CaO values, likely related to increases in carbonate-enriched water from the wetlands, compounded by an abundance of freshwater ostracod skeletons inherited from the marsh and lake water. These carbonates were mitigated against on-site by anthropogenic input introducing organic material and changing conditions of decomposition, deposition, and precipitation from groundwater.

The 20,000-Year-Old Aggregation Site of Kharaneh IV: What Were People Doing On-Site?

Reconstruction of the physical palaeolandscape at and around Kharaneh IV indicates that people were settling at Kharaneh IV because it was a rich wetland environment, and archaeobotanical and zooarchaeological work (see below) also demonstrates a diversity of associated flora (including grasslands and trees) and fauna in the local environs. This supports work elsewhere in the Azraq Basin where abundant local resources provided an attractive location for human settlement throughout the EP (Ames et al. 2014; Betts 1998; Copeland and Hours 1989; Cordova et al. 2013; Garrard and Byrd 2013; Jones and Richter 2011) (Fig. 1). After addressing the question of "why here?", now we must ask, what were people doing at the site to create such a rich and diverse archaeological record?

Following early work at the site by M. Muheisen in the 1980's (Muheisen 1983, 1988a, b), EFAP has since completed seven excavation seasons (2008–2010, 2013, 2015–2016, 2018) and two study seasons (2011, 2017). Radiocarbon dates from throughout the Early and Middle EP occupational deposits demonstrate the site was occupied between 19,800 and 18,600 years ago and, in this 1200-year span, multi-season, prolonged and repeated habitation of the site created one of the largest Palaeolithic sites in the region (Fig. 9). Repeated occupation led to the formation of a complicated, high-resolution stratigraphic record containing evidence for hut structures, hearths, postholes, symbolic and mundane caches, flint knapping activities, food processing, consumption and disposal areas, and human burials (Maher et al. 2012b). The immense size of the site, as well as its richness in stone tools, fauna, worked bone objects, ochre, marine shell beads, and archaeobotanical remains, provides evidence for a wide range of activities by hunter-gatherer groups. These include evidence for technological innovation, food surpluses (involving storage and feasting), and caching of utilitarian and symbolic objects (Maher 2016; Maher et al. 2016; Spyrou in review). Hut structures, in particular, are extremely unusual at late Pleistocene sites in southwest Asia. Thus, the presence of at least four structures (Fig. 10) provides a rare opportunity to investigate the intersection of domestic and symbolic activities and the organization of space in and around these structures—the earliest and most complete discovered in Jordan to-date. The discovery of structures at this site hints at emerging sedentism and settlement, economic intensification, and ritual behaviors associated with dwelling almost 8000 years earlier than previously known. Excavations to-date have focused on two main areas, Area A (Middle and Early EP) and Area B (Early EP),[1] with smaller test soundings in several locations in between (Fig. 9). A series of radiocarbon dates from both areas taken throughout the entire stratigraphic sequence of the site indicate occupation of the site between 19,830 and 18,600 years BP, a duration of ~ 1200 years (Early EP 19,830-18,730 and Middle EP 18,800-18,600; Richter et al. 2013). This occupation is "continuous" until abandonment, meaning that, although occupation was not necessarily (or likely) permanent during this time, there are no discernible episodes of abandonment.

Previous work is detailed in several publications (Henton et al. 2017; Jones 2012; Jones et al. 2016a, 2016b; Macdonald 2013; Macdonald et al. 2018; Maher 2016,

[1] The well-established terms Early and Middle EP have been used here to designate differences between the two main excavation areas (Areas A and B) where significant techno-typological differences in lithic assemblages have been documented and described in detail elsewhere (Macdonald et al. 2018; Macdonald 2013; Maher and Macdonald 2013; Maher 2016). We ascribe the Early EP occupations to the Kebaran cultural complex, associated clearly with gracile, obliquely truncated and backed pieces, micropoints, narrow-faced cores, and with little to no use of the microburin technique. We ascribe the Middle EP occupations to the Geometric Kebaran generally, with broad-faced cores, and a highly variable assemblage of geometrics with limited use of the microburin technique. However, it should be noted that there are also some minor distinctions between occupational phases within the Early and Middle EP contexts in Area A (Macdonald et al. 2018) and within the Early EP contexts in Area B, both still under study. We do not claim here that Kharaneh IV was continuously occupied by the same EP groups over its 1200 years of use; rather, we acknowledge that the intricacies of occupation and non-occupation inherent in the concept of an aggregation site are not (and may never be) resolved chronologically, and are certainly deserving of ongoing further analysis.

Fig. 10 Early EP area of Kharaneh IV, showing the location of three structures, with close-ups of the large anvil stone and marine shell and ochre caches placed on top of the burnt superstructure of Structure 1 (right) (modified from Maher et al. 2012b). Structure 4 is located in a small test trench to the north of Area B and not visible here

2017b; Maher and Macdonald in press, 2013; Maher et al. 2012a, b, 2016; Martin et al. 2010; Ramsey et al. 2016, 2018; Richter et al. 2011; Spyrou 2015, Spyrou in review). Here, I focus on our most recent work that has revealed evidence for at least four hut structures during the Early EP occupations (Fig. 10). Structure 1 is just over 2 m × 3 m in size and shows a complex sequence of construction, maintenance, use, and destruction events, where the hut was burnt after abandonment (Maher et al. 2012b) (Figs. 10 and 11). Near the center of the structure, we found three distinct caches of pierced marine shells, each containing 100's of shells imported from both the Mediterranean and Red Seas, each accompanied by a large chunk of red ochre, placed around a large flat anvil stone. The burnt structure was then sealed by a distinctive orange sand, suggesting it was intentionally destroyed after abandonment. On each of the hut's three distinct floors, we excavated a high density of artifacts, as well as several *in situ* caches of groundstone, bone and flint tools, ochre, and articulated animal remains (Fig. 12).

Of note, the three distinct hut floors, and the abandonment and sealing deposits, show patterns in the types of material culture intentionally deposited in these contexts—repeated themes in how people were using the floor spaces, caching items, and marking the end of the life of the structure (Fig. 11). For example, on each floor and in the sealing deposits, we see partially articulated animal remains, namely fox paws, gazelle phalanges, and tortoise carapaces. Discarded and cached bone tools, namely awls and points, are notably rare outside of the structure, yet there are several examples from each floor context inside, including one floor with nine polished bone points.

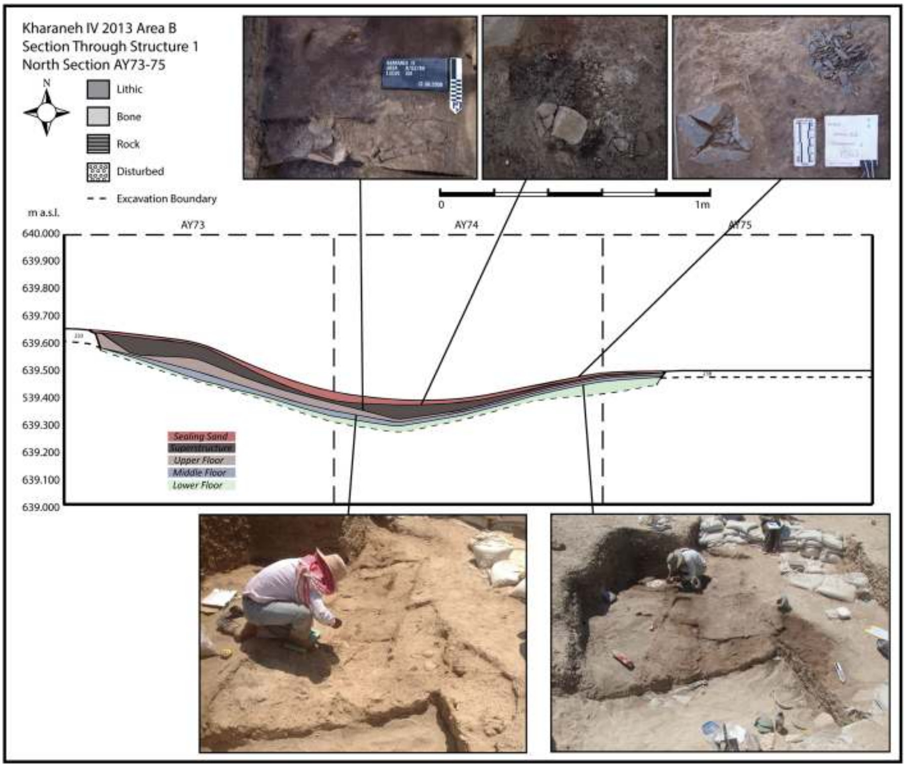


Fig. 11 Section through Structure 1 showing the three superimposed floors and overlying burnt superstructure and orange sealing sand. Counterclockwise from top right: two nodules of fire-cracked flint showing through the surrounding orange sand sealing the hut structure, cache of marine shells and red ochre beside a large cobble placed on the burnt superstructure, articulated aurochs vertebrae on the surface of the uppermost floor, excavation of the middle floor, and excavation of the lower floor

There are multiple caches of marine shell beads and, while none are as rich as the sealing deposit caches, one example consists of several shells in a position suggesting they were once strung together. Caches of horn cores or lithics and bone points are also known from several deposits immediately outside the structure (Maher et al. 2016), including one cache of 12 gazelle and 2 aurochs horn cores, all burnt, and elsewhere several instances of articulated burnt gazelle horn cores emplaced upright adjacent to the structure and hearth. The burnt horns from the cache may have been curated and stored for later use, but the ensconced articulated horn cores were clearly intended for immediate and, arguably, ostentatious display. A human burial from deposits underneath Structure 1 (Rolston 1982) was reported to have two gazelle horn cores placed one on either side of the head of the interred individual. The occurrence of gazelle horn cores in caches and in human burials is known from several Natufian sites to the west (Munro 2003; Tchernov and Valla 1997).

