Purpose, Permanence, and Perception of 14,000-Year-Old Architecture: Contextual Taphonomy of Food Refuse

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Purpose, Permanence, and Perception of 14,000-Year-Old Architecture

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Remains of early architecture at the Epipaleolithic-Neolithic transition of the Near East are commonly evaluated by means of two criteria: structure size and permanent interior features or decorations. Less attention has been given to associated refuse, which could be the key for discerning the role of architectural space in the lives and minds of the last hunter-gatherers. We consider this dimension by modeling the deposition of animal remains in an Early Natufian (ca. 14,000 cal BP) architectural complex at the el-Wad Terrace (Mount Carmel, Israel). Contextual taphonomy shows that a sequence of structures was used for everyday living activities, including food preparation and consumption—probably at the household level—as well as bone working. Despite the relatively permanent habitation, reflected by repeatedly renovated stone architecture, a broad-spectrum economy, and the infliction of heavy habitation damage to in situ refuse, the inhabitants did not systematically engage in the clearing away of organic trash or otherwise marking out their domicile. The perception of the house was probably still "Paleolithic" and functional in character, highlighting the complex mosaic of old and new traits in the preagricultural communities of the Levant.

Archaeologists studying the material remains of the first settled human communities in southwest Asia, ca. 15,000–10,000 years ago, often strive to identify domestic, communal, or "ritual" structures in order to shed light on the nature and extent of early sedentism. Attempts have been made to describe the life history of houses and to reconstruct their place in the minds of their builders (e.g., Banning and Byrd 1987; Finlayson, Mithen, et al. 2011; Hodder and Cessford 2004; Samuelian 2006; Valla 1988; Watkins 1990, 2004). The delineation of site type in this period is normally based on the inferred purpose and permanence of its architecture. This is how dwelling sites and "ritual centers" have occasionally been classified along the Epipaleolithic–Early Neolithic sequence (Goring-Morris and Belfer-Cohen 2008).

During the Upper Paleolithic and earlier Epipaleolithic of the region, architectural units consisted of huts made of organic materials and are, therefore, preserved only in rare circumstances. The 23,000-year-old camp of Ohalo II (Israel) yielded brush huts displaying superimposed flooring, bedding, and permanent interior features such as a hearth and a fixed grinding stone (Nadel, Weiss and Tschauner 2011). Recently, based on well-preserved 20,000-year-old huts in Jordan containing artifact caches, human burials, and a high density of finds, Maher and colleagues (2012) argued for an early case of prolonged habitation and for houses that were rich in symbolic meaning. In the Late Epipaleolithic Levant, the emergence of durable architecture and other stationary features produced a strong foundation for the beginning of sedentary life in the Natufian Culture (Bar-Yosef 1998; Garrod 1957), together with an increased presence of commensal animal species (Tchernov 1992) and expanding diet breadth (Davis 2005; Munro 2004). In the succeeding Pre-Pottery Neolithic A (PPNA), architectural remains are plentiful and their interpretation takes center stage. To name just two recent examples, the PPNA architectural complex at WF16 (Jordan) was identified as a large communal building surrounded by

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"special purpose" structures, leading to the interpretation of the site as a short-term communal site rather than a long-term residential one (Finlayson, Mithen, et al. 2011). The commonly accepted identification of PPNA Göbekli Tepe (Turkey) as a shrine center, based on its elaborate structures (e.g., Schmidt 2010), has been contested by Banning (2011), who suggested that they were residential houses, albeit rich in symbolic content.

The understanding of the purpose, permanence, and perception of these important structures is often evaluated by means of two criteria: the size of the structure and its permanent interior "furniture," such as plastering, fixed groundstone items, and built-in decorations (Finlayson, Mithen, et al. 2011; Kadowaki 2006; Watkins 1990; Wright 2000). Less attention has been given to a third potentially important dimension, that of the ample refuse that is frequently associated with architectural spaces, and its potential testimony to site-formation processes, site organization, and the use of built space (Banning 2011; Goring-Morris 1988; Hardy-Smith and Edwards 2004; Nadel, Weiss, and Tschauner 2011; Samuelian 2013). Here we consider this third dimension in detail. We employ vertebrate taphonomy integrated with context (henceforth "contextual taphonomy") to model the deposition of animal remains in and around an Early Natufian (ca. 14,000 cal BP) architectural complex, in an attempt to identify the activities carried out in and around the structure, its maintenance, and conceptualization.

Natufian Refuse in Context

The Natufian culture of the Levant (ca. 15,000–11,700 cal BP) is renowned for its durable stone-built structures, the oldest in the region (Belfer-Cohen and Goring-Morris 2008). The distribution of refuse in large Natufian hamlets in the Mediterranean zone of the southern Levant has led scholars to investigate the massive amalgamations of chipped lithics, animal remains, groundstone and bone tools, shells, and minerals that were embedded in seemingly domestic contexts (Hardy-Smith and Edwards 2004). Bearing in mind that Natufian refuse is important for architectural interpretation, surprisingly few attempts have been made to fully integrate it with stratigraphy and context. Valla (1988) inferred several types of domestic and ritual activities from the overlapping distributions of groundstones, animal remains, worked bones, and lithics on the living floors of Structure 131, a large EN building at 'Eynan (Israel). Smaller structures in the Late Natufian (LN) cave occupation of 'Iraq ed-Dubb (Jordan) yielded abundant faunal refuse, which was interpreted by Edwards and Martin (2007) as having been found in the original place of discard, suggesting the absence of a systematic disposal of refuse. Special concentrations of animal bones, differing in composition from the general faunal assemblage, were associated with the LN architecture of the Hayonim Terrace (Israel) and possibly demonstrated the discard of particularly large and impeding remains, as well as the caching of symbolic items (Munro 2012). Various types of artifacts were present on house floors in Final Natufian 'Eynan (Israel), attesting to a diversity of activities that took place there and cumulatively left some of their remains in situ. Consequently, this evidence reinforced the domestic nature of the Final Natufian houses (Samuelian 2006, 2013).

In a distribution analysis of many classes of finds inside and outside the large EN structures of Wadi Hammeh 27 (Jordan), Hardy-Smith and Edwards (2004) attributed the extreme density of finds inside the structures to in situ discard, together with sporadic manifestations of artifact caches that were primarily interpreted as storage. This pattern of refuse deposition inside houses was contrary to the pattern they had anticipated based on modern ethnographic research showing that, in long-term camps exhibiting durable architecture, refuse is usually accumulated and then disposed of systematically outside the house. Taking an evolutionary perspective, they maintained that Natufian refuse behavior was "Paleolithic" in nature, better adapted to small ephemeral camps than to sedentary villages, and that systematic refuse disposal strategies (i.e., regularly cleaned house floors) appeared as late as the Pre-Pottery Neolithic. As the phenomenon these researchers observed nicely illustrates the linkage between refuse and the purpose, permanence, and perception of architectural space, it was used to cast doubt on the level of EN sedentism, because sedentary communities would presumably have maintained their domestic refuse in a more systematic fashion (see also Edwards 1989).

Although some exceptions to this rule occur, the most frequent pattern in the Natufian is of simple, "indifferent," domestic refuse maintenance and of rare domestic partitioning of space for certain activities (Hardy-Smith and Edwards 2004; Samuelian 2013). This raises the problem of disentangling primary from secondary and tertiary refuse in these complex hamlets (LaMottta and Schiffer 1999). Is Natufian trash indeed in its place of use, reflecting the time of habitation, or is it a product of either site maintenance (cleaning) or abandonment processes? Detailed contextual analyses of material remains in houses have been few and, in cases where several classes of finds have been presented, they are inevitably undetailed and consequently do not shed much light on the circumstances of the depositional history of the finds. Thus, contextual taphonomy of house-floor assemblages may provide an effective marker of house function or merely of its maintenance and the formation processes of specific archaeological records. Here we expand on previous studies by investigating the deposition of the faunal portion of Natufian trash, utilizing the rich data offered by vertebrate taphonomy.

Interpretive Framework

Our contextual taphonomy approach involves the integration of stratigraphic and contextual data with zooarchaeological and taphonomic data to establish the life history of a faunal

Table 1. Summary of the framework for the contextual taphonomy analysis

Refuse category	Depositional scenarios	Archaeological expectations
Primary refuse	Primary deposition: discard of animal parts where butchered, consumed, or worked, without further treatment	Living areas exhibiting: no size sorting of bones; a high diversity of species; all but the most impeding body-parts; minimal bone movement; in situ attrition due to habitation activity.
Secondary refuse	Cleaning: frequent tossing away or systematic removal of animal parts following consumption and disposal	Size sorting (smaller bones in the dwelling, larger bones in a dumping zone); evidence for bone movement in the postconsumption stage; possibly slower burial but less in situ attrition due to later anthropogenic activities (burning, trampling) compared with the dwelling area.
	Storage: caching bones for later use (e.g., for working)	Caches of a certain type of animal remains of possible use for a specific future task, or conspicuous absence of skeletal parts (independent of preservation concerns), attesting to particularly valued and curated archaeofaunal remains and artifacts.
	Preburial deposition: removal of specimens subsequent to discard but prior to burial (by dog ravaging, trampling)	Extensive damage from animal gnawing and weathering; differential preservation of skeletal elements in living areas vs. areas with less human traffic.
Tertiary refuse	Postburial deposition: removal of sediment containing older faunal refuse in the course of building, burying or other activities	Indications of massive postburial bone movement (no articulations, no refitting); architectural features showing disturbances from later occupations.

sample in a given context. For the past 3 decades, the use of vertebrate taphonomy to track the history of a faunal assemblage has been a common practice in zooarchaeology (Bar-Oz and Munro 2004; Behrensmeyer 1991; Lyman 1994). The rich taphonomic literature offers a middle-range framework for interpretation (e.g., Binford 1981). The range of animal species and body parts, bone fracture patterns, and especially bone-surface modifications may reflect the agents that affected the faunal specimens. Building on the assemblage-level taphonomic analysis and zooming into the contextual level, faunal specimens are informative regarding the formation processes of their respective proveniences. Creating taphonomic-based depositional models would ideally mean that archaeological features could be interpreted accordingly (as a refuse pit, a butchery or roasting area, a cache of raw material, a funerary deposit, etc.), leading, under certain conditions, to the identification of activity areas by intrasite comparisons. Attempts to integrate the taphonomic and contextual data sets have rarely been applied in the past, but recently have been increasingly undertaken (e.g., Enloe 2012; Marom and Zuckerman 2011; Miracle 2002; Munro and Grosman 2010; Speth et al. 2012; Twiss et al. 2009; Yeshurun, Bar-Oz, and Nadel 2013; Yeshurun et al. 2013).

The first aim of the ensuing analysis is to classify the faunal samples based on their depositional histories (LaMotta and Schiffer 1999; Schiffer 1976; see also Hardy-Smith and Edwards 2004; Hodder and Cessford 2004). The first category is primary refuse, which is the result of discarding items at their original location (e.g., the discard of animal parts in the place of butchery, meat consumption, or bone working, without further treatment); the next category is secondary refuse, which is intentionally discarded elsewhere (i.e., the random tossing away or systematic removal of animal parts following their consumption and disposal); and the third category is tertiary refuse, which is the unintentional or postburial redeposition of material away from its original location (e.g., the removal of sediment containing older faunal refuse in the course of building, burying, or other activities; see table 1). Such a typology of disposal behavior by humans is coarse but has nevertheless proved useful during many ethnoarchaeological studies to describe behavioral patterns (e.g., Beck and Hill 2004; Binford 1978; Kent 1981; O'Connell 1987; Svoboda et al. 2011; Yellen 1977).

Obviously, this is a simplified model of the dispersal of archaeofaunal remains. Other than pit digging by later inhabitants that inadvertently created tertiary refuse, other processes may have conceivably obscured patterns of disposal behavior by humans. Postdepositional agents, such as trampling, carnivore ravaging, fluvial transport, and subaerial weathering prior to the burial of remains, and indirect burning or biochemical activity subsequent to the burial, may significantly alter the location or the state of preservation of discarded remains (Bar-Oz and Munro 2004; Gifford-Gonzalez 1991; Kent 1981, 1993; Meadow 1978; Schiffer 1983).

Additional caveats are applicable to the study of archaeological palimpsests, such as long-lived Natufian base camps (our case study here). These normally contain thick accumulations of refuse representing numerous occupations, some undoubtedly longer or more intensive than others. Radiocarbon chronology is still not refined enough to identify gaps in the occupation of these sites or to assess their actual duration. In addition, the true stratigraphic relations between seemingly contemporaneous features (e.g., a dwelling floor and its corresponding exterior) can hardly be ascertained. Bearing all this in mind, we are not maintaining here that an archaeofaunal sample or an architectural unit represents any distinct "occupation," even in a well-preserved context. Rather, we acknowledge that palimpsests of unknown duration are being analyzed here and thus have opted to identify the repeated patterns of use of a specific accumulation, com-

pared with those of other accumulations at the site (Bailey and Galanidou 2009; Galanidou 2000). To this end, our analytical unit in this study is the *pooled context*, a vertical series of similar features, forming an accumulation that is spatially distinct from other stratigraphically contemporaneous accumulations at the site.

Taking the archaeological nature of our case study into account, we offer the following scenarios to explain the observed taphonomic patterns by context (see table 1): primary deposition (no systematic cleaning); cleaning (systematic deposition of refuse); storage (purposely caching items for later use; see Cunningham 2011); preburial distribution (by the scavenging of dogs or other animals, human and animal trampling, or weathering processes); and postburial deposition (nondeliberate removal of sediments with bone remains during later construction activities). The primary deposition scenario corresponds to the creation of primary refuse; the cleaning and storage scenarios, and possibly the preburial scenario, would create secondary refuse; and postburial deposition would create tertiary refuse (LaMotta and Schiffer 1999).

The ability to distinguish between different types of depositions depends heavily on deciphering the mode of refuse maintenance employed by the site's inhabitants (Hardy-Smith and Edwards 2004). Ethnography provides important data concerning disposal behavior and site structure (e.g., Bartram, Kroll, and Bunn 1991; Binford 1983; Hayden and Cannon 1983; Kent 1981, 1993, 1999; Kroll and Price 1991; Needham and Spence 1997; O'Connell, Hawkes, and Blurton-Jones 1991; Schiffer 1976). The intensity, frequency, and technological advancement of cleaning are inversely correlated with the deposition of refuse at or near its original location. Sweeping would leave less refuse in primary deposition than the simple tossing away of large or bulky items (Metcalfe and Heath 1990). The Natufian floors were made of compacted earth and stony pavements but were seldom entirely paved (e.g., with large slabs or lime mortar), and thus it is expected that much of the small refuse became buried in the earthen floor or in the sediment between stones and remained there relatively well protected (Samuelian 2006). Trash zones normally contain larger pieces of refuse than activity areas that have been cleaned. Large pieces of refuse are frequently tossed away because they are bulky and constitute sanitation hazards. Small fragments, less than 3–5 cm in length, have a better chance of surviving the cleaning of activity areas and are thus more indicative of the primary spatial distribution (Binford 1978; O'Connell 1987; Simms 1988). In order to determine the relative proportions of small vs. large pieces of faunal refuse, here we define *small* as fragments of faunal remains less than 3 cm in length and *large* as any fragments longer than 4 cm.

An additional, and somewhat neglected, proxy measure of primary refuse deposition is termed here *evidence of minimal bone movement* (EMM). This term refers to vertebrate remains that display exceptional anatomical or taphonomic preservation and that were unlikely to have been preserved if they had been moved. EMM indicators include articulated or paired elements, refitted ancient breaks, large bones lying horizontally, and fragile elements preserved intact. Individual EMM remains were recorded qualitatively during excavation and lab sorting, and were subsequently subject to comparisons between different pooled contexts by counting excavation units with EMM remains and standardizing the individual count results relative to either the total count for all excavation units or excavation volume.

An important issue in discerning refuse formation is the location and nature of fire in relation to the refuse being examined. The domestic hearth is often the focal point for many activities, including the roasting and consumption of food (e.g., Bartram, Kroll, and Bunn 1991; Jones 1993; Yellen 1977). Sometimes faunal refuse is thrown into a hearth, for reasons of sanitation or as fuel (Costamagno et al. 2005). Experiments have shown that buried bone may undergo postburial charring when a fire is burning a few centimeters above it (Bennet 1999; Stiner et al. 1995). As a result, the frequency and intensity of bone burning in each context may be informative regarding the proximity of fire, redeposited hearth material, or the charring of bones subsequent to burial (Cain 2005).

Thus, in the complex taphonomic system of our case study, the Early Natufian (EN) habitation at the el-Wad Terrace (EWT), we have generated specific depositional scenarios and have tested them based on our contextual taphonomy (table 1). Primary archaeofaunal deposits should exhibit minimal size sorting and increased EMM, quicker burial, and intensified in situ attrition compared with secondary archaeofaunal deposition. Storage would be detected by the presence of caches of a certain type of animal remains that may be useful in the future or by evidence indicating any particularly valued and curated skeletal elements or osseous artifacts. The impact of tertiary depositional processes on either of the above scenarios would be indicated by evidence of massive postburial bone movement, correlated with the level of preservation of architectural features.

Case Study: The el-Wad Terrace

Our case study is based on the renewed excavations at the UNESCO World Heritage Site of el-Wad, which exhibits lengthy and rich habitations from the Early to Late/Final Natufian (Garrod and Bate 1937; Weinstein-Evron, Kaufman, and Yeshurun 2013; Weinstein-Evron et al. 2007, 2012). The site, a large cave with an adjacent terrace, is situated on the western face of Mount Carmel (Israel), where the cliff of the mountain meets the open expanses of the Mediterranean coastal plain, 45 m above modern sea level, within the Mediterranean climatic zone of the Levant (fig. 1).

El-Wad was first investigated by Lambert in 1928 (Weinstein-Evron 2009) but became well known as a result of Garrod's 1929–1933 excavation campaign (Garrod and Bate 1937). The terrace was later revisited (Valla et al. 1986), as

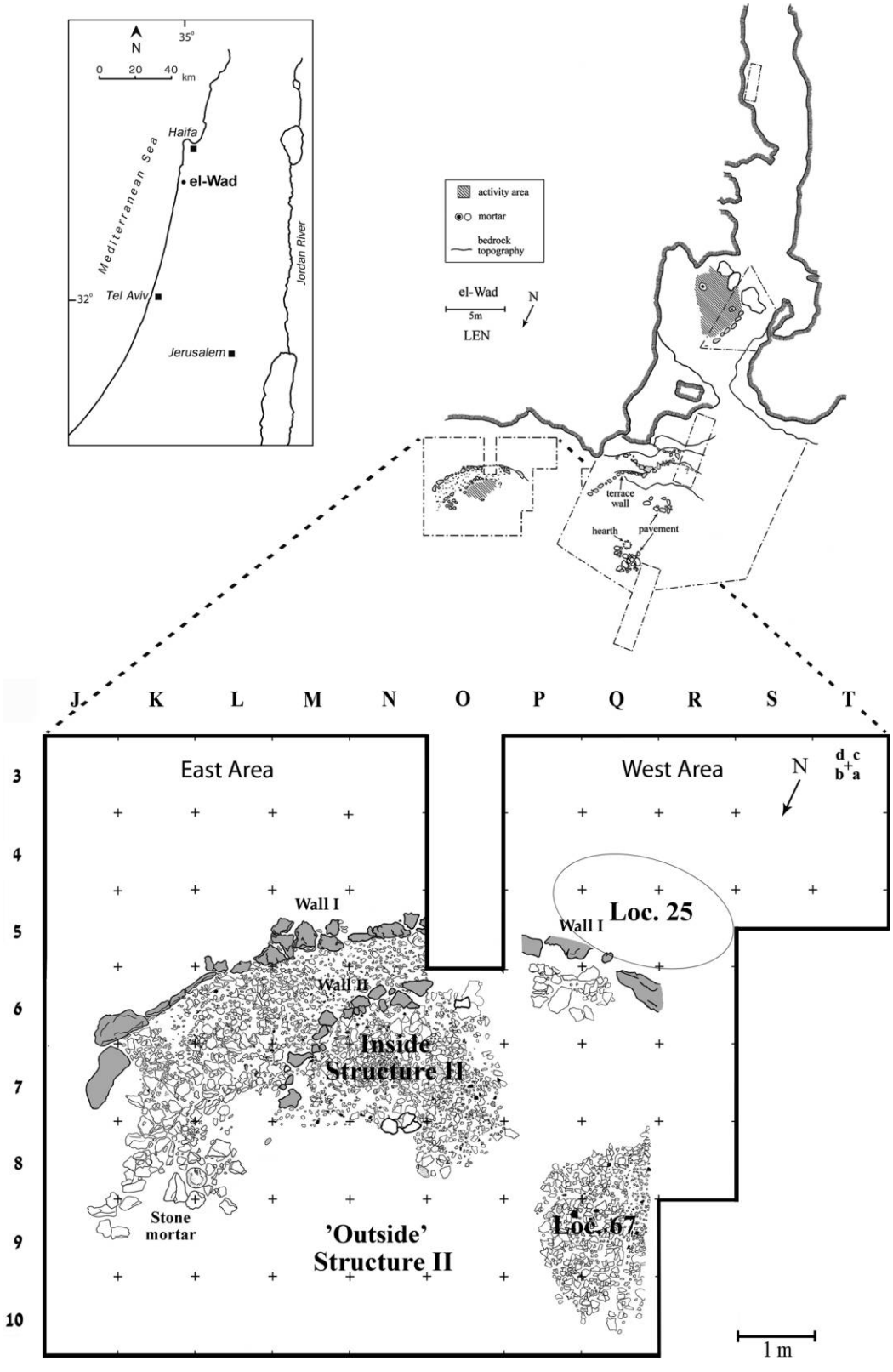

Figure 1. Location map, a general plan of el-Wad in the Late Early Natufian (LEN) phase, and a plan of the renewed excavation. Note Wall I, enclosing the architectural compound; Wall II and associated stony floor, enclosing a structure within this compound; the Locus 67 heap of stones and artifacts; and location of Locus 25, beyond Wall I.

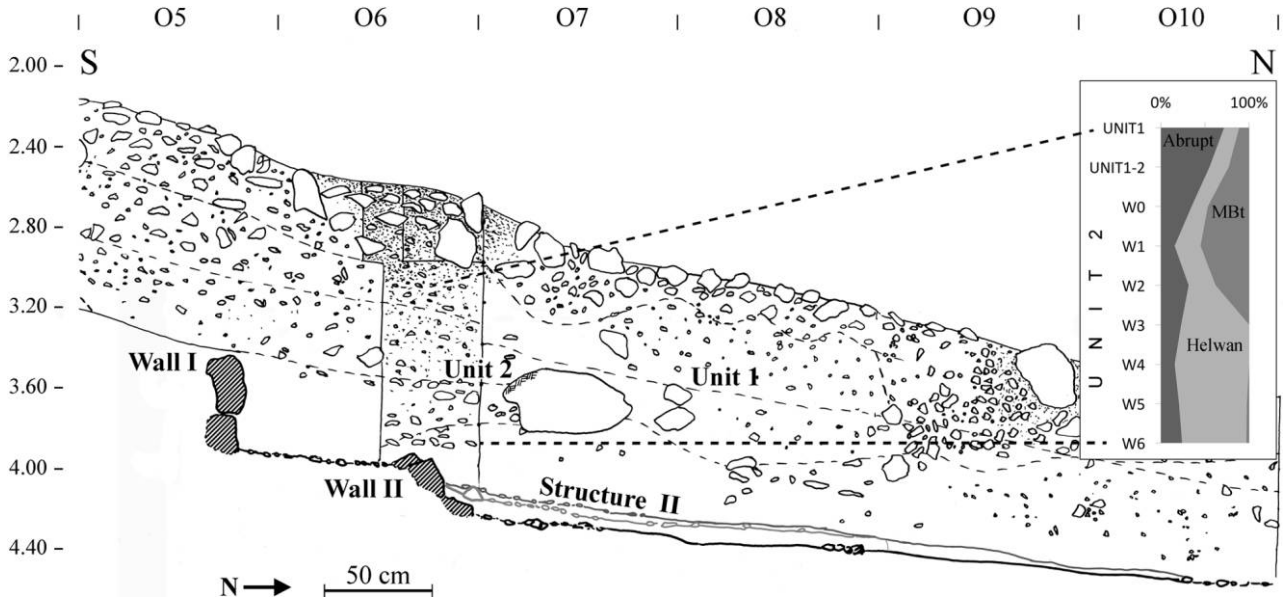

Figure 2. Section presenting the general stratigraphy of the terrace (the N-O line in fig. 1). The lithic-based cultural division is depicted in the inset, showing the proportions of Helwan-retouched and abruptly retouched lunates, as well as microburins. Note Walls I and II. The three lowermost stony floors, abutting Wall II, are indicated.

was the cave (Weinstein-Evron 1998). Our recent excavation focuses on the northeast (NE) part of the terrace (figs. 1, 2). An area of ca. 70 m^2 was exposed, yielding Natufian sediments between 0.5 and 1.5 m thick. A composite stratigraphy of the entire site (Weinstein-Evron, Kaufman, and Yeshurun 2013) suggests an ephemeral occupation at the base of the Early Natufian (EN), followed by a prolific burial phase containing almost 100 individuals, and culminating with the Late Early Natufian (LEN). The latter is the "classic" EN layer of the site, characterized by varied architectural features (fig. 1). The LEN phase appears as a massive, > 0.5 m thick accumulation of repeated occupations. Overlying this architectural phase are thick EN living levels with a few stone-built features, but generally lacking structures. The sequence ends with a thin LN layer devoid of architecture, but displaying several concentrations of graves.

The "architectural" (LEN) phase in the northeast terrace forms our case study. The renewed excavation exposed an architectural complex (figs. 1, 3) delineated by a 9 m curvilinear "terrace wall" (Wall I) encompassing a sequence of at least nine architectural subphases, each defined by a thin stony floor, some of which abut a smaller stone wall (Wall II). Aside from their association with Wall II, the interpretation of the stony levels as intentionally arranged floors is based on the well-defined vertical and horizontal boundaries of these features, containing numerous and densely distributed small stones (mostly 5–10 cm in diameter), with relatively large and complete long animal bones placed horizontally on and between the stones. Usually these features are one stone thick, and, when superimposed, they are separated by readily distinguishable stone-poor sediments (< 1–5 cm thick). The stony floors are typically surrounded by distinct lateral boundaries between the stony and the stone-poor matrixes, the latter occasionally being of a distinctly lighter color (figs. 2, 3).

The three lowest floors clearly abut Wall II and subsequently were defined as a structure, Structure II, cut within the area delimited by the large terrace wall (Wall I: see fig. 3; the profile view of the three lowermost floors is seen in fig. 2). The six floors overlying Wall II are similar to those abutting it and likely are the remnants of one or more similar structures, constructed on the same spot, together forming a 40-cm-thick deposition of superimposed dwelling events. The structures' kidney-shaped contours (fig. 3) were defined by the spatial extent of the stone-rich floors, and this observation was supported by the extent of Wall II in the levels in which it was preserved, that is, the three lowermost floors. Thus, the series of stony floors and between-floor sediments are interpreted as dwelling interiors, and the stoneless matrix lying north of this series is interpreted as having been outside of the dwelling (but still within the area delimited by the large terrace wall; fig. 3). In addition to these internal/external dwelling accumulations, a large pile of stones, a seemingly burned matrix, and concentrations of lithics (Locus 67) were found northwest of the area of Structure II (figs. 1, 3). Beyond the terrace wall is another massive amalgamation of stones (Locus 25; fig. 1), which was probably formed by a combination of human terracing done as a part of the Wall I system and some colluvial activity. These construction phases were dated by radiocarbon measurements on charcoals and ungulate bones to yield a calibrated age range of 14,660–14,030