All of the items found on each floor, as well as in the superstructure and sealing deposits, were mapped out in three dimensions for spatial analyses, and detailed analysis of the chipped stone debris, including use-wear analysis of all the tools, and faunal remains show interesting insights into the organization of domestic space (Fig. 13). Hearths are notably absent from the structure; however, fire-cracked rocks,

Fig. 12 Repeated themes in the deposition/placement of materials inside and outside of Structure 1, including partially articulated animal remains (left column), bone points and a flint cache (middle column), and marine shell and bone/flint cache (right column). **a**, **d** Articulated fox paw and tortoise carapace, respectively, from Structure 1 floor. **b**, **e**, **h** Bone points from floors inside Structure 1. **c** One of three marine shell and ochre caches placed on the burnt superstructure of Structure 1. **f** A string of pierced marine shell on one of the Structure 1 floors. **g** One of at least three sets of burnt, articulated gazelle horn cores found just outside Structure 1 adjacent to a large hearth. **i** Cache of 12 burnt gazelle horn cores and 2 burnt aurochs horn cores found just outside of Structure 1 and adjacent to Structure 2. **j** Cache of flint bladelets and a core found just outside Structure 1 adjacent to a large hearth. **k** Several articulated fox paws surrounding a flint core found at the boundary of a large hearth between Structures 1 and 2 (modified from Maher et al. 2012b)

often in small caches, are present on each floor, and a large hearth was excavated immediately outside the structure. Cores are also found on each floor, and in small caches on the middle and lowermost floors. While there are no clear patterns in how tools were being stored within the structure, it is notable that the most common EP tool type—microliths—are rare and, indeed, those used as projectiles are absent. Thus, it seems that both the production and storage of these hunting and small processing tools was performed elsewhere. Scrapers, the second most common tool type from our Early EP contexts, were recovered in much higher proportions within the structure than outside the structure. From two of the floors, endscrapers used for working both fresh and dry hides (Macdonald pers. comm.) are the most commonly found indoor tool types. Indeed, it seems that blades, flakes, scrapers, and burins—found on all floors, but lacking from the superstructure and sealing deposits—suggest hide-scraping and butchery-related activities were performed inside, along with some flint knapping, while microlith production, use, and storage was performed outside, perhaps in more communal areas or around the hearth.

Faunal remains from outside of the structure are dominated by gazelle, but a wide range of other species are common as well (Maher et al. 2016; Martin et al. 2010). Within the structure, taxonomic representation is limited to goitered gazelle (67%), spur-thighed tortoise (17%), cape hare (6%), red fox (4%), and equids (4%) (Allentuck pers. comm.). These species are represented repeated on all floors inside of the structure and in notably high frequencies as articulated or partially remains, especially in comparison to outdoor deposits that are characterized by large middens, dispersed and diffuse occupational contexts, or very dense accumulations of mixed fauna (what we have dubbed "bone beds" because of their incredibly high faunal densities). This suggests minimal post-depositional disturbance. While gazelle is present, it occurs in notable less frequency inside the structure in comparison with outside deposits, and horn cores are virtually absent. The skull of a juvenile canid (probably wolf) and the feet of a fox and a hare were discovered within the burnt superstructure deposits and may represent animal parts originally hanging inside the hut that fell onto the uppermost floor when the structure burned and collapsed.

Some of the bones, including an articulated fox paw (Fig. 12), are burnt, as are some, but not all, of the flints and cobbles found on floors contexts. It is possible, but given the haphazard occurrence of burnt pieces from all floors, it seems more likely that burning occurred outside of the structure and these items were placed on the floors in their burnt condition. Cut marks on fox remains inside and outside the structure indicate both decapitation and skinning and that the pelts were collected in such a way so as to preserve the skull and retain the paws inside the pelt (Allentuck pers. comm.; Martin pers. comm.). This non-dietary use of fox clearly has an early origin in the EP.

Microscale analysis of the floors, superstructure, and sealing deposits through micromorphology allows one to look at the construction, maintenance, and use of these structures. Multiple lines of evidence, including multi-element analysis of the deposits and phytolith analysis, are providing nuance to our reconstructions on the use of space, and this work remains ongoing, alongside newly developing work to explore the potential of fecal stanol biomarker analysis to identify areas of human activity and geo-ethnoarchaeological work on hut reconstructions to understand the geoarchaeological traces of structured space and site-formation processes. At present, micromorphology paired with macro-scale analyses has proven a powerful tool for exploring the floors and associated cleaning, intentional caching, and destruction activities—providing a life-history perspective on these structures.

Floors have always been of particular interest to archaeologists as the "place" on which evidence of human activity is deposited. Looking at the depositional and post-depositional processes involved in floor preparation and use, one can distinguish between areas with intense human activity that we might describe as related to discrete actions (*i.e.*, a hearth) as opposed to more dispersed and diverse actions or activities (*i.e.*, sleeping areas, "living areas," "the kitchen"). The former may be characterized by the addition of increased amounts of vegetal matter, ash, and charcoal or other types of cultural debris, while the latter may be described as more compact, with smaller pore sizes and less turbation or mixing, but with less bounded or quantifiable differentiation (Friesem et al. 2014). In either case, it is clear that micromorphological analysis is able to discern certain kinds of activities because they result in diagnostic residues, and this is particularly true for floors. Several geo-ethnoarchaeological studies have shown that houses in which the roof collapsed rapidly after abandonment or due to conflagration events caused the fast burial of residues deposited on the floor surface and thus enabled better preservation (Goldberg and Whitbread 1993; Milek 2012; Friesem et al. 2014). At Kharaneh IV, we see the intentional destruction of two structures (see Structure 2 below) through conflagration and excellent preservation of floor deposits. Examination of the floor contexts of Structure 1 in thin section shows that each surface consists of thinly laminated, compact silty-clay and is remarkably clean of objects or clasts larger than coarse sand (Fig. 13). However, they are extremely dense in highly fragmented anthropogenic materials like charcoal, bone, and flint microflakes. The fact that high densities of very small cultural materials (microscopic) and macroscopic materials (complete tools, fire-cracked rock, animal bones, complete shells) are found on each floor, often in caches or consisting of articulated remains (animals, strung shells), suggests two things: (1) the floors were highly maintained, probably swept and kept clean, and (2) that these caches are intentional and placed after use of the floor. The larger objects are not simply “garbage” or refuse lying around on the floors during or after occupation of the structure (Fig. 13). They were intentionally placed on the floors each time, after the end of the life of the floor and before new material was placed on top to construct the new floor above. It also gives us some possible clues on the temporal dimension of the life of these structures—with such large objects placed in deliberate ways, and the excellent preservation of delicate, articulated bones and strung shells on even the lowest floors, I suggest that there was no interruption in occupation: one floor was built on top of another in a short period of time and the building of a new floor may have marked an important life event for its occupants. The latter interpretation is even more compelling when we consider Structure 2, where a human burial was placed on the uppermost floor before the structure was intentionally buried and sealed in sand. The death of this individual may have marked also the end of the life of the house they lived in. In Structure 1, the restriction of evidence for burning to the confines of the underlying structure’s footprint and lack of evidence for burning outside suggest the burning was intentional and the caches placed over the burnt superstructure, as well as its sealing with orange sand (of unknown origin), indicate that this act marked the end of the life of this structure.