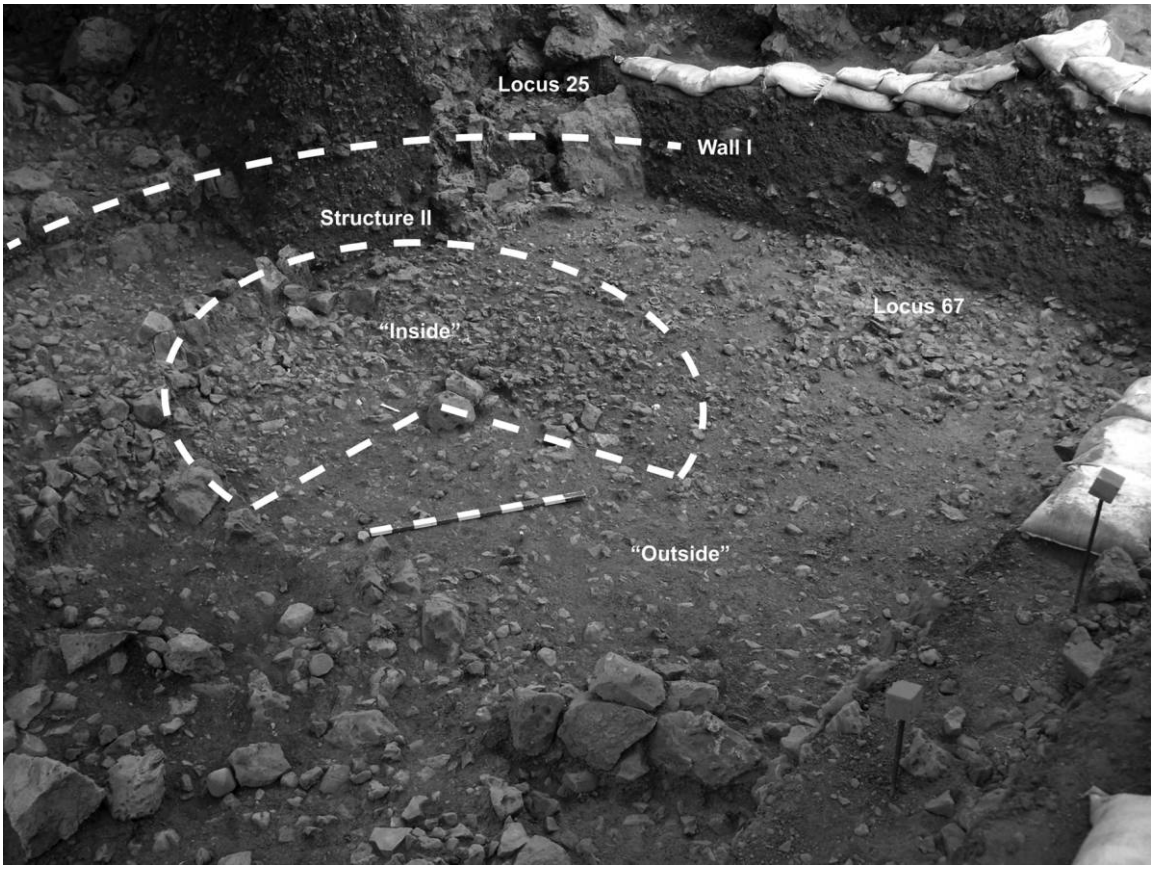

Figure 3. The EN architectural compound at the el-Wad Terrace. The main features are indicated. A color version of this figure is available online.

cal BP ($\pm 1\sigma$: Eckmeier et al. 2012; Weinstein-Evron et al. 2012). Human remains are virtually absent in these contexts but the density of other finds is very high, specifically chipped lithic and groundstone tools, bone tools, bone and shell ornaments, ochre, and a large faunal assemblage. The stone structures, numerous living floors, density and diversity of finds, and the absence of burials indicate that this part of the site was intensively used for daily habitation activities during part of the EN.

Based on these observations, we conducted an intrasite comparison of four distinct pooled contexts (thick palimpsests that are stratigraphically contemporaneous): (1) *Inside* is the accumulation of the nine superimposed stony floors, interpreted as the remains of a continuously renovated dwelling (Structure II); (2) *Outside* refers to the area just outside (north) of Structure II, probably corresponding to the exterior of its floors; (3) *Locus 67 area* is a large and deep pile of stones and gray sediment crusts northwest of Structure II, including its capping sediments; and (4) *Locus 25* is a large pile of stones located beyond Wall I, delineating the living area (figs. 1, 3). The four pooled contexts allow the examination of contextual taphonomic patterns in four different modes of accumulation: those of the postulated interior and exterior of a dwelling; that of an adjacent, perhaps specialized, activity/dumping area; and that of a feature outside of the living area. The distinct architectural character of each of these contexts led us to hypothesize that distinct activities and differing discard patterns took place in each of them.

Contextual Taphonomy Results

This section presents the taphonomic comparison of the four pooled contexts, according to the tests for depositional scenarios formulated above (table 1). The statistical procedures we employed are detailed in supplement A, available online. A summary of excavation methods, faunal analysis procedures, and assemblage-level results is presented in Yeshurun, Bar-Oz, and Weinstein-Evron (2014), while the most pertinent points are given here, usually based on the number of identified specimens (NISP). The large and generally well-preserved faunal assemblage is primarily dominated by animals weighing 20 kg or less: mountain gazelle (*Gazella gazella*) and a suite of small game species such as tortoise (*Testudo graeca*), hare (*Lepus capensis*), fox (*Vulpes vulpes*), and squa-

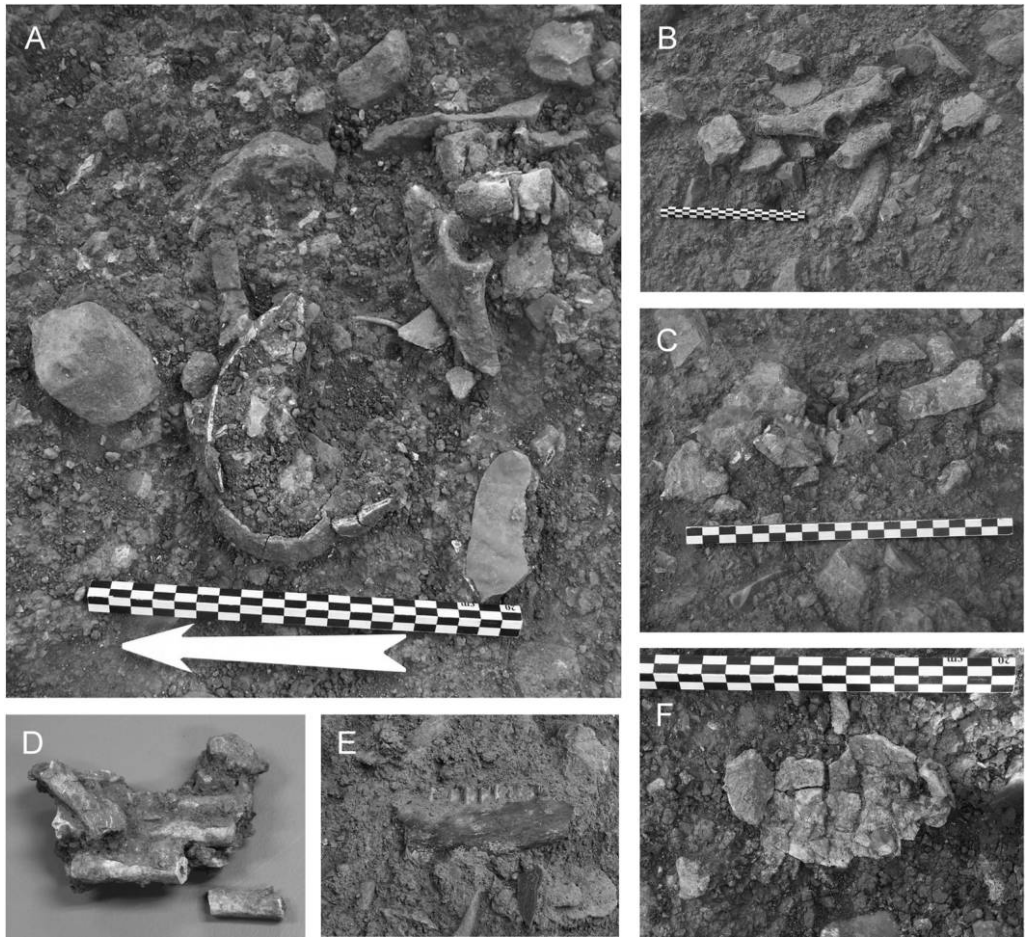

Figure 4. Examples of bone specimens displaying minimal movement in the Early Natufian of the el-Wad Terrace: (*a*) tortoise carapace and gazelle illium just outside of Structure II; (*b*) paired gazelle horn-cores and near-complete fallow deer innominate; (*c*) gazelle mandible outside Structure II—broken in situ, probably by trampling or compaction, but the two halves still conjoin; (*d*) articulated piece of a *Canis* paw from a floor inside Structure II; (*e*) carbonized but nearly intact gazelle mandible from inside Structure II; (*f*) articulated tortoise carapace just outside of Structure II. A color version of this figure is available online.

mates (snakes and lizards). Larger animals, mainly wild boar (*Sus scrofa*) and fallow deer (*Dama mesopotamica*) are rarely present. Numerous bones were coated by carbonate concretions, which were successfully removed using diluted acetic acid treatment, enabling systematic microscopic examination of bone surfaces. The animal remains are anthropogenic in origin, bearing ample evidence for butchery, fracturing, consumption, and working. The bones are fragmented, resulting from both intentional human activities (butchery) and post-discard activities (trampling and indirect burning). Burned bones are frequent. However, overall burning intensity is low and is primarily associated with carbonization, that is, indirect, or short, contact with fire. The anatomical distribution of burning is very even and does not correlate with food utility or fat-rich body parts. This bone burning pattern is consistent with the lighting of hearths located on top of earlier refuse, thereby unintentionally inflicting secondary burning on bones buried underneath (Stiner et al. 1995).

Field Observations, Concretions, and Densities

The four pooled contexts differ markedly in their observed architectural nature, ranging from thin, repeatedly built, and well-defined dwelling floors to massive piles of stones and artifacts. Spatially, Locus 25 stands out as the only pooled context that is outside of the dwelling area delimited by Wall I. The Inside and Outside contexts of Structure II display defined floors and walls, while Loci 67 and 25 preserve no such clear domestic architecture (though the boundaries of these stone piles are well defined). Rather, they constitute massive amalgamations of stones and artifacts (fig. 3).

Evidence of minimal movement (EMM) of archaeofaunal remains is present in all contexts (fig. 4, table A1; tables A1–A11 available online). The Inside and Outside pooled contexts contain the most excavation units with EMM, while Locus 25 displays the fewest EMM indicators per excavation units (normally 0.5 × 0.5 m^2 spits, 5 cm or less in depth) or per

volume (table A2). The presence of multiple EMM in all contexts and throughout the entire accumulation of Structure II indicates good preservation of at least some of the archaeofaunal remains in their original location. The anatomical articulations point to deposition prior to decomposition of soft tissues (i.e., just subsequent to consumption and disposal).

Numerous bones in the EN samples are coated with carbonate concretions, presumably as a result of fluctuating water tables at the site, but the intensity of concretions is variable among pooled contexts, reflecting differing depositional microenvironments (Eckmeier et al. 2012; Weinstein-Evron et al. 2007). Bones in Locus 67 display markedly fewer concretions compared with the Inside and Outside pooled contexts (table A2). This result suggests that little mixing had occurred between these two nearby areas in the postburial stage subsequent to concretion formation.

Volumetric densities of faunal remains were calculated for each pooled context (table A2). The Inside and Outside pooled contexts display a very high, and nearly identical, density of bone remains in terms of bone mass (measured in grams), but the NISP counts per volume are higher in the outside sample (reaching 3,709 identified specimens per cubic meter, vs. 2,717 NISP/m^3 inside the structure). Of the four samples, Locus 25 stands out as having the lowest bone mass and NISP count—almost half the values for Structure II and its surroundings. However, Locus 25 also displays a high NISP mass for its small number of identified specimens and its low overall density of bones. In other words, this locus exhibits relatively fewer identified specimens in relation to excavation volume, but these specimens constitute a relatively large portion of the locus's bone sample and hence are greater in size.

Taxonomic and Anatomical Composition

For this analysis, all taxa were assigned to one of seven groups: small mammals, small ungulates, medium ungulates, large ungulates, tortoise, squamates, and birds. While the Inside and Outside samples are very similar taxonomically, the Locus 67 area stands out as having significantly more tortoise and fewer small ungulates. Inversely, Locus 25 displays an overrepresentation of medium ungulates, fallow deer, and wild boar (table A3). Thus, larger animals are better represented in Locus 25, and smaller animals in the Locus 67 area.

The small size of most of the EWT game means that carcasses were likely to be carried complete to the site, a notion verified by body-part profiling. All anatomical regions of the small ungulate group are present in all pooled contexts, but significant variability in their relative proportions occurs. Limbs (mainly shaft fragments and tarsals) were underrepresented inside Structure II, and overrepresented, coupled with an underrepresentation of head parts, in the Locus 67 area. Axial and feet parts are similarly represented throughout (table A4).

Bone-Surface Modifications and Burning

Several types of modifications present a differential distribution among pooled contexts (table A5, figs. A1–A4, available online). All pooled contexts contain cut-marked and percussion-marked bones that are the result of human butchery and consumption. The faunal remains in Locus 25 exhibit higher weathering and more indications of carnivore ravaging, thereby reflecting longer duration of exposure (slower burial) relative to the living area. The Locus 67 area exhibits a contrasting pattern of rapid burial, with low weathering and negligible carnivore and rodent activity. This area also experienced more trampling relative to the others. Postburial processes, represented here by root marks and abrasion, seem to have acted similarly on the bones in all pooled contexts.

The Inside and Outside pooled contexts are very similar in their burning patterns. About one-quarter of the specimens are burned, and this is manifested as carbonized, rather than calcined, remains, indicating low burning intensity and probably indirect burning episodes. Limb bones were burned subsequent to their being cracked open (i.e., nonnutritional burning), as evidenced by the similar burning intensity on both sides of the diaphysis (table A6). However, the two "nondomestic" contexts, the area of Locus 67 and Locus 25, are markedly different. The proportion of unburned specimens in the Locus 67 area is significantly lower than statistically expected, whereas the proportions of bones burned to varying degrees (from light carbonization to calcinations) is significantly higher. By contrast, Locus 25 displays the lowest burning frequency and intensity and significantly less carbonized specimens (fig. A2, table A7).

Worked Bones

Some of the gazelle and occasionally partridge and tortoise elements were worked to create pointed implements, beads, and a variety of other artifacts. The worked items were discarded with the other faunal refuse. Worked bone items were found mainly inside and outside Structure II and in the Locus 67 area, whereas they were scarce in Locus 25 (table A8). The distribution of types of worked items is not uniform. Ornaments are similarly represented among pooled contexts, but their production waste is overrepresented outside the structure and underrepresented inside. Tools are slightly overrepresented in the Locus 67 area. It seems that the highest diversity of item types is found inside Structure II, but larger samples are needed to verify this pattern.

Fragmentation

"Green," or fresh fractures, attributed to the deliberate fracturing of bones to access marrow for consumption by humans or carnivores, and "dry" or "intermediate" fractures, representing bones that broke (or were broken again) following discard, are represented nearly equally in the total assemblage (Yeshurun, Bar-Oz, and Weinstein-Evron 2014). Given that

the bones overwhelmingly show evidence of systematic and deliberate fracturing to obtain marrow, the "original" state of the discarded limb bone was a diaphysis displaying a green fracture. Subsequently, postnutritional causes broke a sizable portion of the discarded bones yet further. Thus, the ratio of green fractures to dry plus intermediate fractures represents the amount of divergence from the original state of disposal. The Inside and Outside pooled contexts are similar in the ratio of green to dry or intermediate breakage. Conversely, the Locus 67 area stands out as having significantly higher proportions of dry breakage, while Locus 25 exhibits the opposite pattern—significantly more green breakage (fig. A3, table A9). Put in interpretative terms, the ungulate limb bones are best preserved in their original discard status in Locus 25 and exhibit the least effect from postdiscard agents (e.g., trampling).

Bone Fragment Size

The average length of bone fragments in the total assemblage is just 21 mm (NISP, excluding squamates), reflecting the preponderance of small-bodied taxa, as well as the high fragmentation and systematic recovery of the assemblage. The vast majority of fragments (90% of NISP) fall into the "small refuse" group (fragments with a maximum dimension $\leq$ 30 mm). However, large fragments (with a maximum dimension of $\geq$ 40 mm) are also present in the sample (NISP = 433, 5%), all belonging to mammalian taxa.

Bone fragments from Locus 25 are significantly longer than those from the Locus 67 area. The inside and outside of Structure II are statistically similar with regards to bone fragment size and also display statistically insignificant differences relative to the two nondomestic contexts (table A10). Large fragments were most abundant in Locus 25 and least abundant in the Locus 67 area, consistent with the calculated results for mean fragment size. Thus, Locus 25 was characterized by a relatively higher mean length of bone fragments, more large specimens, better preservation of bones in their postdiscard state, and a greater frequency of large-bodied taxa. In contrast, the Locus 67 area exhibited the smallest mean length of bone fragments and the lowest count of large specimens, in conjunction with greater frequency of small game and significantly higher nonnutritional breakage.

The recurring deposition of nine superimposed stony floors inside Structure II, separated by thin sediment fills (fig. 2), enabled examining bone size trends in this domestic sequence. The stony floors yielded significantly more large fragments than the between-floor fills, typically as relatively complete bone elements embedded in the stony matrix (fig. 5). Overall, bone fragments were consistently longer within than between floors (fig. A4, table A11; note, however, that in absolute size the vast majority of specimens still fall into the small fragment category). The consistency of these patterns along the entire sequence of habitations raises the possibility that larger bone fragments were more protected when trampled into the floor and, as a result, were less susceptible to being tossed away during the phase when each specific floor was in use. Furthermore, it seems unlikely that larger bone fragments were intentionally used as part of the bedding fill prepared to support remodeled floors, as the most conspicuous bone items are found embedded within the stony floors rather than in the fills. The material within a floor and just above it (i.e., on the floor's surface) probably derives from the same refuse accumulation: some items got trampled into the floor, while others were not, causing somewhat different patterns of preservation within the Inside pooled context.

Discussion

Our contextual taphonomy analysis reveals site-formation processes and patterns of use, intensity of occupation, and perception of built space during the Early Natufian of the el-Wad Terrace, with implications for the understanding of early architecture. Some statistically robust patterns are apparent in our intrasite comparison (table 2; fig. 6). All pooled contexts yielded similar taxonomic representation and presence or absence of body parts. Hence, it is likely that all remains originated in the same hunting, butchery, and consumption episodes. However, their taphonomic history parted ways in the postconsumption stage. While the interior and exterior of Structure II are strikingly similar, the Locus 67 area and, especially, Locus 25 form noticeable outliers in the density of faunal deposition, bone size, pace of burial, and postdiscard damage. The Locus 67 area displays a marked rise in the relative amount and intensity of bone burning. The density of faunal remains is very high, and their deposition was rapid and intensive, while postdiscard damage is marked. Locus 25 is conspicuously different, with its indications for slower burial, less intensive deposition, milder postdiscard damage, and deposition of larger bone pieces, some from larger ungulates.

Modeling Faunal Deposition in an Early Natufian Habitation

We now consider the depositional scenarios (see explanation above) that could account for the observed taphonomic patterns in each context. We begin by ruling out tertiary types of deposition as possibly significant effectors and then move on to evaluate secondary and primary depositional scenarios (table 1).

The intercontext comparison found no convincing evidence implying large-scale tertiary, *postburial deposition*. A considerable number of excavation units yielded EMM, and the architectural preservation and variability in carbonate-concretion intensity seem to rule out large-scale reshuffling of sediments in later years. Moreover, the intracontext patterns studied in the sequence of nine stony floors in Structure II indicates that postburial deposition did not impact the Inside pooled context significantly. The two potentially most damaging processes, pit-dwelling construction and burial, are

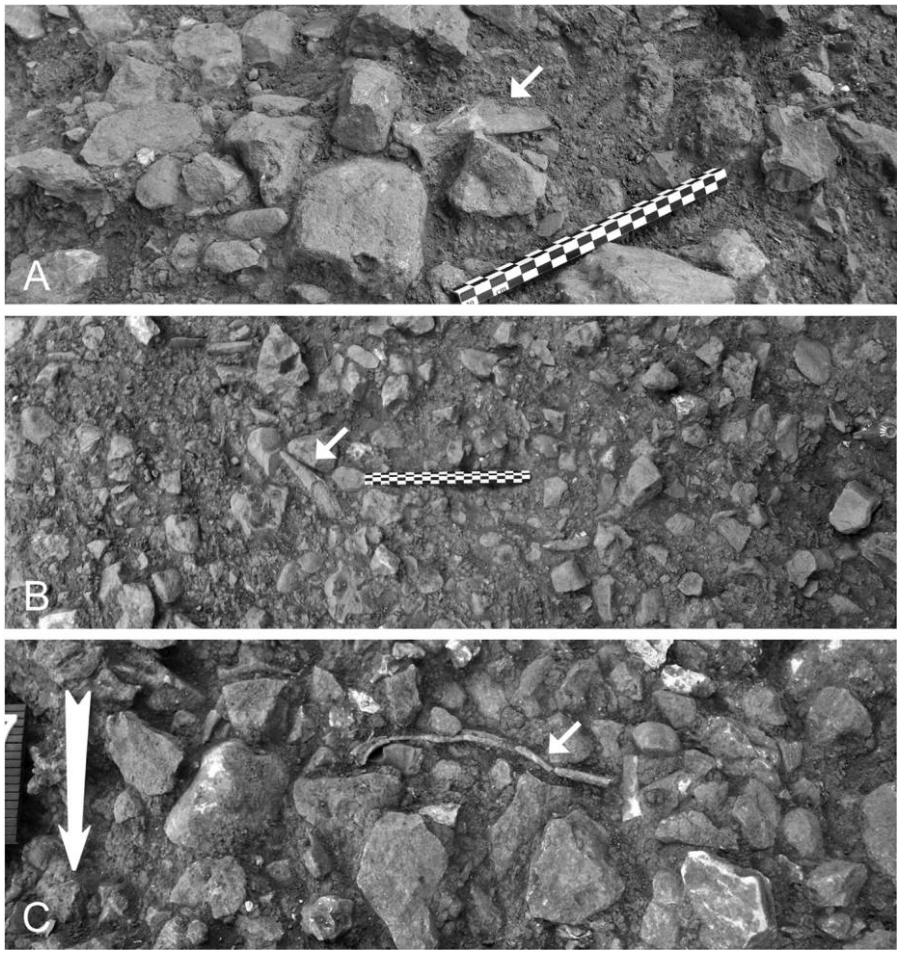

Figure 5. Examples of larger and relatively complete faunal specimens (gazelle scapula, horn-core, and rib) embedded within the stony matrix of Structure II's floors. A color version of this figure is available online.

hardly manifested in the thick EN sediments overlying the phases studied here. The impact of these processes on architectural and assemblage integrity is certainly seen elsewhere at the site, for example, in the uppermost EN and the LN layers in parts of the excavation that were disturbed by multiple LN burials (Weinstein-Evron et al. 2007). It is possible that some tertiary deposition of sediments and bones occurred vertically, within each pooled context (except the Inside), but the horizontal effects of mixing were statistically negligible.

Moving on to types of secondary deposition, no discernible evidence of storage or caching of any kind was found. Moreover, the skeletal-element profiles of the EN assemblage yielded no evidence for preferred or noticeably missing bones, which might hint to their collection or export elsewhere, independent of nutrition and preservation concerns. Hence, although bone caches are sometimes manifested in Natufian sites (e.g., Munro 2012), storage may be excluded from the considerations of explaining the observed bone distributions in our case study.

Preburial distribution of faunal items should be considered, chiefly because evidence from bone-surface modifications hints at some carnivore ravaging affecting the faunal remains that have been discarded but still not buried. Carnivores could move bones from one location to another or from the living area to more distant areas off-camp, especially if domestic dogs with free access to the hamlet were the gnawing agents (Bartram, Kroll, and Bunn 1991; Kent 1993). Given the putative evidence for the presence of domesticated dogs at Natufian sites (Dayan 1994), it is conceivable that domestic dogs were responsible for these gnawing modifications. However, the proportion of gnawing modifications in our case is still much lower than the frequency of gnawing occurring at most ethnographic cases of dog feeding in camps (e.g., Kent 1993; Svoboda et al. 2011), and skeletal elements that one expects to be severely underrepresented under intensive ravaging (such as carpals, tarsals, and epiphyses; Marean and Spencer 1991) are actually well represented.

A more in-depth examination of the pooled contexts yields several lines of evidence suggesting that the "primary refuse" scenario is represented by the faunal assemblage from the

Table 2. Summary of contextual taphonomy results

	Inside	Outside	Locus 67 area	Locus 25
Stratigraphy	LEN, in the Wall I compound	LEN, in the Wall I compound	LEN, in the Wall I compound	LEN, outside the Wall I compound
Architecture	Domestic: walls and floors of Structure II and capping deposits	Domestic: stone-poor matrix adjacent to Structure II floors	Massive pile of stones and artifacts, with gray concretions in the center	Massive pile of stones, possibly a colluvial deposition
Volumetric faunal density	Very high	Very high	Very high	Least
EMM	Present	Present	Present, but only for small game specimens	Present
Taxonomy	Small ungulate and small game	Small ungulate and small game	Small ungulate and small game	More larger ungulates, less small game
Skeletal parts	All present; fewer limbs	All evenly present	All present; more limbs	All evenly present
Bone working	Varied artifacts, no waste	Production waste	Mainly tools	Very few items
Anthropogenic modifications	Butchery and consumption (all stages)	Butchery and consumption (all stages)	Butchery and consumption (all stages)	Butchery and consumption (all stages)
Nonanthropogenic modifications	Rapid burial (minor weathering and gnawing)	Rapid burial (minor weathering and gnawing)	Rapid burial (minor weathering and gnawing), more trampling	Slower burial (more weathering and gnawing)
Burning	Mild, indirect, and repeated	Mild, indirect, and repeated	Intense, some direct, mostly nonnutritive	Least
Fracture patterns	Both green and dry fractures: consumed limbs broken after discard	Both green and dry fractures: consumed limbs broken after discard	Least preserved in postconsumption stage	Best preserved in postconsumption stage
Bone size	Mostly small fragments, larger pieces entrapped in floors	Mostly small fragments	Smallest	Largest
Summary	Intensive and repeated deposition of consumed fauna in superimposed domestic contexts, specimens trapped in stony floors, minimal movement, pre- and postburial damage from repeated occupations		Intensive and repeated deposition of consumed fauna, with high burning impact, intensive postdiscard damage	Less intensive faunal deposition, larger specimens, slower burial, and less damage from later activities

Note. LEN = Late Early Natufian; EMM = evidence of minimal movement.

interior and exterior samples of Structure II. First, multiple EMM indicate preservation at or very near the original discard location of many faunal items. Second, no size sorting is apparent when the source and preservation of the faunal material are taken into account; most bone fragments are small, because bone fragment size was small to begin with, due to the procurement of small animals (namely, gazelle, tortoise, hare, and fox) and their intensive processing to smaller consumption units. Hence, the bones were already discarded as small refuse, which is more conducive to their surviving having being tossed away or low-intensity cleaning (Binford 1978; O'Connell 1987; Simms 1988). Third, recurring indirect burning, as well as trampling and in situ breakage on these faunal remains, suggest that a great deal of food refuse remained in the living quarters and was subsequently damaged. Specifically, the trampling of a portion of the faunal items inside the stony floors indicates that at least some of the consumption refuse was not cleared away. Fourth, the architectural nature of the Structure II area is not that of a trash or storage pit; it displays at least nine habitation episodes (represented by the well-defined stony floors) superimposed in roughly the same location and showing consistency of the aforementioned taphonomic patterns. It is possible for an abandoned house to be used as a trash bin; however, the explanation of repeatedly converting a house to a dumping place through nine episodes, after each of which a new floor was constructed on the same spot, is difficult to accept. Moreover, no corresponding cleaned locales or bone-poor zones were discerned in the Wall I complex. All of these observations are consistent with assumptions about a domestic context that was not systematically cleaned.

The depositional scenario changes in Locus 25 and the Locus 67 area. The architectural nature of Locus 25 and the characteristics pertaining to less intense deposition, better preservation of bones in their postdiscard state, and more large bone elements indicate that it may have served as a refuse deposition (secondary deposition). The taphonomic characteristics of this pooled context converge to suggest that bones there did not significantly experience repeated trampling and indirect burning, but did suffer relatively prolonged exposure. It should be stressed here that Locus 25 cannot be termed a *midden*, or a formal dumping area; it exhibits the lowest density of food refuse items and bone tools among the pooled contexts. A certain portion of the fauna made its way there—particularly large and impeding remains—but by no means most of these elements. Hence, Locus 25 fits the sce-

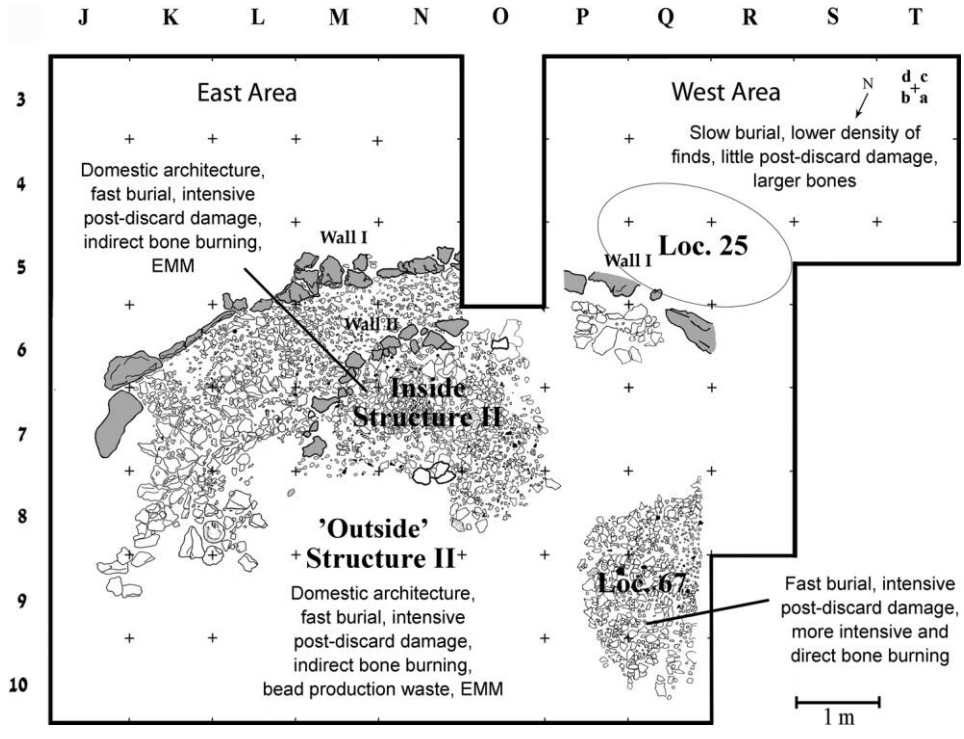

Figure 6. Summary of the contextual taphonomy results, projected on the plan of the most widely exposed EN level. Note that the samples originate at deep accumulations; thus, the results not only represent the level shown here, but a series of similar levels.

nario of the occasional tossing away of exploited faunal elements over the large terrace wall that demarcates the boundary of the EN domestic space (fig. 3).