Ongoing work on the phytoliths recovered from all of the Structure 1 deposits provides interesting clues as to how the occupants of the structure used local plant resources to construct their huts and furnish indoor spaces. Comparison to the Early EP site of Ohalo II, located on the shores of the Sea of Galilee and containing several well-preserved hut structures, demonstrates that similar plant resources were employed in both site’s hut constructions, including extensive use of wetland sedge and reed resources (Ramsey et al. 2018). Intensive use of the local wetlands around Kharaneh IV is not surprising, but provides a new context within which to understand EP landscape use in the region. The phytolith evidence demonstrates that woody and shrubby dicots were employed for construction of the hut frame and that a variety of grasses, wetland reeds, and sedges were used as bundled thatching to cover the frame of

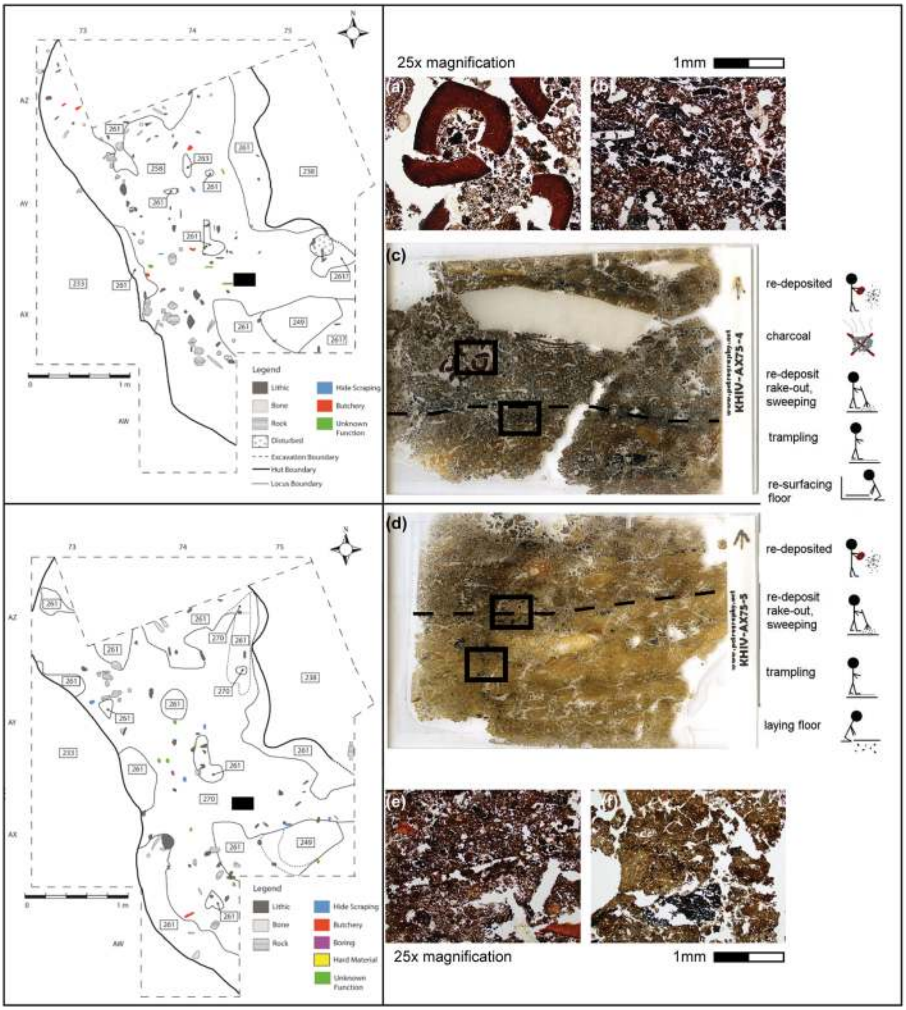


Fig. 13 All objects from each context of Structure 1 were recorded and mapped, including from the upper and middle floors shown on the left. Discussed in detail in the text, each floor shows a compact, horizontally laminated texture free of any components coarser than sand. These floors were prepared and maintained through sweeping or some other form of cleaning. Phytolith analysis suggests matting may have been placed on their surfaces (Ramsey et al. in press). The items found on their surfaces (*e.g.*, Fig. 13) were intentionally placed there before reuse of the structure and construction of the next floor or final burning of the structure. Photomicrographs of these floors also show their compact, laminated fabric with only highly fragmented charcoal, bone, and other associated living debris, likely from trampling. Macroscopic (**c**) and macroscopic (**a**–**b**) examination of the upper floor: The dashed line in **c** marks the boundary between the floor and overlying burnt deposits. The locations of photomicrographs (**a**) and (**b**) are marked left (**a**) to right (**b**) by the bold boxes. **a** One of four broken bone beads from on top of floor deposit. **b** Spongy and granular structure of the overlying burnt deposit sitting on top of the upper floor, containing *in situ* remains (such as the auroch vertebrae in Fig. 12), and an extremely high density of fragmented charcoal (black component). **d** The middle floor boundary is marked by the dashed line and locations of photomicrographs (**e**) and (**f**) are in bold, left (**e**) to right (**f**). **e** Compact, laminated floor deposit cleaned of any large components. **f** Boundary between the floor and overlying deposit (containing caches of chipped stone, shell, fauna, bone tools, stones) marked here with a large piece of charcoal (black, lower center). Interpretations of the sequence of events noted from these floors is presented to the right

the superstructure, as well as laying down loose floor coverings or mattings in the interior, perhaps to increase the comfort of the indoor living space (Ramsey et al. 2018). Alongside other lines of evidence presented here, and elsewhere, this emphasizes that Early Epipalaeolithic hunter-gatherers were increasingly investing in creating a "place." The construction of these early homes (Maher and Conkey in press), arguably as an elevation of the value of certain local resources, would have heightened the social meaning of the Kharaneh IV landscape.

Archaeologists generally recognize the building of a house or a home as a cultural phenomenon; something that involves technological knowledge and social and ideological/symbolic activities that structure social interactions (Boivin 2000; Tringham 1995). A house is not just a material embodiment of the social relationships of those who dwell within and around it, but is a "place" of special meaning, itself entangled in the creation and maintenance of these relationships (Hodder 2012). Its role is much more than a physical container for activities occurring within, much more than a "shelter" (Maher and Conkey in press); it is a socially constituted place and houses and the people who live in them are in a "mutually constituting relationship" (Hendon 2004, p. 271), the traces of which are preserved in the material culture and material context of the structure and spaces around it. Archaeologists can examine and explore these roles through micro-scale analyses of daily activities, and their rhythmicity, that relate to the entangled quotidian and symbolic lives of those who build, rebuild, maintain, use, and abandon or destroy these structures. So, an approach to hut structures that goes beyond "a shelter," through examining the microscale traces of technological, social, economic, and ideological/symbolic activities and interactions, here I show that the occupants of Kharaneh IV created "homes" as both physical spaces and social places embodied with permanence and with meaning in all these realms (Maher and Conkey in press); these homes reside at a locale created as a persistent place in the EP landscape.

In 2015 and 2016, we excavated the surface deposits of Structure 2, and excavated its contents in 2018. The sequence of deposits associated with the structure show that, like Structure 1, the hut was burnt after abandonment and capped with a near-sterile orange sand. Here we also see a series of floors and fills, and intentional deposition of material on each floor (micromorphological analysis is ongoing).[2] While phytolith analysis here is also ongoing, it appears likely that its construction was similar to Structure 1, where grasses and wetland reeds were bundled or thatched over wooden support poles. On the uppermost floor deposits of the burnt hut, we discovered the burial of an elderly female (c. 55 years old; J. Stock pers. comm.) individual buried in a tightly semi-flexed position (Maher et al. in review). The woman had a healed right distal radius fracture and heavily worn teeth, but was otherwise in good skeletal health. Her remains are heavily burnt and she appears to have been placed inside the hut after death and prior to burning of the structure. While not a cremation in the classic sense of the term, it seems likely that the intention was to burn the structure and interred woman together. Of note, early work at the site also recovered two human burials (Rolston 1982). Through our renewed excavations, we now know these remains were associated

[2] Of note, all of the fire-related features (burning of Structures 1 and 2, hearth) have clear and distinct boundaries and are separated from each other by areas with no evidence of burning, suggesting these events were separate and controlled uses of fire.

with deposits immediately below Structure 1 (however, we cannot determine whether the individuals were buried prior to construction of the hut and, thus, may be unrelated, or buried under the floor(s)). Hut structures and human burials are known from other Early EP sites, such as Ohalo II, where the adult male was found adjacent to several structures (Nadel 1994, 1995), and Ein Gev I, where an adult female was found below the partial remains of a paved floor (although the association between the burial and the floor remain unclear; Arensburg and Bar-Yosef 1973). However, this is the first time that human remains have been found as definitely inside a structure (and on a floor) prior to the Natufian. Huts at Ohalo II demonstrate specific structured domestic activities performed within EP structures (Nadel 2002, 2003, 2006), and with the burial of a person inside Structure 2 at Kharaneh IV, we also have clear evidence for a symbolic aspect to these structures pre-dating the well-known association of burials and houses during the Natufian and Neolithic (Bar-Yosef 1998; Croucher 2012; Kuijt 1996; Valla and Bar-Yosef 2013). The richness of Structures 1 and 2, as two examples of other similar structures at the site not yet fully excavated, suggests the enormous potential of Kharaneh IV for yielding rare insights into spatial organization of related domestic and non-domestic activities within hunter-gatherer sites.