The Locus 67 area yielded a picture inverse to that of Locus 25. The density of bones in the Locus 67 area is as high as in the Structure II area, and bone fragments are the smallest of all pooled contexts, consistent with a scenario of primary deposition. The marked rise in bone burning in the Locus 67 area might mean that more fire-related activity occurred. Alternatively, Locus 67 might reflect the repeated disposal of hearth material (burned stones, sediments, and artifacts) brought from elsewhere, possibly the Structure II area, thus constituting refuse deposition (Cain 2005; Svoboda et al. 2011). However, this last hypothesis is problematic, because considerable amounts of (indirectly) burned bones were still left inside and outside Structure II. If such hearth maintenance did take place, it was not thoroughly done, as ample traces of burned artifacts and possibly burned sediments (Weinstein-Evron et al. 2007) were left behind. This "intermittent ash cleaning" interpretation should be viewed as a working hypothesis that awaits verification in future geoarchaeological studies. At present, the taphonomic characteristics of the Locus 67 area are best explained as an amalgamation of both primary deposition and refuse deposition that took place in this location.

The conclusion that the faunal remains inside and outside of Structure II largely constitute primary deposition, that Locus 25 contains refuse deposition, and that the Locus 67 area constitutes a mixture of both may seem counterintuitive in a site that was inhabited during such a long period of time, and where numerous repeated occupations are superimposed or intermingled in a small area. Our contention is that the enduring features of site structure, that is, the clear stone walls and stony floors, the large terrace wall, and possibly the location of the sampled area within the site, all dictated the spatial nature of daily human activities for generations and thereby created a spatial signature that is consistent through time (Bailey and Galanidou 2009; Galanidou 2000). Such a signature is archaeologically visible, some pre- and postburial mixing notwithstanding. It is a recognized phenomenon of much older Paleolithic deposits in the region, where presumably less intensive human occupation events, extending over millennia, still create conspicuous patterns of site structure, depending more on intrasite location than on stratigraphy (e.g., Speth et al. 2012).

Purpose and Permanence

The area analyzed in this study, albeit small, is architecturally and taphonomically diverse and provides some clues as to EN site organization (fig. 7). Faunal remains deposited in the context of Structure II and its surroundings, being mostly primary refuse, may potentially be excellent indicators of spatial function and disposal behavior. Butchered and roasted

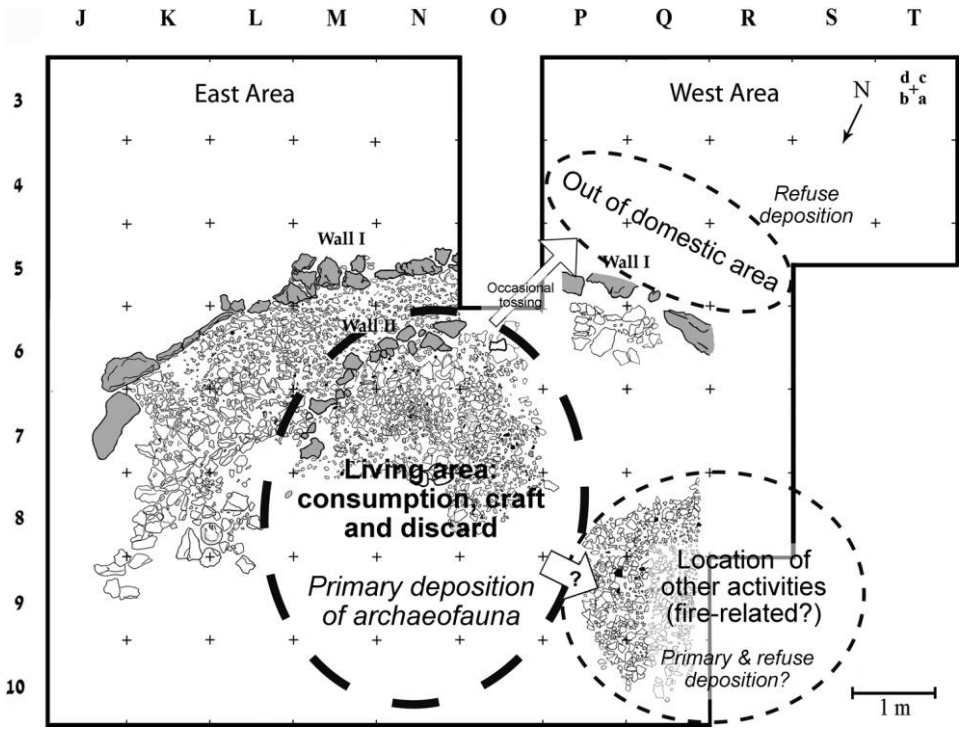

Figure 7. Interpretation of the contextual taphonomy results.

animal parts were discarded in Structure II, presumably after consumption activity in this location, and were subsequently trampled, unintentionally burned by hearths lighted above them, and eventually became embedded in between or above the stony matrix of the dwelling floors. Hence, it is possible to infer repeated consumption of gazelle and small game inside Structure II. The area just outside Structure II was used and maintained in a similar manner, with an even more intensive buildup of faunal refuse and the highest counts of waste from bone working. Thus, it is possible that more daily tasks, such as bone working and perhaps some food preparation stages prior to consumption, were handled just outside the dwelling. By contrast, the taphonomic characteristics of Locus 25 indicate that this locale was not considered part of the living quarters. Fires were probably not lit here, nor were dwellings constructed. The Locus 67 area probably served as a focus of varied domestic activities and possibly as a destination for the occasional hearth disposal of refuse that perhaps originated in the area of Structure II, where no formal hearths were preserved (fig. 7).

In the Structure II sequence no task-specific floor was discerned. All stony floors seem to have been used for food consumption and, possibly, preparation. It is very likely that these floors also served as the location for performing other tasks, reflected in the rich assemblages of chipped stone, discarded pestle fragments (Rosenberg et al. 2012), ochre, shell, and phytoliths (Portillo, Rosen, and Weinstein-Evron 2010). The function of the Structure II area as a generalized activity center used for a variety of tasks and manifested by intermingling archaeological markers, is reminiscent of several case studies of contemporary hunter-gatherers (e.g., Galanidou 2000; Janes 1989; O'Connell 1987; Yellen 1977). It appears that EN intrasite space was not functionally constructed in a rigid fashion, in the sense that at least some stages of food preparation, consumption, and bone working were performed in the same places. In all probability, these places were also used for a variety of other activities including working, sleeping, and social interaction. The simple refuse disposal behavior and site organization found here correspond well with other Natufian case studies analyzed by different approaches (Hardy-Smith and Edwards 2004; Samuelian 2013).

The sample studied here comes from the later EN, a phase with substantial stone architecture and no burials (Weinstein-Evron, Kaufman, and Yeshurun 2013; Weinstein-Evron et al. 2012). The moderate size, simple construction, and absence of decorations and noticeable artifact caches in the studied series of dwellings, as well as the rarity of explicitly "symbolic" items found here (apart from bone and shell beads), suggest that it was repeatedly used for mundane, domestic-scale activities and not for corporate or ceremonial purposes. Thus, the faunal assemblages studied here are probably the remains of routine meals of Natufian "households," representing the everyday economy of a small (possibly kin) group. The repeated patterns of household economy are elucidated here—a notion implicitly made in many zooarchaeological studies but one that actually needs to be checked.

The interpretation of architectural spaces solely on the basis of their size and features should, if possible, be complemented by looking at in situ refuse, supported by detailed and holistic taphonomic evaluation. Using the advocated approach, it would be interesting to test and compare the actual use of simple huts, on the one hand, and some unusually large or well-constructed structures, on the other (Finlayson, Mithen, et al. 2011; Goring-Morris and Belfer-Cohen 2008; Maher et al. 2012; Schmidt 2010). In theory, a detailed contextual taphonomic analysis could indicate whether the faunal refuse in these examples is contextually informative and, if so, what and how intense the possible uses of these structures were. In light of recent debates on the use and mode of habitation of Epipaleolithic and early Neolithic structures, the faunal-deposition model suggested in this study may prove useful in interpreting other house-floor faunal assemblages that, it has been claimed, were accumulated through nonroutine uses.

Perception

The demonstrated Natufian habit of discarding food refuse in the place of consumption may constitute one of the last manifestations of such behavior in the prehistoric sequence of the Levant. Pre-Pottery Neolithic and Early Pottery Neolithic dwellings exhibit relative cleanliness, as it becomes uncommon to find as much cultural debris on house floors as in the Natufian (Hardy-Smith and Edwards 2004). Watkins (1990, 2004, 2008) has suggested that an increase in the cultural importance of dwelling structures, namely, a transformation from merely being considered a "house" (shelter) to being a true "home," had taken place during the transition to farming. In his view, the creation of a "built environment," full of symbolic meaning, was a crucial adaptation to life in a sedentary village community, enabling the expansion of the Neolithic social and economic sphere. As part of this adaptation, people ascribed special importance to their dwellings and, accordingly, took care of them by regularly cleaning house floors; deposited foundation offerings; buried the dead beneath house floors; abandoned some houses in a ritualistic fashion; and embedded decorated interior furniture, such as sculptured pillars, cattle bucrania and plastered skulls, inside the buildings (e.g., Hodder and Cessford 2004). However, Watkins is not clear on the timing of this postulated revolutionary attitude toward the dwelling.

The present analysis positions the Natufian attitude toward their dwellings closer to Watkins's house than to his home concept. The Early Natufians of the EWT used their dwellings for numerous everyday tasks, while paying little attention to the clearing away of the resulting refuse or maintaining it in some orderly way. They disposed of refuse inside the house or next to it or occasionally tossed some bulkier elements outside of their living compound. They repeatedly did so through at least nine (and probably many more) occupations at the same spot during EN times, continually rebuilding their dwellings on top of previously discarded refuse, without bothering to clear it away, and without leaving behind interments or specific "foundation gifts," archaeofaunal or other, which we can identify. Perhaps the constant accumulation of fresh organic refuse produced only "static smells," a constant, tolerable, and unavoidable part of the cultural landscape (Bartosiewicz 2003; Galanidou 2000) that went unnoticed by the Natufians. Thus, we suggest that the architectural compound at the EWT was viewed first and foremost as simply a sheltered place to live and did not play a significant symbolic role.

This indifferent attitude to the EN house is, in some ways, in contrast with the dwellings from the PPNA and especially the PPNB (Hardy-Smith and Edwards 2004; Watkins 1990). While a few Natufian structures do present symbolic elements in their construction, this phenomenon is more widespread in the Early Neolithic (Goring-Morris and Belfer-Cohen 2008). A similar array of domestic activities were probably carried out inside Neolithic dwellings but, compared with those from the EN, refuse maintenance in the former was much more rigid, the dwelling was more organized, and more attention was given to symbolic and cosmological aspects. In contrast to EN dwellings, Neolithic residences also exhibit the presence of foundation and abandonment rituals (e.g., Hodder and Cessford 2004; Meadow 1978; Twiss et al. 2009; Watkins 1990). It is likely that the construction of plaster floors in the PPNB resulted in less refuse getting trampled into the floor compared with the Natufian beaten-earth or stony floored living levels (Hardy-Smith and Edwards 2004; Samuelian 2006). Was house cleaning in the Neolithic a hygienic adaptation to living in a true sedentary village (Hardy-Smith and Edwards 2004), or did it derive from a conceptual change toward the dwelling and its meaning for humans (Watkins 1990)? As attested by the novel patterns of building stone houses and terrace walls, hewing bedrock mortars, establishing cemeteries, intensively procuring small game and gazelle fawns, and inadvertently creating new ecological niches for commensal animals (Bar-Oz 2004; Belfer-Cohen and Goring-Morris 2011; Davis 2005; Grosman, Munro, and Belfer-Cohen 2008; Munro 2004; Tchernov 1992; Valla 1988; Weinstein-Evron 2009; Weissbrod et al. 2012), some Natufian communities were already practicing sedentism to a degree, while living with considerable—and by modern Western standards, intolerable—quantities of organic faunal refuse. Thus, the cleaning of such refuse started millennia after permanent and repeatedly renovated architecture was established and, hence, should perhaps be viewed as a conceptual, and not a hygienic, transformation.

Conclusion

Applying the contextual taphonomy approach to the study of in situ refuse has indicated that the Early Natufian architectural compound at el-Wad Terrace was used for everyday living (food preparation and consumption, probably at the household level, as well as bone working). Despite intensive habitation reflected in such innovative stone architecture, a

broad-spectrum economy, and heavy damage to discarded animal remains left in the living area, the inhabitants did not engage in clearing away organic refuse or in otherwise marking out their domicile. Rather, the perception of the house was still "Paleolithic" and functional in character, highlighting the complex mosaic of old and new traits in the preagricultural communities of the Levant.

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Comments

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This paper aims to demonstrate how careful and detailed intrasite analyses of refuse and refuse contexts associated with buildings provide a more useful tool for understanding practice than do analyses of the structures alone. As the authors are well aware a comparable approach was taken by Lewis Binford some 30 years ago, so studies of the Epipaleolithic-Neolithic Near East have been slow to engage with this scholarship. More specific objectives of this paper, though, are to demonstrate that animal bone taphonomies and their sequential contexts can be used to differentiate between short-term and long-term occupation in Natufian structures, and also to identify their communal or residential use. Fundamental to a study that concerns more consumption-oriented approaches to lived space are four levels of analyses. These consist of detailed analyses of artifact taphonomies; detailed contextual analyses; analyses of artifact assemblage patterning; and approaches to the use of space. Here I use the term *artifact* to include faunal remains as the refuse of human action.

With its primary focus on investigating the contexts of food refuse this paper's use of a concept of pooled contexts is a sensible spatial approach for comparing patterns of successive artifact assemblages according to the artifact taphonomies. The scenarios to categorise generalized depositional processes of discard are also imminently practical for animal bone, although without an explicit example it is difficult to conceptualise situations where certain types of bones are "missing" from primary refuse because they would have been cached for later use.

Detailed analyses of faunal remains and their condition are undoubtedly the most significant refuse for understanding food processing and discard patterns at this Natufian site. While it is important to include worked bone among these animal bone taphonomies this belongs to an essentially different use category. Its inclusion here raises the question of why the same attention has not been paid to the taphonomies of other artifact types found on the El Wad terrace. The authors refer to the high densities of other artefacts at this site, but these are not really considered here. While the aim of the paper is indeed to demonstrate the important role of faunal remains in understanding social activities, more comprehensive analysis of the complete artifact assemblages in the various pooled contexts, including any archeobotanical remains, can lead to more holistic understandings of socio-spatial practice. It is afterall the complete assemblage that is most indicative of the use of space. Admittedly such analyses will not have similar results to those of these faunal remains but the relative condition, type, and quantities of, for example, groundstone, lithic, and bone tools in these same contexts might serve to test the results from analyses of the contextualized faunal taphonomies.

The authors argue that the refuse assemblages in Structure II on the el-Wad Terrace can be used to assess the duration of activities, in broad terms, and to demonstrate long-term build-up of everyday domestic activities, associated with nine subphases of building, rather than short-term communal, and more ceremonial, activities. However, the terms "short-term" and "long-term" are not clearly defined. Of greater concern, though, is a proposed dichotomy between "communal" and "residential" occupancy without any evident and explicitly theorized meaning of these terms. Rather, there seems to be an implicit understanding that communal buildings are by nature ceremonial and nonfunctional and that residences are "functional" and nonceremonial. The point is well taken that the build-up of food refuse in this structure documents several eating events over a considerable period. There is inadequate evidence and reasoning, however, to argue that these events could not be both "communal" and "domestic," and also significant feasting events. It is also difficult to argue, on the basis of one case study, that final, or indeed repeated, use identifies the intended purpose of a structure. To argue for intentionality obviously requires further intersite analyses, but even then it is by no means assured that practice will follow prescribe social "rules" (Díaz-Andreu 2005, 23; see also Allison 2013:5–7).

In conclusion, this study demonstrates that rigorous anal-

yses of both artifact taphonomies and contexts can be used more effectively to interpret the spatial distribution of household activities, although a more critical approach to interpretation of social practice is needed. Nevertheless this case study provides an example for more rigorous approaches to other Natufian sites that might be used for intersite analyses. It is evident that detailed and fully theorized investigation at all the levels outlined above, including more holistic approaches to artifact assemblage patterning, is a necessary part of the planning of any excavation and that it is difficult to use contextual taphonomy for spatial analyses unless it is built into the original research design (Allison 2013:38–39).

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Palaeolithic Densities on a Neolithic Scale

Yeshurun and colleagues present a convincing model of refuse disposal for the Early Natufian phase at El Wad Terrace, developed from a rigorous analysis of faunal remains, while factoring in critical stratigraphic and taphonomic data. Further, they have framed their study at an appropriate temporal perspective. It will be interesting to see how the evidence of other artefacts and materials influences the pattern obtained from faunal fragments and worked bone.

The picture gained from El Wad corroborates the evidence from Wadi Hammeh 27 in Jordan (Hardy-Smith and Edwards 2004) in demonstrating that Early Natufian communities habitually allowed the detritus of daily life to lie where it fell on their hut floors while engaging in minimal trash disposal; essentially just dumping refuse outside the walls of their huts.

The authors mention upcoming geoarchaeological studies, which should augment the picture they have obtained so far. Micromorphological analyses have not yet figured much in Natufian archaeology, but they have proved effective when applied, for example, at Hayonim Terrace (Colleuille 2012; Wattez 2012). At that site they played an important role in clarifying the use histories of occupational surfaces by identifying trampled floors and their components, including burned particles and minute stone and bone residues. Geoarchaeological issues may also have influenced the authors' interpretation of Structure II at El Wad Terrace as a utilitarian shelter. Here, as at other Natufian cave and terrace sites, natural sedimentation rates were low compared with anthropogenic ones, with only a few centimeters of intercalated deposits building up before remodeling of the stony floors. At Wadi Hammeh 27, on the other hand, natural sedimentation rates were rapid, subsuming large objects in the fills used subsequently as floors. These items include caches of basaltic groundstone tools and other items arranged in precise and unusual manners, redolent of ritual or symbolic behaviour (Edwards 2007, 2008). Such practices might also have occurred at El Wad Terrace, but the evidence would not have survived under the depositional conditions prevailing in Structure II.

The present work builds on a tradition of fine-scale distributional analyses in Natufian archaeology; apart from those already mentioned they include studies by Valla (1988) and Samuelian (2013). Thereby, models of architectural function are tethered to key evidence for the use of architectural space. It is painstaking work, since Natufian settlements were built to a Neolithic scale yet they contain Palaeolithic densities of material. To my mind, these efforts only serve to highlight the dearth of such distributional studies in the following Pre-Pottery Neolithic periods in the Levant, where, however, theoretical interpretations of architectural function are in full flower.

The recent *Neo-Lithics* forum on "The Symbolic Construction of Community" (Gebel and Rollefson 2013) seeks to understand the development of "neolithization" in the Levant, especially the role of monumental architectural constructions and elaborate symbolic repertoires at Göbekli Tepe in southern Turkey. Gebel and Rollefson (2013) ask whether we don't have the responsibility now to infuse archaeology with recent "evolutionary, cognitive and neurobiological perspectives" (2)? Possibly, but we should be mindful of the ontological limits of archaeological evidence and our scope for operationalizing such ideas (Dunbar 2013:27). Archaeology has borrowed from other disciplines with gusto for at least 6 decades, and we would be wise to look back at the fads littering the theoretical trail (e.g., Catastrophe theory, Chaos theory, Coevolution of plants and people, Cultural Virus theory). Among other things, the volume contributors advocate the merits of the reciprocal dialectical influence of the brain's matrix (Benz and Bauer 2013*a*:3), cognitive niche construction (Watkins 2013:7), the mutual cause and interaction of shamanism and crisis situations (Bohnet 2013:55) and emotional contagion and empathy (Benz and Bauer 2013*b*:18). However; Banning's (2011) critique of Göbekli Tepe as a dedicated ritual center, based on his examination of the site's contents, is ignored by each of these writers.

As Hodder (1986) has stressed, context is important and we should not be seduced into abandoning in it favor of generalized theory. Hodder is a founder of ideational and cognitive approaches in archaeology, and his project at Çatalhöyük in Turkey dwarfs Levantine ones for size. Nevertheless, he and his colleagues have thrown every conceivable method of recording (Hodder, Cessford, and Farid 2007), fine-scale distributional analysis (Martin and Russell 2000), and scientific technique such as micromorphology (Matthews 2005) and geochemistry (Middleton, Price, and Meiggs 2005) at the site's impressive wall paintings and ritual furnishings, in order to comprehend them. We know that Levantine Neolithic communities built round or square houses, often with impressive monuments. Finding more of them won't help us

to understand them better if we don't pause to establish what went on in them. Only fine-scale examination of their contents, according to context, will help us in this regard.

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This is a useful contribution, with a thorough and detailed analysis of a well set out hypothesis. The nature and purpose of early prehistoric architecture, commonly used as prima facie evidence for increasing sedentism and subsequently developing social complexity, still needs this sort of detailed examination of basic precepts.

The interpretation of Early Natufian structures as "dwellings" that is made here is based on a reasonable use of the term, where it is argued that the structures were used for intensive daily habitation activities, and not, for example, burial. It is good to see an attempt to positively demonstrate a domestic context, rather than just assume. It is particularly interesting that the space immediately outside the structure was used in a similar manner to the area inside the structure. Despite its walls and floors the structure is not a unique form of space within the site with sharply defined specific tasks or activities associated with it. Only Locus 25 is fully excluded from the "living quarters" (another useful term employed to encompass both inside and outside areas), and there is a general absence of functionally defined space.

The work reported here confirms in broad terms the nature of previous analyses. Hardy-Smith and Edwards (2004) proposal that waste disposal in the Natufian was still "Palaeolithic" is a starting point for the current paper, where the Natufian evidence contradicts ethnographic research regarding waste disposal associated with durable architecture. One initial observation is to reiterate Boyd's comment that we are possibly misled by the substantial nature of architecture to believe that this equates to permanence of occupation (Boyd 2006). At its simplest, this may mean that the cleaning of living space is after all related to length of occupation, but a difficulty still arises in how and why the treatment of waste changes with the beginning of the Neolithic within the context of a relatively smooth development of architectural forms and degree of sedentism (see Finlayson, Kuijt, et al. 2011; Finlayson, Mithen, and Smith 2011).

This creates a problem when the authors suggest that their approach should be adopted to study Neolithic contexts and structures, looking at in situ waste. The emergence of the practice of floor cleaning compromises such a use (Roe 2007). It seems that primary waste on floors is rarely present in the Neolithic, and that refuse is treated very differently from the preceding Natufian. Waste is of course still present on site; both the early Neolithic examples cited in the paper, WF16 and Gobekli Tepe, have substantial midden deposits, but these are secondary deposits within structural units that were no longer in use for their primary purpose and were effectively being filled in by the rubbish. As the authors note, this is not a simple matter of waste disposal. Waste appears to gain a specific role, from the early Neolithic where it is kept on-site with a highly restricted distribution, and can even have an architectural role, providing the matrix for building semi-subterranean structures (see Finlayson, Kuijt, et al. 2011), to the later Neolithic where it may be taken off-site and used for fertilizing soil (Kuijt et al. 2007).

The development of floor cleaning therefore has an impact on the use of this method, and the analysis of use of space has to proceed down different lines of evidence. Cleaning also affects our interpretation of space. Although Watkins argument that pre-Neolithic houses were simply shelters "for general everyday activities" (Watkins 1990:344) appears to be confirmed here, the idea that "cleanliness" relates to an idea of "home" is misplaced. As the authors state, Watkins did not detail the timing of this transition. The sort of Neolithic combination of dwelling and ritual space well known from later Neolithic Anatolian Catalhoyuk is not known in the PPNA, at least in the southern Levant, where architecture appears to have become more functionally specific (Finlayson, Mithen, et al. 2011). It is not at all clear that there is a shift to a greater symbolism in houses, but this is precisely the point when cleaning appears to have become common, predating the appearance of PPNB plaster floors. The arguments made by Yeshurun and colleagues (i.e., that the change may be conceptual and not hygienic) may remain correct but need not be an aspect of increasing symbolism and, rather, relate to a change in the use of space, which ceases to be dominated by an undifferentiated mix of everyday domestic functions, inside or outside the dwelling.

In order to be able to examine the change in use of structures over time we need not only to develop methods that are appropriate to the differing archaeological contexts but also to be very careful not to conflate the Neolithic into a homogenous chronological and geographical whole. The key characteristic of a Neolithic use of space may be diversity, in opposition to a more uniform pre-Neolithic, or Palaeolithic, general pattern of domestic use of space.

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The paper by Yeshurun et al. explores the deposition of animal remains, in the form of refuse, within the permanent framework of Early Natufian stone architecture in a long-lived base camp. In so doing it displays eclectic affinities with research into how space is used both by mobile groups in sites without

any durable architectural remains and by more sedentary ones in built domestic settings, namely, houses. These two branches of settlement archaeology have developed independently due to epistemological reasons. This spatial analysis of remains left by the first settled communities in southwest Asia who were still subsisting on hunting and gathering is ideally suited to bring these two themes together. Because of its subject matter, approach, and conclusions, it is an important and innovative contribution to the consideration of behavior in a built space. The material and symbolic significance of dwelling in permanent houses is central; the house is at the heart of the social organization of Natufian people, a token of its transformation. The adoption of a solid methodological strategy, namely, the contextual taphonomy of house-floor assemblages, establishes the biographies of bone remains and tools in their individual contexts, so shedding light on depositional sequences. The el-Wad Terrace house, being of stone, is forward-looking, yet the use of its space, as expressed in the refuse disposal practices, is not. The repeatedly renovated stone architecture lends the EN house a complex entity; its spatial dynamics encompass older ways of conceptualizing, creating and maintaining space within the new physical structure.

Three interconnected issues emerge. First, by choosing to analyze the faunal portion of the Natufian refuse the authors demonstrate the potential significance of such evidence to reveal patterns of spatial behavior that would otherwise go unnoticed, in addition to illuminating matters pertaining to subsistence and economy. In sites with durable structural remains emphasis is often placed on the architecture, that is, the properties—plan, size, type, materials, traits—of the shell of the edifice as well as on the smaller-scale furnishings within, whereas refuse is only discussed elliptically with respect to whether or not it was systematically disposed of. However, architectural remains constitute but one of the many components of spatial behavior, to be taken alongside patterns of orientation, foundation gifts, symbolic or temporal partitioning of space, refuse discard, living floor maintenance, and so on. The authors opt for an integrative approach, combining faunal refuse, stratigraphy, and context, to obtain a holistic picture of space use and thus a deeper comprehension of architectural interpretation.

The second concern brought forward in this EN domestic setting is permanence. This property, clearly coexisting with sedentism, appears earlier in the global archaeological record, in, for example, the robust patterns of Upper Palaeolithic cave-hearth location and reuse (Galanidou 1997). In the el-Wad Terrace context it coexists dynamically with a practice of domestic refuse disposal concordant with a highly mobile lifestyle. The paper dispels the view that these two aspects of behavior are mutually exclusive. Rather it invites us to look more carefully at Palaeolithic spatial signatures of permanence.