Just as micromorphological analysis can shed insight into activity areas within the structure, an examination of the contexts of finds in the “outside” spaces between structures is illuminating. Here, we find several caches of chipped stone debris from individual knapping events (always of microlith production, notable with the absence of microliths inside), sometimes with bone tools or chunks of red ochre included, and caches of burnt gazelle and ibex horn cores, including one large cache of two articulated aurochs horn cores and 11 disarticulated gazelle horn cores (Maher et al. 2012b). The space in between Structures 1 and 2 also contains one large, probably reused hearth, marked as a deep pit with fire-reddened boundaries filled with charcoal and burnt lithics and fauna, lined with several large, burnt slabs of limestone placed on end, and surrounded by several tortoise carapaces, and one cache of four articulated fox paws surrounding a used bladelet core interpreted as a pelt bag for the core (Maher et al. 2012b). Also of note were three instances of burnt gazelle horn cores still articulated to the frontal bone, installed upright and surrounding the hearth. While several of these things are clearly “functional” or quotidian in nature, they may have also had a symbolic dimension, and when thought of within the context of surrounding less-obviously functional deposits, like the burnt horn cores, suggest a rich symbolic component to life inside and outside of these structures. Perhaps distinctions between inside and outside are not as clear-cut as we might think or, at least, not directly comparable to contemporary preconceptions about what “should” be done inside or outside.

The Middle EP area of occupation (Area A) shows an equally interesting and complex relationship between the site’s occupants and the local landscape (or, rather, the creation of a highly socialized landscape). Discussed in detail elsewhere (Maher et al. 2016), this area exhibits a much more straightforward sequence of events, but with great import for our reconstructions of changes in hunter-gatherer behavior over time. In this area, we do not find any discernible hut structures or sizable caches, or other evidence of small, discrete, spatially bounded activities. Instead, we see activities spread out over space; there are three thick, poorly (if at all) bounded, massive, superimposed compact earthen surfaces that likely represent ‘outdoor’ or open, communal spaces. Each of these contains several hearths, sometimes partially superimposed on each other, and surrounded by several small post-holes that we interpret as the remains of drying or smoking racks placed over and adjacent to the hearths to process gazelle meat (Maher et al. 2016; Spyrou 2015). Indeed, gazelles are extraordinarily abundant in these contexts. These outdoor "floors" are accompanied by extensive midden deposits, containing both intensively and minimally processed carcasses. While gazelle horn cores (sometimes articulated, but not burnt or upright), marine shell, and worked bone and stone are more abundant in these "floor" and midden contexts than in the Early EP, they are generally isolated finds, usually in refuse areas. It seems that activities here, including flint knapping, food processing, cooking, storage and, possibly, consumption, and perhaps even sleeping, eating, and other "domestic" activities, were performed openly and communally, or in other areas of the site as yet unexplored. This is consistent with the faunal evidence that shows intensive processing of gazelle here, probably including for later storage and feasting of gazelle meat (Allentuck pers. comm.; Spyrou 2015), and mortality profiles of gazelle that are also consistent with multi-season and communal hunting strategies (Martin et al. 2010). In any case, it seems clear that in comparison to the Early EP areas, daily activities were performed more publically.

Other lines of environmental evidence, beyond geoarchaeology, provide valuable insights into landscape use at and around the site. Prolonged dry, desert-like conditions since abandonment of the site mean excellent preservation conditions for macroscopic archaeobotanical remains that record local vegetation and habitat change, as well as provide an abundance of charcoal material for radiocarbon dating. Woody and shrubby charcoal consists of wild almond (Amygdalus), tamarisk (Tamarix), buckthorn (Rhamnus sp.), a variety of chenopod species like goosefoot, as well as dicot species (Asouti pers. comm.; Asouti et al. 2015). A rigorous program of phytolith analysis of deposits from Area B is yet another line of evidence for palaeoclimate and human use of plants. An abundance of phytoliths from all sampled deposits show extensive use of a wide variety of arboreal, grassland, and wetland species, with an intensive use of wetland resources (especially for the construction of Structure 1). Ramsey et al. (2016) hypothesize that the site's occupants focused on both grassland and wetland resources; however, semi-arid steppe vegetation—the grasses—would have been more risky due to their susceptibility to fluctuations in precipitation. On the other hand, wetland resources are more reliable as their taxonomic representation and abundance are not modified greatly by seasonal or other temporary climate fluctuations. With increasing evidence of year-round (but not necessarily multi-year) occupation at Kharaneh IV (Maher et al. 2016) within an intensively used wetland habitat, Ramsey et al. (2016) suggest that cereals were not needed for sedentism and wetland resources were also an important driver for this adaptation, providing the possibility of a new pathway for "Neolithization."

Similarly, zooarchaeological evidence corroborates a rich and diverse local habitat, with both grassland (*e.g.*, gazelle) and wetland (*e.g.*, wild boar, wild cattle) species well-represented in all contexts. Discussed in detail elsewhere (Allentuck personal communication; Maher et al. 2016; Spyrou 2015), the faunal assemblage for the site is overwhelming dominated by gazelle (mostly sedentary), comprising between 84 and 95% of the identifiable remains (Martin et al. 2010). The presence of a wide diversity of other species, including some water-dependent animals like boar and hippopotamus, confirm a wide range of habitats surrounding the site and exploited by its inhabitants. Most remains are extensively processed, and microliths in both areas show clear use as hunting projectiles. Examination of gazelle cementum, dental isotopes, and mortality profiles indicate year-round hunting and a probable shift from targeted individual hunts in the Early EP to communal hunts or herd culls, perhaps using game drives, and communal processing (possibly with the storage and feasting of gazelle) in the Middle EP (Henton et al. 2017; Jones 2012; Martin et al. 2010; Spyrou 2015). Yielding clues towards the issue of duration of occupations, these data suggest that while occupation of the site may not have been "permanent" (or, at least, it would be difficult to ascertain this), it was clearly repeated, prolonged, and multi-season. Both migratory and sedentary gazelles are present and, while sedentary gazelles predominate, the presence of migratory species raises the possibility that some hunter-gatherer groups may have followed these herds, periodically congregating at Kharaneh IV as local herds grew during periods of aggregation.

The local landscape around Kharaneh IV was clearly attractive to EP groups, drawing them from within the Azraq Basin and beyond. Those coming from beyond are evidenced by the material culture left at the site, namely an abundance of marine shell (Fig. 12f). Marine shell number in the thousands and are found in all contexts. Species from the Mediterranean Sea, such as *Columbella rustica* and *Mitrella scripta*; from the Red Sea, such as *Nerita sanguinolenta*; and species known from both seas, such as *Antalis* sp. and *Cerastoderma glaucum*, are particularly common (Richter et al. 2011). In addition, *Euplica turturina*, known today only from the Indian Ocean, attest to the possibility of these long-distance exchange and movement networks. Most of these shells show manufacturing traces of piercing (drilling and chipping), denticulations, or other forms of modification and use-wear traces of having been strung (Richter et al. 2011). Many also retain traces of red ochre staining. These "exotic" items mark the connections between people at the site and others, near and far, from the surrounding landscape. While clearly indicating the movement of objects over long distances, the movement of flint knapping technologies (and not raw material, see below) strongly suggests both connections between sites stretching from the Azraq Basin to the seashores through both the movement of objects and people. Marine shell beads are known from early in the Palaeolithic, including in the Levant (Bar-Yosef Mayer 2005), where their social significance in information exchange is well-recognized (Kuhn and Stiner 2007; Kuhn et al. 2001). One could imagine at Kharaneh IV a similar scene to that reconstructed by Breuil (1949) for Upper Palaeolithic sites in Europe of a "shell trade fair," showcasing these shells used for a variety of economic (currency), technological (tools), political (alliances, marriage partners), cosmological (role in rituals), and social signaling (decoration, status) purposes.

The study of prehistoric technologies, particularly chipped stone tools, to understand the enmeshed roles of technology in the creation, maintenance, and transformation of people's relationships with each other, the landscape, and the material world is particularly illuminating in reconstructing human-landscape dynamics. A *chaîne opératoire* approach to technology can yield insights into the social role of technology and the processes of learning and apprenticeship, both of which occur within a social landscape (including even who has the knowledge of where to get raw materials and access to these materials). At Kharaneh IV, ongoing technological analysis of the chipped stone assemblage allows us to assess the transmission and situated learning knowledge of flint knapping traditions, as well as connections between various aggregating groups on-site and the movements and connections between dispersing groups off-site across the larger landscape (Maher and Macdonald in press; Maher 2016). With an approach to lithic production that highlights communities of practice, these communities are assumed to be dynamic, fluid, and regularly changing with the various social constitutions of the site's inhabitants.

Examination of technological strategies at Kharaneh IV shows clear differences in knapping between Early and Middle EP phases (Maher and Macdonald 2013) (Fig. 14), with Early EP occupations showing a clear preference for the gray-brown flint found immediately around the site and an emphasis on initial core preparation. Middle EP flint knappers utilized a wider variety of flints, although still all from within 5–20 km of the site (Delage pers. comm.), and focused more on ongoing core maintenance over initial preparation. Narrow-faced cores, investment in core shaping, and minimal retouch of blanks to form the desired non-geometric microliths mark Early EP strategies, while broad-faced cores, flexible raw material choice, investment in core maintenance, a lack of standardization in blank production, and heavily retouched microliths mark Middle EP strategies. In essence, Early EP production was relatively standardized while Middle EP production was highly variable and, over time, blank size and shape was less important because through heavy retouch, almost any small flake or blade could be formed into a microliths of the desired size or shape. In addition, the final form of geometric microliths in the Middle EP is highly variable; much more so than at other contemporary sites, with over 15 different forms of trapeze or rectangle

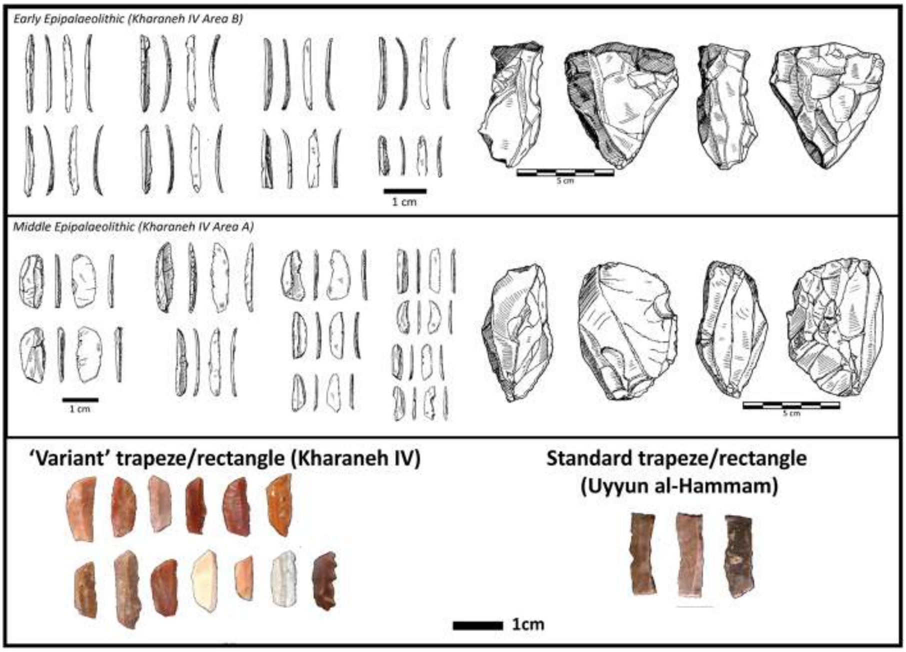


Fig. 14 Chipped stone tools from the Early and Middle EP phases at Kharaneh IV. Early EP microliths are characterized by gracile, non-geometric microliths and narrow-faced cores (upper). Middle EP microliths are highly variable in overall shape and form, but are generally characterized as broad trapeze/rectangles made from broad-faced cores (middle). The lower image compares the high degree of variability of the Middle EP trapeze/rectangles at Kharaneh IV to the more uniform, standardized trapeze/rectangles from Uyyun al-Hammam

variants recognized (Muheisen and Wada 1995). While there is significant discussion and debate regarding the meaning of this type of microlith variability—for example, does the lack of backing represent a new type, or is it simply an unfinished piece (see also Maher 2010; Olszewski 2002)—even conservatively excluding forms that might be considered "unfinished" or marking only one part of the larger life-history of the tool (*e.g.*, unbacked types, types with one end slightly curved, *etc.*), there is greater variability in discrete forms (denticulated, hooked, rectangular, *etc.*) at Kharaneh IV than elsewhere and that all forms are both used and unused. Beyond typological analyses, this is borne out through geometric morphometrics and use-wear analysis of the microliths from Kharaneh IV (and elsewhere, especially in comparison with Uyyun al-Hammam; Macdonald 2013) that show a wider range of variation in tool shape and use. Of course, some degree of variability in microlith forms is expected and documented at most EP sites and likely results from intentional choice to produce preferred forms, as well as changes in the life history of a piece, *ad hoc* suitability for specific composite tools, or equifinality in production (Kuhn and Zwyns 2014). Problems with explanations of change in form resulting from various aspects of the life-history of an EP microlith (*e.g.*, re-sharpening, discard, reuse, *etc.*) have been addressed as minimal by various researchers (Neeley and Barton 1994, and replies therein). In any case, at Kharaneh IV, rapid burial of occupational deposits and intentional caching made many of these tools inaccessible between occupational phases (excepting surface deposits, where there are no noted changes in microlith types on the magnitude of those documented between Early and Middle EP phases).

While it is likely the case that these alternative reasons contribute to some of the Kharaneh IV variability, ongoing comparisons between tool types from Kharaneh IV and contemporary assemblages elsewhere in the region (Maher 2016; Maher and Macdonald 2013, in press) suggest much of this variability may be traced back to assemblage similarities with other geographically bounded clusters of sites to the west, north, and southwest of Kharaneh IV. For example, there are strong stylistic similarities in trapeze/rectangles from Kharaneh IV and sites in the Negev (*e.g.*, denticulated, pointed, and hooked pieces from the Shunera sites, S. Qeren II and Azariq XVI, Goring-Morris 1987; standard trapezes from Neve David, Yeshurun et al. 2013 and AWS48, Richter et al. 2014; elongated trapezes from Wadi Hisban, Edwards 2001; rectangles from Uyyun al-Hammam; triangular shaped pieces from the Jordan Valley, Edwards 2001). Of particular note, one of the features documented at nearby Jilat 6, the only other comparative Early and Middle EP aggregation site, is a similarly high degree of microliths variants (Garrard and Byrd 2013). These comparisons reinforce the idea that different social groups may have aggregated in the Azraq Basin, bringing the knowledge (not the raw materials or final tools) of their lithic traditions, sharing this on-site through fluid communities of knappers and resulting in what appears to us, at least, a blending of tool types and highly variable assemblages.

Peopling the EP Landscape in Eastern Jordan

While there is much more work to be done at the site, some provisional observations can be made. In summary, at Kharaneh IV, we see some notable spatial and temporal differences in the ways people were doing things and where they were doing them. Houses were places for daily domestic life, but also served as important symbolic locales. Stone tool production and use was more spatially circumscribed and sometimes even cached in the Early EP, yet communal and public in the Middle EP (where we also see dramatic increases in technological and tool variability). Daily life in general was more bounded in the Early EP, with clear inside and outside spaces and discrete, spatially bounded contexts, like hut structures, hearths, and caches. In the Middle EP, daily life was largely performed in what could be interpreted as communal places and might reflect more community-based organization of hunting, food processing, and other tasks, as well as shared ideologies and symbolic life. In both phases, shell beads and worked bone and stone served a variety of symbolic, social, and economic roles, differing in abundance and contexts over time (increasing in both in the Middle EP). And human burials (*so far* only associated with Early EP occupations) played a role in symbolic life, maintaining connections between people and places in life and in death.

In both phases, the occupants of Kharaneh IV constituted hunter-gatherer communities, with fluid and dynamic spheres of connections and interactions between members that shifted over time and by situation, and were sometimes restricted and sometimes highly communal. These communities probably changed regularly as groups visited and re-visited, aggregated, and dispersed at the site, but were, in some form, maintained over larger geographical spaces and over time (Byrd et al. 2016; Maher 2016). However, there are notable distinctions between the Early and Middle EP phases that might provide some nuance to differences in landscape use over time. For example, it is possible that the greater similarities in stone tool production and, namely, microliths form within Early EP occupations might suggest use of the site repeatedly and for prolonged periods by the same social group[3] from within the Azraq Basin (see also Maher 2017a, b), using the site as a base camp—although still with notable connections (or movements) to more distant lands as seen by the marine shell (see also Macdonald et al. 2018 for differences in landscape use within the early and later Early EP). While the range of variability in geometric microliths, increase in marine shell, and evidence for an increase in communal activities in the Middle EP might suggest movements and aggregations of multiple groups, and from farther afield (or at least highly connected to groups farther afield), as we envision for an aggregation site (Conkey 1980). On the broader scale the site occupants were engaged in a landscape of interacting hunter-gatherer communities, connected through people, places and things. In addition, these movements may not have always been direct, creating a picture of the EP social landscape full of sites, "places" in between sites, and all connected by a chaotic collection of meanderings and seemingly indirect pathways (Fig. 15). These social networks of interaction involved multiple hunter-gatherer groups from near and far, and resulted in archaeological residues indicative of repeated, prolonged occupation of Kharaneh IV, itself a "place" on the landscape, by people engaged in a wide range of activities leaving a variety and high density of material culture and material context traces. The presence of private (hut) and public (gazelle processing installments) structures indicated the occupants made themselves "at home" in various ways and that structures were not necessarily temporary or flimsy in nature. Marine shell and flint