A third matter is the contribution of palimpsests, those archaeological deposits produced by discard, superimposition and mixing of rejected material by anthropogenic and natural processes and averaged by time, in the discussion of Natufian house-space perception and use. In the architectural complex being discussed the fabric of the dwelling comprises at least two elements. First stone walls and floors and then a material palimpsest scattered on and around them. Their analysis suggests a lack both of any structured deposition of materials and of any regular or large scale maintenance of refuse. Ethnoarchaeological studies on the use of space by hunter-gatherers have observed that palimpsests may be actively created and maintained. Two examples are relevant. Brody's (1981) observation of the jumbled objects lying in front of the British Columbian hunter-fishers' permanent houses, effectively a store of materials purposefully left lying around to be used later. In the same vein is Politis' (2007) observation of the Colombian Amazon Nukak hunter/gatherers' practice of discarding remains of edible plant food on the campsite floor. After abandonment of the site and the intervention of the rainy season these refuse areas develop into patches of growing plants, a food resource for future seasonal visits. The physical presence of palimpsests—created with a conscious eye to the future or not—potentially provides attractions for the reoccupation of a living floor: a source of materials to facilitate activities, a resource-recycling strategy, or encouraging the replication of space partition. Was any of such in play in an EN house? Or had the Natufians no interest in their trash? Additional comprehensive studies like this one will help address the question. Answers may be forthcoming from both high resolution sites where the "Pompeii premise" (*sensu* Binford) is met and from lower-resolution palimpsests with a clear imprint of repetitive spatial behavior.

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13 V 14

The study represents a novel approach to better understanding the taphonomy of vertebrate faunal assemblages and concomitantly the intrasite behavioral patterns of Natufian groups during an interval of striking economic, demographic, and social transitions in the Levant. By employing a remarkably wide range of taphonomic keys to reconstructing depositional and postdepositional processes, the research offers an unusual opportunity for fine-tuning and cross-checking interpretations. From a technical perspective, the researchers' formal recognition of evidence of minimal bone movement (EMM) as a means of measuring the degree of postdepositional disturbance is an especially important contribution to the study of vertebrate taphonomy.

Although not a focus of the study, the popular notion of an emergent broad-spectrum economy in the Natufian relies more on the taxonomic diversity of prey species than their

relative caloric contributions, the latter of which shows a marked dietary dependence on gazelle. Moreover, from a comparative perspective, one would expect less mobile groups such as the Natufian to have enjoyed a somewhat wider resource base simply due to the exploitation of their site catchments over a greater part of an annual cycle with an attendant wider range of seasonal peaks of different resources (Henry 1989). This is an old, well debated issue not to be rehashed here, but the idea of a broad spectrum subsistence base in the Natufian should not be accepted uncritically (Humphrey 2012).

A more central aspect of the research is the concept of a pooled context, a vertical series of similar features, forming an accumulation that is spatially distinct from other stratigraphically contemporaneous accumulations at a site. While interesting and clearly useful for intrasite studies, this time-averaged palimpsest offers little direct information on the temporal duration of its formation. The researchers interpret the time-transgressive pattern of the pooled context as evidence of some degree of occupational permanence, but this need not necessarily be so. This palimpsest of repeated, stratified occupations within Structure II is presumed to have resulted from a sedentary encampment. Could these occupations of indeterminate duration have been prolonged, but perhaps of a seasonal nature, along the lines suggested for Natufian encampments at Wadi Hammeh and 'Iraq ed-Dubb (Edwards 2013; Edwards and Martin 2007)? From his work at Wadi Hammeh, Edwards (2013) argues that Natufian groups may have followed a residential strategy in which they regularly vacated their larger settlements in order to fallow their local food resources. At 'Iraq ed-Dubb, Edwards, and Martin (2007) suggest that broadly spread bone refuse may be an expression of a series of overlapping events corresponding to several semipermanent stays with gaps between. In many ways the thinness (< 1–5 cm) of the deposits separating the nine or more floors in Structure II at el Wad, the relatively rapid rates of deposition and the repeated reconstructions with cobble pavements are consistent with episodes of periodic abandonment and return. If we follow the sedentary model, what would have prompted the episodic reconstruction of floors within the structure?

While the degree to which Natufians tolerated the accumulations of intramural refuse may be debated, the authors' argument of an intermediate cultural evolutionary position of the Natufian between Paleolithic and Neolithic worlds is perceptive. Natufian groups appear to have been truly transitional in retaining many elements of earlier and even contemporary mobile foraging populations, while precociously adopting much of what was to appear later in the Neolithic. The site structure at el Wad, largely defined from refuse patterns, shows a number of significant parallels with intrasite studies recently reported from Wadi Hammeh (Edwards 2013), Eynan (Valla 1988, Samuelian 2013), and 'Iraq ed-Dubb (Kuijt and Goodale 2009, Edwards and Martin 2007) that underscore the transitional status of Natufian site structure. These studies clearly show the time-transgressive continuity in the organization of space at a general scale, as evidenced by repeated use of similar places for similar purposes. But at a more detailed scale, especially intramural, Natufian groups appear to have not segregated their activities spatially to the degree seen within Neolithic communities. This fine-grained conceptual labeling of space, especially within households, appears to have been tied to the domestication of space and the evolution of the concepts of *house* to *home* in the transition from forager to farmer. Although it is tempting to see the enhanced conceptual labeling of space in the Neolithic as a consequence of greater sedentism, even within the context of transhumance, Early Neolithic groups maintained distinct intramural task areas (Henry et al., forthcoming).

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By carefully integrating zooarchaeological, taphonomic and contextual data, this paper breathes new life into the study of Natufian faunas. The contextual taphonomy approach proposed by the authors provides a robust new method of household archaeology—it effectively detects the function of spatially discrete areas by assembling multiple, independent lines of evidence. The approach can be applied to myriad times and places. The data needed to tackle these questions have long been employed to zooarchaeologists, but the authors capitalize on the high-resolution contextual and archaeological data from their careful excavations at el-Wad Terrace to examine patterning on a smaller scale. Higher-resolution excavation strategies that are able to tie specific data types to high precision spatial data are becoming increasingly more common—particularly due to technological advancements in spatial data recording during excavation. These contexts will provide especially fertile ground for applying the contextual taphonomy approach.

In the Natufian period, the application of a contextual taphonomy approach enables new investigations on the nature of sedentism and the shifting use of space, households and social organization across the forager-farmer transition. The results from el-Wad Terrace reveal that despite repeated occupation of specific locations at the site that other than the largest most uncomfortable pieces, the Natufians did not practice waste removal, but left their trash where it landed. The el-Wad Terrace data show that in the southern Levant waste disposal did not begin before the Neolithic; however, when exactly it does begin and its relationship to site occupation intensity remains elusive. A contextual taphonomy or similar approach has not yet been applied to the Pre-Pottery Neolithic A (PPNA) period, when house plastering was rare and refuse patterns may have resembled those at el-Wad. Even

in the mid-PPNB when plastering and symbolism was more readily expressed in houses, there is significant variability from site to site. The application of a contextual taphonomy approach to PPNA, early and mid PPNB sites along with investigations of changing architectural, economic and symbolic practice will enable a more robust understanding of the variability of expression of sedentism and its interplay with site structure and village life and improve precision about the timing of the beginning of waste removal.

The authors adopt Watkins (1990) "house to home" concept to describe the transition from the trash-filled structures of the Natufian to the clean, plastered houses of later Neolithic cultures. They argue that the Natufians did not view their architectural features as anything more than conveniences, shelters or places to engage in everyday domestic activities and that they did not ascribe any symbolic attachment to them. It is fair to say that that house underwent significant change from the Natufian to the PPNB, and that symbolic behavior associated with the house became more routinized and visible especially by the mid-PPNB. However, the leap from the data required to assume that the Natufians did not perceive their structures as "homes" belittles the social complexity of Natufian society. Sense of place may have been very keenly felt by the Natufians who likely spent significant periods of time in some locations—must an abode be clean and plastered to feel like a home? This is a value judgment that cannot be made from the current data. Why waste disposal begins when it does remains a valid and interesting question, but the timing of trash removal must be pinpointed so that it can be investigated in relation to the specific conditions that surround it. Application of the contextual approach presented here to early Neolithic contexts will be an excellent place to begin.

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21 V 14

This excellent article is a sterling example of the power of the taphonomic study of animal bones to yield important contextual information (Russell 2012:399). Animal bone has major but largely untapped potential to contribute to contextual interpretation because it is relatively durable, yet soft enough to record many of the processes that shape not only faunal assemblages but also site formation. The key is what the authors term "contextual taphonomy": to analyze the information that most zooarchaeologists record routinely (taxon, body part, fragmentation, weathering, burning, gnawing, digestion, etc.) at the level of the individual deposit, rather than aggregating as we usually do into assemblages from entire sites or levels. In other words, it means practicing zooarchaeology in the mode of household archaeology, at the scale of lived experience (Boivin 2000; Clarke 1977; Foxhall 2000; Tringham 1991). This kind of study also affirms the value of "scrap" bone (those fragments that cannot be identified to taxon) as important sources of taphonomic information about the forces that have rendered them undiagnostic (Marean et al. 2004; Outram 2001).

While bone is particularly amenable to these questions, incorporating evidence from other materials would clearly enhance understanding of site formation processes and, especially, building function. It would also be worthwhile to examine the individual layers within their pooled contexts in terms of more variables than fragment size, to explore possible changes in use. These additional analyses would likely yield a fuller understanding of the el-Wad Terrace; however, for zooarchaeologists the greater significance of this article is methodological.

While other studies have taken a generally similar contextual taphonomic approach (e.g., Driver 2004; Marciniak 2005*a*, 2005*b*; Meadow 1991; Murray 2000; Orton 2012; Russell et al. 2013), I particularly appreciate the methodological rigor the authors have applied here. They skillfully blend careful definition of terms and archaeological implications with judicious use of quantitative methods. Their term "evidence of minimal movement" is perhaps an improvement on what we at Çatalhöyük referred to as the "integrity" or "coherence" of the assemblage from a particular deposit. While the authors produce a convincing interpretation of the occupation of el-Wad Terrace, the greater importance lies in these clearly defined methods, which will be much more broadly applicable.

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30 IV 14

Yeshurun et al.'s contribution deals with zooarchaeological method and theory applied to the study of Natufian site formation and household activities. Treating bone refuse as a tool for understanding human perceptions of "house" is original and interesting. The methodology (sampling, quantification, and variables considered) is sound and rigorous, and the theoretical framework used for interpretation is thoughtful. As a geoarchaeologist, I found the taphonomic approach in this study to be especially stimulating because the research questions posed in this study are similar to research questions posed in modern, site-specific, geoarchaeology. I find it striking that despite similarity in research questions—and even similarity in the overall methodological approach (namely, reliance on taphonomic markers)—so little cooperation exists between zooarchaeologists and geoarchaeologists on these aspects. My comment therefore focuses on the taphonomic approach with the aim of highlighting avenues for communication between zoo- and geoarchaeology.

The work of Yeshurun et al. makes use of several taphonomic parameters and ties them in space to four different contexts that, based on architectural considerations, are interpreted as reflecting different co-occurring activity areas. The authors argue that this contextual taphonomic approach indicates whether faunal refuse is contextually informative, a notion that I absolutely agree with (for a similar approach studying phytolith assemblages see, e.g., Cabanes et al. 2012). The most convincing taphonomic parameters presented in Yeshurun et al.'s study are those related to preburial processes—fragmentation that is indicative of anthropogenic activities such as burning and/or trampling, and surface weathering and gnaw marks whose presence relates to rapidity of burial. These are used by the authors to differentiate primary from secondary refuse, rule out the presence of tertiary refuse, and demonstrate that differentiating anthropogenic from nature-related formation processes is crucial for interpretation of past human activities and activity areas.

Identification of refuse type has long been acknowledged as highly important for archaeological interpretation. Yet, in most archaeological research the sediment matrix in which refuse is embedded is largely ignored. I argue that contextualization of refuse items should not focus only on their spatial and temporal distributions; it must also consider the sedimentary matrix, which includes many indicators for site formation and taphonomy (e.g., Goldberg and Macphail 2006:211–224).

Modern geoarchaeology is becoming more and more focused on the level of the site rather than on the regional or landscape level. Several methods are utilized in order to decipher microstratigraphic patterns in space and time, tightly associated with several implicit and explicit questions posed by Yeshurun et al., namely, definition of floors, identification of activity areas, and an overall understanding of past spatial organization. Contextualization is best achieved through micromorphology, a method that allows direct observation of intact sedimentary contexts, inclusive of all macro- and microscopic remains. Contextualization of bones within the sedimentary matrix would therefore be a superb way to gain further taphonomic insights and site formation data that in turn will evolve into a holistic understanding of site formation processes and thus better archaeological interpretation. For example, Shahack-Gross et al. (2005) studied a set of stratified sediments at Tel Dor (Israel), an Iron Age mound site, where micromorphology was of outmost importance in differentiating floor from fill deposits. Moreover, they identified microscopic indicators for in situ trampling of fish bones relying on a parameter identical to Yeshurun et al.'s evidence of minimal movement. Micromorphology further provides evidence for the makeup and construction methods of floors, and direct evidence for trampling-in and size sorting of refuse items (e.g., Karkanas and Efstratiou 2009; Milek 2012).

A few examples of depositional uncertainties in the study by Yeshurun et al. that could have been resolved though holistic contextualization are (*a*) the nature of the sediment matrix—does it include evidence for fluctuating groundwater levels and thus be used to explain the carbonate concretions on bones?; (*b*) are bones in the presumed dump (locus 67) associated with hearth ash?; and (*c*) what is the contribution of gravitational slope movement (colluviation) to the formation of the sedimentary matrix at the site?

A lacuna, to my knowledge, in the utility of the taphonomic approach in zooarchaeology is related to building frameworks of interpretation. "Bones are not enough" stated Dianne Gifford-Gonzalez (1991), arguing that interpretation of bone assemblages must be based on frameworks built from ethnoarchaeological observations. Contextualizing bone taphonomy, on both the macro- and microscopic scales of analysis, via ethnoarchaeological observations of floor formation processes is crucial for archaeological interpretation. Such studies are absent, to the best of my knowledge, in sedentary contexts. Future collaborative ethnoarchaeological studies by zooarchaeologists and geoarchaeologists, using a holistic macro-micro approach targeting formation of floor assemblages along a spectrum of sedentary modes of habitation, will be invaluable for archaeological interpretation.

Zooarchaeologists and geoarchaeologists often ask similar questions pertaining to assemblage formation and spatial patterning. We use different, but complimentary, methods to answer these questions. Increased communication will result in integrated studies that will promote the certainty of interpretation in future archaeological research.

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9 V 14

I am impressed (and embarrassed) that an idea that I proposed 24 years ago (Watkins 1990) has been taken as the basis for putting a new study into the context of the neolithisation process. I wrote hurriedly (between leaving Iraq in May, and late summer the same year) on the basis of our experience at the site of Qermez Dere, a small settlement that was established at the very beginning of the aceramic Neolithic. The scrupulously clean floors of the carefully plastered chambers at Qermez Dere were impressive. François Valla had recently published his careful study of the material found within abri 131 at Mallaha (Eynan), dating to the early Natufian phase (Valla 1988). The extraordinary amount, and variety, of cultural debris deposited within that structure, and the (in archaeological terms) rich amounts of material recovered from the floors of other structures both at Mallaha and at other Natufian occupations were in sharp contrast to the practice at Qermez Dere.