[3] Here, I do not necessarily mean the literal same group each time, but instead fluid communities or groups with shared aspects of material culture (especially in microliths production) that we currently define as one (here Kebaran) of several contemporary cultural entities or social traditions, in line with what we currently understand for the Early EP in southwest Asia (see "The Epipalaeolithic Period in Southwest Asia" section above, and references therein).

knapping traditions served as social currency, creating and maintaining large-scale social relationships, while at the same time, use of local flint raw materials and intensive use of the local habitat indicate knowledgeable connections to a local place. In this view, Kharaneh IV and other aggregation sites like Jilat 6 (Garrard and Byrd 2013) can be viewed not just as refugia but as nodes or hubs of interaction, where sites are strategically located at the intersections of prehistoric pathways within a landscape full of ecological and social import. It is clear that hunter-gatherer groups met at Kharaneh IV—a persistent place—and tracing material residues from the site in other directions, we can begin to fill in the blanks between Kharaneh IV and other contemporary places to understand how the nature of this highly socialized EP landscape (Fig. 15).

Discussion

The Pre-Natufian EP Landscape: Social Relations between People, Places, and Things

The features we use to define the process of "Neolithization" discussed above harken back to our earlier definition of human-landscape interactions as characterized by the relationships between people, places, and things. In Southwest Asia, research on the origins of agriculture focuses on distinguishing socioeconomically between small groups of mobile hunter-gatherers operating within bounded territories and later settled Neolithic farming communities interacting through large-scale trade and exchange networks. For a long time, this was easy to do, as Neolithic sites are obtrusive and the physical and symbolic connections to places seem (relatively) obvious. However, with an increase in intensity of hunter-gatherer research and improved, high-resolution excavation and analytical techniques, we continue to gain new glimpses into the socially complex lives of past hunter-gatherers; lifeways that we have long suspected existed in the past based on contemporary ethnographic studies (*e.g.*, David and Kramer 2001; Kent 1992, 1995; Wiessner 2014; Yellen 1977), but are now able to demonstrate in the archaeological record of prehistoric hunter-gatherer landscapes and sites of Southwest Asia. For example, the transition(s) from foraging to farming here is acknowledged to be a series of processes where the socially complex hunter-gatherers of the Natufian play a key role.

Evidence presented from Kharaneh IV and Uyyun al-Hammam shows that even earlier EP sites exhibit clear evidence of "incipient" Neolithic behaviors, including complex uses of space and landscape (making homes and communities), long-distance trade networks, increasing sedentism, social and symbolic behavior associated with the built environment, and with sites as persistent places of aggregation and (re-)use within a "lived-in" landscape. More importantly, these behaviors typify hunter-gatherers within a hunter-gatherer worldview. These sites shed light onto how we view hunter-gatherer aggregation sites and how we reconstruct human-environment interactions prior to the more obtrusive manipulations of the landscape visible in the Neolithic. Reassessing how we interpret variability in hunter-gatherer settlement, site use, and the creation of "places" in the landscape shows us that in order to reconstruct landscape use and interactions we must in the future expand our focus from isolated sites to explore

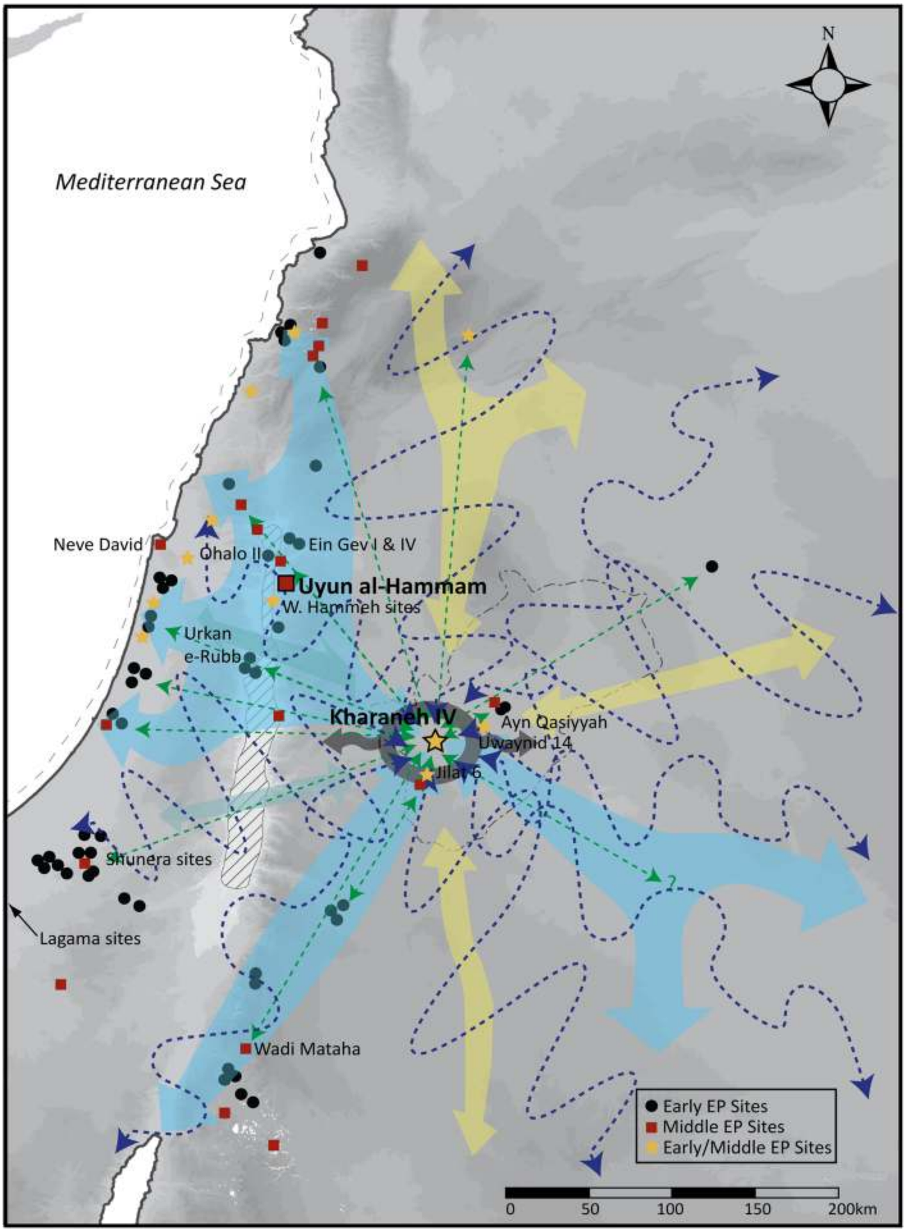


Fig. 15 Map of the Southern Levant suggesting possible connections between Kharaneh IV and other Early and Middle EP sites in the region, as traced through movements of marine shell to and from the Mediterranean and Red Seas and, possibly, the Indian Ocean (blue arrows), connections between Kharaneh IV and other sites through similarities in chipped stone tool technologies (green arrows), and possible movements near and far from the site following gazelle herds (yellow arrows). The wavy dashed lines represent the meandering, less-than-direct pathways through the landscape likely taken by prehistoric groups in these movements tracing a variety of economic and social relationships at sites, and the pathways and places in between them

what happened in the places in between sites (Maher and Conkey in press). The long-acknowledged importance of a nuanced picture of human actions within a social landscape has significant implications, obliterating the idea of transition over time from simple, mobile groups to complex, sedentary groups and the idea of sedentism, the construction of community, and the built environment as necessary steps towards becoming Neolithic. These were clearly aspects of hunter-gatherer lifeways and occurred within a social context without any intentionality to "become" Neolithic. At Uyyun al-Hammam, repeated occupation of the base camp, followed by its repeated use as a cemetery, demonstrate the importance of this "place" to the traditions and cosmologies of at least one social group over time. Similarly, at Kharaneh IV, the life histories of hut structures provide a glimpse into the enmeshed domestic and symbolic lives woven into and around these homes. With groups congregating at and dispersing from Kharaneh IV (perhaps even in different ways over time), it was but one of many persistent places connected to others across a landscape of hunter-gatherer communities.

I hope to have shown here the contributions of this research to understanding hunter-gatherer lifeways and human-landscape interactions, particularly at the intersections between people, places, and things. On the microscale, through geoarchaeological approaches to the use of space, this approach can address aspects of human practice. At the meso-scale, through exploring prehistoric technologies and other aspects of material culture, I explore situated social learning and interaction, which would have included aspects of landscape learning, especially for old and new community members at Kharaneh IV. At the macro-scale, through palaeoenvironmental reconstruction and examining patterns in aggregation and dispersals, I address hunter-gatherer use and perceptions of landscape and interactions across these landscapes. At both prehistoric sites, we see (a) abundant and varied evidence for both mobility and use across a landscape and aggregation and connections to places within/at the site, (b) substantive evidence for investment in place and locality in a "storied" landscape (Maher and Conkey in press), and intensive use of places, including persistent memory of place on-site and in the larger landscape.

In a volume entitled "Desert Peoples," Veth et al. (2008) synthesize archaeological work done on Australian prehistoric hunter-gatherers to explore new pathways and trajectories between hunter-gatherers and agriculturalists, highlighting that simplistic categories of forager and agriculturalist do not work there. In Australia, research instead documents hunter-gatherers who "precociously manipulated plant and animal resources for millennia within a forager ideology and practice and without culminating in agriculture" (Veth et al. 2017, p. 1). These groups exemplify behaviors comparable to what we reconstruct for hunter-gatherers in Southwest Asia, socially constituted groups enmeshed in 'complex and enduring sets of people-place-thing relationships' (Veth et al. 2008). This approach to hunter-gatherer research highlights the relevance of these past peoples for contributing to our understanding of several large-scale, discipline-wide anthropological topics, including discerning archaeological traces of daily practice and articulating these practices with people-place-thing relationships through the analysis of the organization and use of space, prehistoric technologies, social landscape creation and transformation at multiple scales, and the creation and maintenance of long-distance communities connected through elaborate and extensive social networks.

Articulating Landscapes and People, Past and Present

Understanding the *longue durée* of landscape change and human-landscape interactions in the Azraq Basin is but one example of the timely and enduring relevancy of this research to contemporary communities. The Azraq Basin has always been a delicate ecosystem, and despite recent government interventions, the contemporary landscape is no exception. Existing aquifers accumulated water very gradually over thousands of years and, until recently, this hydrological system was largely kept in equilibrium through natural rainfall and spring discharge (Al-Kharabsheh 2000; El-Naqa 2010; Noble 1998). Today, the Azraq aquifers are one of Jordan's largest and principal fresh water sources and, until very recently, were heavily pumped to supply the capital's population with fresh water. Within the last decade, several springs in the central oasis have ceased to flow and the once-rich marshland and adjacent playa has quickly dried up, with devastating effects for the local community. Once a substantial refuge for migrating birds and other local wildlife, these animals are now rarely seen. The local salt industry (the only large-scale industry in Azraq) has collapsed as the salt that is normally collected as seasonal rains dry up in the large Azraq Qa has disappeared. In the few years that EFAP has been working in the area, water supplied to residential houses has become too saline to drink regularly. Despite the tireless advocacy of the Royal Society for the Conservation of Nature and government attempts to mitigate against this desertification, pumping water back into the two remaining springs, Ain Soda and Ain Qasiyya, supply cannot keep up with demand.

In a similar balancing act between climate change and human demands on the landscape, EP groups experienced dramatically changing palaeoenvironmental conditions in the Azraq Basin at the end of the LGM such that the balance became tipped towards increasing aridification c. 18,000 years BP (Jones et al. 2016a). Radiocarbon dates show that Kharaneh IV was abandoned around this time. In contrast to other areas of Southwest Asia, where increased temperatures were paired with increased moisture and brought about climatic amelioration (Bar-Matthews 1997; Enzel et al. 2008), here, it brought increased rates of evaporation, shrinking the wetlands and associated resources. These conspiring factors caused the visitors and occupants of Kharaneh IV to reconsider their use of this location for large-scale settlement and, in fact, such aggregation sites disappear entirely. Thus, the occupants of Kharaneh IV experienced a situation very similar to other prehistoric (Akkermans et al. 2014; Ames et al. 2014; Rowan et al. 2015), historic (Müller-Neuhof 2014), and modern-day inhabitants of the region where water is an increasingly dwindling and precious resource. The contemporary burdens of this situation on continually diminishing environmental and culture heritage resources cannot be understated.

In light of the relevance of EFAP's work to issues of habitat conservation, landscape change, and sustainable water-use practices in Jordan, EFAP works closely with the local Azraq community and the Royal Society for the Conservation of Nature to share our findings of the past and work together to promote sustainability for the future. Through our research, we aim to educate the Azraq community about changing local environments and water resources, while at the same time the community educates us as to the demands and import placed on these local water resources. Today, as an oasis, Azraq attracts eco-tourists interested in exploring the area's unique landscapes, flora, and fauna. Thus, issues of natural and heritage conservation are important for local economic stability and development. School days and community cultural events are just a few venues to present public talks on project-related work and the conservation of Jordan's archaeological and natural resources. Efforts to become a part of the community have both increased local awareness and interest in cultural heritage and brought about a proactive interest in protecting sites from looting and development, the two biggest destructors of archaeology in Jordan.

I have attempted here to unpack aspects of human-landscape dynamics of Southwest Asia during the Early and Middle EP, periods of prehistory notably understudied in comparison to the later Natufian and Neolithic. We rarely consider the impacts of these hunter-gatherers in shaping the palaeolandscape, perhaps because prior to farming we assume that their impacts were minimal and landscapes retained their "pristine" nature (Denevan 1992, 2011), despite growing evidence for early animal domestication (Gray et al. 2010), plant management (Snir et al. 2015), and extensive social networking (Coward and Knappett 2013; Maher 2016)—all of which would have initiated long-term ecological impacts (*e.g.*, Sterelny and Watkins 2015). Here, I emphasize the importance of social relationships within and between social groups, between people and things (*e.g.*, chipped stone technologies, caches, marine shells), people and animals (*e.g.*, foxes), people and plants (*e.g.*, wetland resources), and people and places (including physical spaces and their features, such as rocks, water, *etc.*). Michelle Langley (2013) categorizes these various relationships as exemplifying either "socialized landscapes" or "landscape socialization." Socialized landscapes reflect "people to people interactions woven into networks which are mapped onto and woven into the physical landscape and which join various locales together through paths and track ways (Gamble 1993). These networks connect individuals and groups (of various sizes) to each other through the use of shared cultural values and practices. These networks likely serve many roles, including to provide access to mates, information and resources (Gamble 1998)." (Langley 2013, p. 615). These networks are constructed at varying scales (intimate, effective, extended, global; Gamble 1998) and material culture (style and information exchange; Wobst 1977) is integral to their identification and maintenance. The social role of technology reflected here in burial practices, exchange of marine shell, and communities of practice in stone tool production are practices that structure these socialized landscapes.

On the other hand, landscape socialization refers to imbuing meaning into the features of a terrain that then transforms it into a landscape—a place meaningful to those who inhabit it. Landscape learning (Rockman 2013) plays a prominent role here in negotiating new terrain as well as training and enculturating new group members to understand the "resources" of the land. As individuals and groups become familiar with the landscape, stories about its meaning and significances are constructed, and aspects of the landscape come to embody perceived economic, technological, social, and ideological import. The activities performed in this landscape can leave material residues that we can trace in the archaeological record. Repeated reuse of locales creates sites, which can be foci of inhabitation (in the strict sense of the word), resource locations, landmarks, or pathways; in all cases, they can be considered places of dwelling. They become a part of the consciousness of a group, and are learned by new members through ongoing dwelling. In fact, these landscapes are constantly being learned, as the construction of landscape is an ongoing, ever-changing phenomena. As Langley (2013, p. 616) suggests "this method of story construction tied to 'site' or 'place' facilitates the easy dissemination of the accumulated knowledge of that landscape, and the relations of particular individuals or groups to each site and/or wider landscape to members both within and outside of the community. This process is where social landscapes crosses over with landscape socialisation as information relating to the relationship of people to landscape is transmitted through the 'social landscape' as part of building relationships between geographically dispersed people."

Conclusions

The ideas presented in this paper represent a holistic approach to the creation, maintenance, and transformation of social landscapes, integrating geoarchaeological methods and the analysis of material culture, employed to tackle the complicated and otherwise well-studied EP period of Southwest Asia, and one that does not suppose or "place" the EP into a larger agricultural trajectory of culture change. It is predictably difficult to extricate one aspect of hunter-gatherer practice from others, as they are entangled in what we know as a wide diversity of the hunter-gatherer lifeways (*e.g.*, Hodder 2012). Geoarchaeology (particularly geo-ethnoarchaeology) is one way in which we can attempt to do this in the archaeological record. In-depth study of the traces of human activities—activity areas, taskscapes, life histories, object (and sediment) biographies—left behind by the daily practices of these people can help us to begin to decipher the entangled relationships between people, places, and things at multiple scales. In the two case studies presented here, I aim to demonstrate two key points: (1) microscale approaches to the analysis of material culture and material context yield high-resolution data on the use of space, within and outside of formal structures, indicating that these spaces were often economically, socially, and symbolically charged spaces, and (2) the spaces between sites—"the landscape"—can be considered a place (or places) where symbolism shaped behavior and the concepts of dwelling and home-making apply.