When Hardy-Smith and Edwards (2004) published their study of the discard patterns in and around the two structures

at the early Natufian site of Wadi Hammeh 27, they referred to a "garbage crisis," reinforcing the idea that there was a marked change in the habitus of the occupants of domestic structures around the end of the Epipalaeolithic and the beginning of the Neolithic. But it was also clear—and Edwards's paper at the ICAANE conference in Madrid made this explicitly clear (Edwards 2008)—that the material recovered from at least one of the two structures was deliberately deposited and that the structure was not simply domestic in function. Much the same could be said for the material in abri 131 at Eynan, which was deliberately deposited in particular spots, and not kicked about and trampled thereafter. It seems that structures of the period that superficially look alike were in fact used very differently; and even "garbage" was sometimes use for deliberate and meaningful deposition.

Yeshurun et al. relate the apparent contradiction between the virtual permanence of the el-Wad occupation and the inhabitants' lack of interest in any systematic refuse disposal practice to the transition from seasonal occupation to permanent settlement. The communities of the Epipalaeolithic and Neolithic were in transition, a "neolithization" process that brought about a profound transformation of the human way of life. Human culture, certainly in the time of Homo sapiens, had evolved reliable modes of cross-generational transmission of large and diverse amounts of complex knowledge and information—what has been described as apprentice learning (Sterelny 2011), which ensures that culture tends to be conservative. On the other hand, the cultural abilities of Homo sapiens also included a remarkable capacity for innovation and its assimilation, allowing cultural accumulation, what Michael Tomasello (1999; 2008) has called the "ratchet effect." It is not surprising, therefore, that in the middle of that cultural, social, and economic transformation communities sometimes conserved cultural practices for longer than we might think sensible.

I take issue with the authors' assumption that the refuse-disposal nonstrategy that they have identified at el-Wad can be extrapolated across the Natufian culture. At a fundamental level, I think that the construct of the archaeological culture was invented to be helpful to archaeologists, but that effective cultural transmission from Gordon Childe, through its application to the early prehistoric Levant by Childe's London Institute of Archaeology colleague, Kathleen Kenyon, has proved ultraconservative (Watkins 2014). It has long seemed to me that one of the defining cultural characteristics of the communities of the late Epipalaeolithic in the southern Levant is their variety. The more that we learn about these communities, the more it seems to me that they shared only their ways of making chipped stone tools and their participation in exchange networks with each other. I am no expert on the Epipalaeolithic of the Levant, but from the little that I know of late Epipalaeolithic, I do not see the site of el-Wad, or any other site, as typical. Rather, it seems to me, each community seems to have been working out its own step-by-step solutions.

Reply

We thank our nine colleagues for providing thoughtful and constructive commentaries, producing a stimulating discussion on the interplay of animal bones, houses, site-formation processes, and human behavior at the dawn of sedentary life.

In this paper we tried to extract some information out of the "discard stage" of artifacts—animal food remains, in this case—rather than focus on the more widely studied procurement (hunting) and use (processing and consumption) stages. This kind of approach is still uncommon, especially considering that the nature of the archaeological record essentially is, at best, the remains of a community's discard behavior. Using this approach we aimed to show that the Early Natufian (EN) architecture of el-Wad Terrace (EWT) had a primarily domestic character and displayed significant occupation intensity while lacking routine refuse maintenance strategies and displaying very simple site organization. Consequently, we think that the "home" concept was less developed in Natufian communities, relative to those of the Neolithic. The comments and our ensuing reply pertain to three main aspects: refining our interpretations at the site level, discussing implications for zooarchaeological method and theory, and assessing the implications for the Epipaleolithic-Neolithic transition in the Near East.

As eloquently put by Russell, animal bone is an extremely useful marker of context formation and use because "it is relatively durable, yet soft enough to record many of the processes that shape not only faunal assemblages but also site formation." Allison, Edwards, and Russell rightly mention the importance of examining other classes of finds, and Shahack-Gross points to the importance of studying the matrix as well, to verify (or modify) the conclusions from animal remains. We wholeheartedly agree and, in fact, initial efforts were already made at EWT (Portillo, Rosen, and Weinstein-Evron 2010; Rosenberg et al. 2012; Weinstein-Evron et al., 2007; Weissbrod et al. 2012) indicating some compatible results, especially regarding the discard of refuse material on the spot within the Wall I living compound and its domestic character. Much remains to be done in this respect. Contextual taphonomic analyses of multiple classes of finds are a major goal as our excavation and analysis continue.

Not wishing to detract from the importance of checking multiple classes of finds, we should make a cautionary note here. It is essential that full consideration of the taphonomy and separate lines of expectations be generated for each type of material, because each has different mechanical and chemical properties and thus potentially different taphonomic histories. The depositional models we formulated and tested here cannot be taken and applied to groundstone items, chipped lithics, or botanical remains, without thoughtful modifications to account for the differences in how humans treated these materials, how they were discarded and what destruction

process affected them pre- and postburial. The magnitude of this task sometimes leads to the presentation of artifact distributions at the material level only (lithics, fauna, ochre, etc.). While this kind of analysis is more inclusive and may yield important insights on the observed archaeological record, it is usually unable to shed light on the biographies of different materials, lacking the data for testing depositional models. Looking into the taphonomy of each type of artifact per context is more informative as to how these finds ended up where they were found, and what was lost in the process. Performing and integrating contextual taphonomy studies of different classes of finds remains an important challenge at Natufian base camps and beyond.

Galanidou asks whether some of the palimpsests of refuse at EWT were created intentionally, for example, in order to provide a cache of raw materials. We tried to tackle this possibility in our storage depositional scenario (table 1). It seems that the discarded faunal remains carried little utilitarian or other value; detailed forthcoming studies of the lithics and other types of finds will shed more light on this interesting issue.

Shahack-Gross highlights the convergence of research questions pertaining to context formation and use that geoarchaeologists and zooarchaeologists have. The huge gains that better communication between the two disciplines can make are evident and, in the specific case of EWT, some micromorphological and phytolith studies have been conducted (Portillo, Rosen, and Weinstein-Evron 2010; Weinstein-Evron et al. 2007) and will be oriented toward shedding light on the interpretation presented here. Truly integrated zoo- and geoarchaeological studies pertaining to intrasite patterns are rare, and there is no question that such an integrated approach is far from exercising its potential. This interdisciplinary miscommunication is, of course, a common problem in archaeology, not one that is special to zooarchaeologists and geoarchaeologists alone. Some improvement may occur when more zooarchaeological studies will incorporate contextual taphonomic perspectives and hence become more relevant for the geoarchaeologists interested in site formation and use, enabling the examination of the same archaeological samples using different tools.

Henry expresses some doubts as to how sensitive our approach is to measuring permanence of occupation. The occupation intensity reflected by our results seems high, yet Henry is right that our approach cannot accurately estimate the frequency and duration of abandonment episodes that certainly took place. Does the Wall I complex reflect a more or less permanently occupied dwelling space that is constantly renovated, or a seasonally occupied base camp? This is an extremely important question for interpreting the Natufian, yet one that is very difficult to directly and unequivocally answer with current archaeological methods. At present, proxy measures such as the constant rebuilding of similar dwellings at the same spot, the deep depositional sequences showing that this part of the site was utilized in a similar manner during the late EN, and the heavy postdiscard damage on the bones, led us to suggest that EWT was more sedentary than earlier Epipaleolithic base camps. The notion of Natufian sedentism is supported by several lines of evidence (see Bar-Yosef 1998; Munro 2004) and is especially evident when comparable Epipaleolithic settlements from the same region are contrasted with the Natufian occupations (Bar-Oz 2004; Yeshurun, Bar-Oz, and Weinstein-Evron 2014). The use of contextual taphonomy, focusing on postdiscard damage in Epipaleolithic camps, may supplement other proxy measures to distinguish degrees in the intensity of accumulation and repetition of habitations in forthcoming studies.

The validity of our interpretations to the pan-Natufian world is questioned by Watkins, who emphasizes the heterogeneity of the Late Epipaleolithic record of the Levant. Edwards and Henry also provide some examples of variability in Natufian site maintenance patterns. While Natufian sites are indeed diverse and exhibit unique site-specific features, we do see similar patterns in the Natufian record, at least that of the "core area" Mediterranean zone. The discard-stage archaeofaunal taphonomy in other hamlets that have architecture and noticeable occupation length appears to be quite similar to our results at EWT (Bridault, Rabinovich, and Simmons 2008; Munro 2012). Furthermore, a contextual taphonomic analysis may actually distinguish other types of Natufian sites, strata or areas displaying lower occupation intensity, similar to our Locus 25 pooled context (Yeshurun, Bar-Oz, and Weinstein-Evron 2014). For example, animal bones from the Natufian cemetery at Raqefet Cave (Israel) display significantly less postdiscard damage compared with the Wall I complex at EWT. This is in line with the different archaeological nature of the two sites: a cemetery vs. a base camp used for a variety of tasks (Yeshurun, Bar-Oz, and Nadel 2013). It appears that the contextual taphonomy approach is sensitive enough to detect the variability of site occupation modes, where long-inhabited dwelling localities and sporadically used burial localities form two points of a settlement spectrum. The applicability of this approach will undoubtedly be enhanced when more archaeofaunal and other assemblages are published in detail, allowing for increasingly refined comparisons.

We proposed that refuse disposal patterns in the Natufian are not necessarily linked to the degree of sedentism, but more to perception of the house and home (Watkins 1990). Hardy-Smith and Edwards (2004) considered the simple nature of Natufian refuse maintenance and site organization to reflect maladaptation to sedentary living (see also Kuijt and Goodale 2009), thus casting doubts on the extent of Natufian sedentism. Given the convincing evidence for an elevated degree of sedentism in the Natufian (see above), we think that the lack of domestic cleaning in the Natufian was more related to cultural preferences; the very same bands (presumably) did carefully gather and stash "special" food refuse in nondomestic localities when it was socially important to do so (Munro and Grosman 2010; Yeshurun, Bar-Oz, and Nadel 2013).

In consideration of this issue, Munro remains unconvinced that the Paleolithic-style refuse organization rules out a "home" concept for the Natufian dwellings. We agree with her that "Sense of place may have been very keenly felt by the Natufians," but what exactly was the "place" they felt for? Was it the house, or perhaps the hamlet or the site catchment were more important in their mind? Natufian territoriality is well manifested in the site as well as the landscape scales by constructing structures, terrace walls and bedrock features, some "off-site" (Nadel and Rosenberg 2011), by setting delineated cemeteries—some quite elaborate—and by site-specific artifactual markers (Belfer-Cohen and Goring-Morris 2013). However, this sense of ownership is not usually manifested in the houses themselves, especially when detailed case studies from later Neolithic villages are compared (e.g., Hodder and Cessford 2004). The understanding of Natufian ownership and territoriality patterns is both intriguing by itself and critical to assessing subsistence strategies and intercommunity ties.

Most commentators seem to agree with us that the contextual taphonomy approach is a constructive analytical tool. It effectively connects some of the most pertinent issues in the Epipaleolithic-Neolithic research—permanence of occupation, use of space, and architectural function and perception under one analytical umbrella. Galanidou clearly expresses the need to consider spatial behavior beyond "the shell of the edifice," calling for testing its utility in intensively occupied Paleolithic camps as well. Several excellent examples of contextual taphonomic studies in Paleolithic deposits do exist (e.g., Cain 2005; Enloe 2012; Speth et al. 2012), and we are convinced that more are called for. Moreover, Russell reiterates her call for zooarchaeologists to "go contextual," because so much information can be gained from integrating vertebrate remains and archaeological context in a myriad of time periods and site types (Russell 2012:398–400). We agree with her that the consideration of depositional scenarios is needed, not just recommended, in the study of zooarchaeological (and other) remains in later villages and urban centers as well. Studying the depositional histories of bones per context enables the zooarchaeologist to correctly identify intrasite biases and directly affects the choice of sampling and interpretation even when "classic" subsistence questions are examined (Meadow 1978).

In contrast, Finlayson expresses doubts as to the usefulness of our methodology in the context of PPN structures where refuse maintenance and spatial partition of activities appear to be more formalized. While the general disregard of the Natufians to clearing their trash is certainly a blessing for archaeologists, enabling us to study primary refuse that potentially reflects the function of the uncleaned locality, we believe our approach can have significant contributions for the study of PPN structures as well. Some prime examples we mentioned are the structures in Göbekli Tepe (Turkey) and WF16 (Jordan). The critical, yet generally unresolved question of the role of the trash inside the structures in the former site was already raised by Banning (2011). In the latter site, impressive architectural remains displaying great variability and complex life-histories were recently published (Finlayson, Mithen, et al. 2011). Here, too, the role of food refuse has not yet been evaluated to discern intrasite patterns, and specifically to reconstruct the history of the abundant faunal subsamples in conjunction with stratigraphic and contextual data. It would be interesting to see whether the food refuse inside these structures indeed displays all the characteristics of a secondary deposition or perhaps its formation was more complex (e.g., small refuse that was left in situ vs. larger refuse items in secondary deposition). Do the animal remains exhibit signs of prolonged exposure before their (intentional?) deposition or infilling in the structures? Are there any "special" or unexpected patterns in the intensity of butchery, the patterns of consumption, or the selection of which body-parts to discard, per context? Were some of the remains extensively trampled and charred before deposition or redeposition and, if not, does that attest to intense cleaning (or stashing) removing them from consumption localities, to short and punctuated occupation events, or both? Assessment of the preburial damage and the degree of variability in each unit may hint at the more plausible interpretation. Are there any intrasite differences among loci in the composition of refuse, or its postdiscard preservation? How do the interior and exterior (specifically middens) deposits compare in these respects? These queries and others, stemming from the contextual taphonomy approach, may be used to capture the variability that Finlayson mentions in PPN spatial behavior in sites and between sites. When tested, contextual taphonomy models may be able to shed some light on repeated activities undertaken in the buildings or in their vicinity, and raise a significant contribution to architectural and, thereafter, site interpretation.

Thus, we join Edwards and Munro in advocating the implementation of the contextual taphonomy approach in PPN localities. It will be extremely interesting to see how the views of sites such as Hallan Çemi, Göbekli Tepe, WF-16 and Kfar HaHoresh are affected when refuse (either primary or secondary) is brought to bear on the purpose, permanence and perception of the earliest village architecture in the Near East.

—Reuven Yeshurun, Guy Bar-Oz, Daniel Kaufman, and Mina Weinstein-Evron

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