In the future, this work can be extended to human-landscape interactions at an even broader scale, linking sites into a social landscape that might extend beyond this small part of Southwest Asia, for example, exploring unique human-landscape dynamics with the first island colonization(s) of Cyprus. Here, the concepts of historical ecology (Crumley 1994), human ecodynamics (Kirch 2007), transported landscapes (Anderson 1952; Rick et al. 2013), and landscape learning (Rockman 2013) are forefront on ideas of hunter-gatherer movements, as these early colonizers would have dealt with completely new ecosystems, plants, and animals and, in some cases, clearly mitigated against these challenges by bringing aspects of their old landscape—or home—with them. Early colonization of Cyprus now pre-dates the Neolithic (Simmons 2014), demonstrating quite "precocious," as Veth et al. (2008) would call it, accomplishments within hunter-gatherer technologies. These earliest occupations are contemporary with the latter half of the EP, and comparable in material culture to sites in the north and west of the mainland Levant. Given the case made here for extensive and expansive networks of movement and interaction by EP hunter-gatherers, it is not unrealistic to envisage these Levantine groups with seafaring technologies, heading into the Mediterranean Sea, exploring and colonizing nearby islands, and perhaps even maintaining continuous and constant contact with the mainland, as seen in the later Neolithic. Here, geo-ethnoarchaeological methods will be of particular relevance for reconstructing human-landscape relationships in these newly colonized environments, as well as for providing information on past practices and lifeways where traditional ethnographies do not exist. Landscape learning and transported landscapes provide unique perspectives on how these hunter-gatherers adapted to and adapted local ecosystems, with the introduction of new plants and animals and rapid extinction of some local fauna (*i.e.*, pygmy hippos) immediately after human arrival (Simmons 2011).

Recent literature on the nuances and complexity of hunter-gatherer use of space and place-making (Apicella et al. 2012; Brody 1982, 2000; David et al. 2006; Ingold 1993, 2000; Ingold and Vergunst 2008; Littleton and Allen 2007; Lourandos 1997; Marlowe 2010; Veth et al. 2008, Whitridge 2004) remind us that prehistoric landscapes were filled with places, pathways, and spaces that hold a wide variety of meanings and import (see also Holdaway et al. 2008; Gamble 1993, 1996, 1998, 2013; Langley 2013; Maher and Conkey in press; McBryde 1997; McDonald et al. 2016). In this light, sites like Uyyun al-Hammam and Kharaneh IV stand out as persistent places with special meaning—places of memory, dwelling, and social interaction imbued as such by multiple groups and persisting on the landscape for generations. The hunter-gatherer aggregation site (or even base camp), for example, becomes a hub of interaction intersecting the movements of groups for a variety of purposes, including engaging in home-making, place-making, and social relationships across the landscape. The movements of these groups can be, at least partially, identified and traced by understanding social interactions as reconstructed through the movement of material culture or the landscape and technological knowledge embedded in these objects (Borck et al. 2015; Collar et al. 2015; Gjesfjeld 2015; Knappett 2011; Latour 2005; Mills et al. 2013). Sites like Kharaneh IV help us to re-conceptualize settlement and variations in the nature, duration, and intensity of occupation at hunter-gatherer sites, as well as how we contextualize individual sites within the larger social landscape to reconstruct human-environment interactions. Ongoing reconstructions of the organization of space and symbolic objects at the Early and Middle EP sites of Ohalo II (Nadel, 2000, 2002, 2003, 2006) and, recently, Ein Qashish (Yaroshevich et al. 2016) and Neve David (Kaufman et al. 2017; Yeshurun et al. 2015) are proving invaluable to understanding EP lifeways. Yet, the rarity of structures at pre-Natufian sites means these kinds of data remain limited. Kharaneh IV has the potential to demonstrate that we can view both the site and those places it was connected to as communities, places traveled to regularly, returned to repeatedly, and filled with economic and social meaning as places, rather than ephemeral occupations on the landscape. That Kharaneh IV is not the only aggregation site in the Azraq Basin (Jilat 6, Uwaynid 18; Garrard and Byrd 2013) drives home the significance of these highly socialized landscapes. Sites like Kharaneh IV and Uyyun al-Hammam are not unique outliers, but exemplify that (a) hunter-gatherers repeatedly and intensively used particular locales, and (b) they used and interacted with the spaces between sites, as evidenced by the objects and knowledge brought to Kharaneh IV. With groups congregating at and dispersing from the aggregation site of Kharaneh IV or the continued return of group(s) to Uyyun al-Hammam to first inhabit and then bury the dead, as just two examples presented here, the "site" is but one of many places connected to others across a landscape created by hunter-gatherer communities. This last point warrants emphasis—these two sites represent only a small part of a larger, connected, and interwoven EP landscape, one in which EP groups created and maintained intricate people-place-thing relationships and, thus, transformed *their* landscape. The physical, social, and ideological worlds created by these EP were their legacy left to subsequent hunter-gatherers and farmers.

I argue here that prehistoric hunter-gatherers in Southwest Asia "lived-in" a landscape, both at sites, some as persistent places, and in the spaces in between them. A "place" is structured and given meaning through human experiences at both individual and group levels. Places can be spiritual or physical, or, more commonly, some combination of these, incorporating art, monuments, architecture, or natural wonder (*e.g.*, Ashmore and Knapp 1999 and references therein; Bender 2001; Bradley 2000; Brody 1982; Ingold 2000; David and Thomas 2008 and references therein; Tilley 1994). They can be intended destinations, like the Grand Canyon, Machu Picchu, or the Louvre. Or places can be marked by the daily routines of the world around us: our homes, our workplace, our backyards, our grocery store, or dry cleaners. The by-products and material remains associated with the impacts of daily hunter-gatherer place-making, including food and material production as well as processing waste, are also important expressions of human experience and the construction of a "place." These material remains provide critical archaeological insight into how people in the past organized their world and, perhaps, how they perceived their relationship with "nature" (although see Balée 2002; Crumley 1994). Furthermore, these places are connected to one another through the movements of people—their pathways and tracks—creating networks of interaction, making new places, and connecting people and places within the social landscape. Pathways can be well-known and shared at the group or intergroup level, such as the "Inca trail," or private and individual, but with places that are no less meaningful, such as one's commute to work that includes a quick stop at a local coffee shop. Extending these concepts back into deeper prehistory, Gamble (1996, p. 270) reminds us that much like our places today, "every site may have been connected to others, and the spaces in between, by a series of 'tracks' marking the complex, interwoven movements of people."

Hunter-gatherers have, for thousands of years, and most likely many more, been creating and maintaining "storied landscapes" (Langley 2013; McBryde 1997). Archaeologists can get at these landscapes through the combination of micro-scale and macro-scale analyses. At the micro-scale, for example, micromorphology, often in combination with other methods like multi-element analyses or ethnoarchaeological datasets, allow the reconstruction of activity areas (Kent 1987, 1990) or even taskscapes (Ingold 1993): the organization and use of space within individual places (*e.g.*, inside and outside homes) and allowing the identification of high- and low-traffic areas connecting (or not) houses, open spaces, and other site features. At the macro-scale, detailed palaeoenvironmental datasets yield important insights into the "nature" of the past landscape, providing parameters for archaeologists to work within for understanding the constraints and affordances of human activities and movements (the possible tracks and pathways taken) in other landscape places connecting sites. However, we can go much farther than this, deciphering the social connections (interaction networks) and physical movements of groups across the landscape (the waypoints and other non-site places) through detailed comparative analyses of material culture, including a *chaîne opératoire* approach that focuses on the technological process of artifact production and use, and the communities of practice within which these technologies are enacted. Aspects of landscape learning, apprenticeship, and situated learning provide valuable insights to understand knowledge transfer both within the technological production of an object and in how one learns a landscape. For example, according the Gamble, a glimpse at elusive Palaeolithic society can be achieved if we understand "the creation of social life through interaction…locales and regions [the micro-scale and the macro-scale] are linked by Leroi-Gourhan's concept of gesture and action, here described as rhythms contained in movement along tracks and through the *chaîne opératoire*" (Gamble 1998, p. 426).

Rathje (1979, p. 28) suggests that archaeology can be seen as concerned primarily with the "relations between people and things", to which I would also add places. While a deceptively simple statement, it encapsulates a wide range of human behaviors enacted between people and other people, people and places, people and things, and places and things—all of which are products of socially constituted human experience. Indeed, the dynamic of a "storied landscape" discussed above fits nicely within the wide-ranging and, perhaps, intentionally unclear deconstruction, reconstruction, and ongoing construction of human-landscape interactions.

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