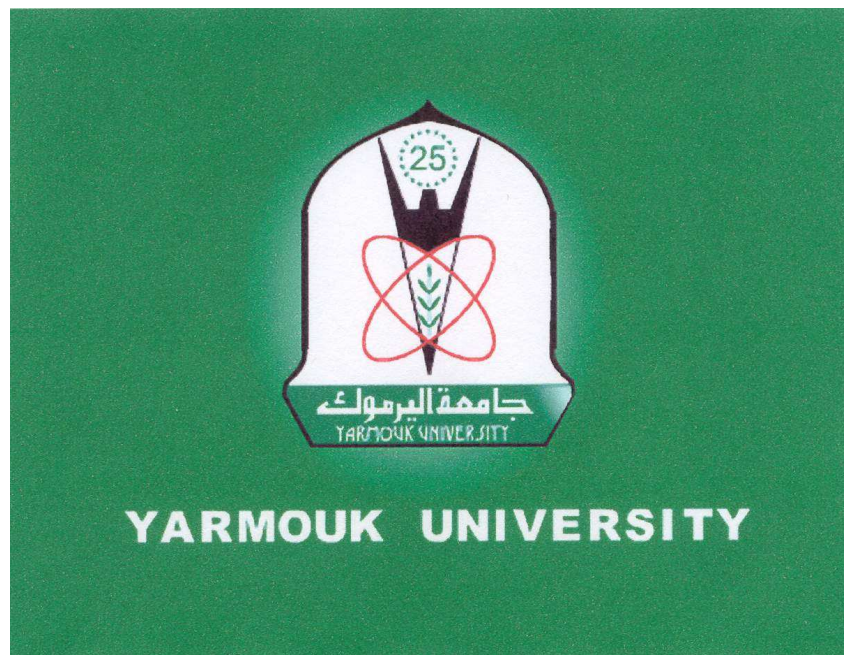


ARCHAEOZOOLOGY OF THE NEAR EAST V

Proceedings of the fifth international symposium on the
archaeozoology of southwestern Asia and adjacent areas

edited by

H. Buitenhuis, A.M. Choyke, M. Mashkour and A.H. Al-Shiyab



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Preface

When I participated in the IVth International Conference of ASWA, held in the summer of 1998 in Paris, I was gratified to learn that the Scientific committee had unanimously agreed to hold the next meeting in Jordan. Thus, on 2 April 2000, the Vth International Conference of the Archaeozoology of Southwest Asia and Adjacent Areas was held for the first time within the region at Yarmouk University in Irbid, Jordan after being held on the past four occasions in Europe.

The themes of this conference were divided into five areas including:

- Paleo-environment and biogeography
- Domestication and animal management
- Ancient subsistence economies
- Man/animal interactions in the past
- Ongoing research projects in the field and related areas

I wish to thank all those who helped make this conference such a success. In particular, I would like to express my appreciation to the Director of the Institute of Archaeology and anthropology at Yarmouk University. Special thanks are due to his excellency, the President of Yarmouk University, Professor Khasawneh, who gave his full support and encouragement to the convening of this conference at Yarmouk University and to all those who contributed the working papers which made the conference possible.

I also wish to thank members of the organizing committee who worked very hard for many months in preparing the venue for this conference.

Abdel Halim Al-Shiyab
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Note from the editors:

The editors wish to thank Dr. László Bartosiewicz for his excellent assistance in preparing and checking the contributions to this volume.



Participants at the 5th ASWA Conference, held at the Yarmouk University in Irbid, Jordan, 2000

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PRELIMINARY RESULTS OF THE WADI MATAHA (PETRA BASIN, JORDAN) FAUNAL ANALYSIS

A. Baadsgaard¹, J.C. Janetski² and M. Chazan³

Abstract

Excavations at Wadi Mataha, an Epipaleolithic site located in the Petra Basin of southern Jordan, took place during the summer of 1999. Preliminary testing in 1997 revealed three occupation periods from the Geometric Kebaran (13,500-10,500 BC), Early Natufian (ca. 11,000-9,000 BC), and Late Natufian (9,000-8,000 BC). Each of these components was further explored in the 1999 season. Over 18,000 bones were recovered from these excavations with sizable identifiable samples from each temporal component. The preliminary results of the faunal analysis are reported as well as the differences between the faunal assemblages from each occupation.

Résumé

Les fouilles à Wadi Mataha, un site épipaléolithique situé dans le bassin de Petra au sud de la Jordanie, ont eu lieu pendant l'été 1999. Les premiers sondages en 1997 ont révélé trois périodes d'occupations depuis le pré-natoufien (13,500-10,500 BC), le natoufien ancien (11,000-9000 BC) et le natoufien récent (9000-8000 BC). Chacune de ces occupations a été plus longuement explorée en 1999. Un total de 18,000 restes osseux fut découvert avec des échantillons d'os identifiés, quantitativement significatif pour chaque période. Les résultats préliminaires de l'analyse de faune sont exposés ici ainsi que les différences dans les assemblages fauniques pour chacune des occupations.

Key Words: Epipaleolithic, Subsistence, Seasonality, Environmental zones

Mots Clés: Epipaléolithique, Subsistance, Saisonnalité, Zones environnementales

Introduction

In May of 1999, Joel Janetski of Brigham Young University and Michael Chazan of the University of Toronto directed archaeological research at Wadi Mataha, an Epipaleolithic site in southern Jordan. The site had been briefly tested in 1997 by Janetski who found evidence of multiple occupations dating from pre-Natufian the Late Natufian (Whitcher *et al.* 1998). The 1999 research was carried out as an archaeological field school for Brigham Young University.

Site Description

Wadi Mataha is a multi-component, Epipaleolithic site in the northern portion of the Petra Basin (Fig. 1). Human occupation lies at the top of and down a steep talus slope at the south edge of Maghur al Mataha, a large sandstone monolith. The elevation is about 950 m. The landscape is rough, broken terrain intermediate between the city of Petra and gentler, hilly uplands which still contain some vestiges of oak-pistachio woodlands. The site slope is littered with sandstone rubble, chipped stone debris and tools, and occasional bone eroding into a secondary drainage of the site's namesake, Wadi Mataha, an important drainage flowing into Petra only 1.2 km to the south. The size of the artifact scatter is about 1100 m². Initial estimates of site size were modest given the possibility that cultural material may have simply eroded down slope; however, the 1999 work has demonstrated that features and buried deposits are present in Test Area 3, which is well down the slope.

Several Nabataean water control features are cut into the sandstone escarpment and occasional Nabataean sherds are present on the site surface. On a sandstone ledge at the base of the escarpment are several bedrock mortars.

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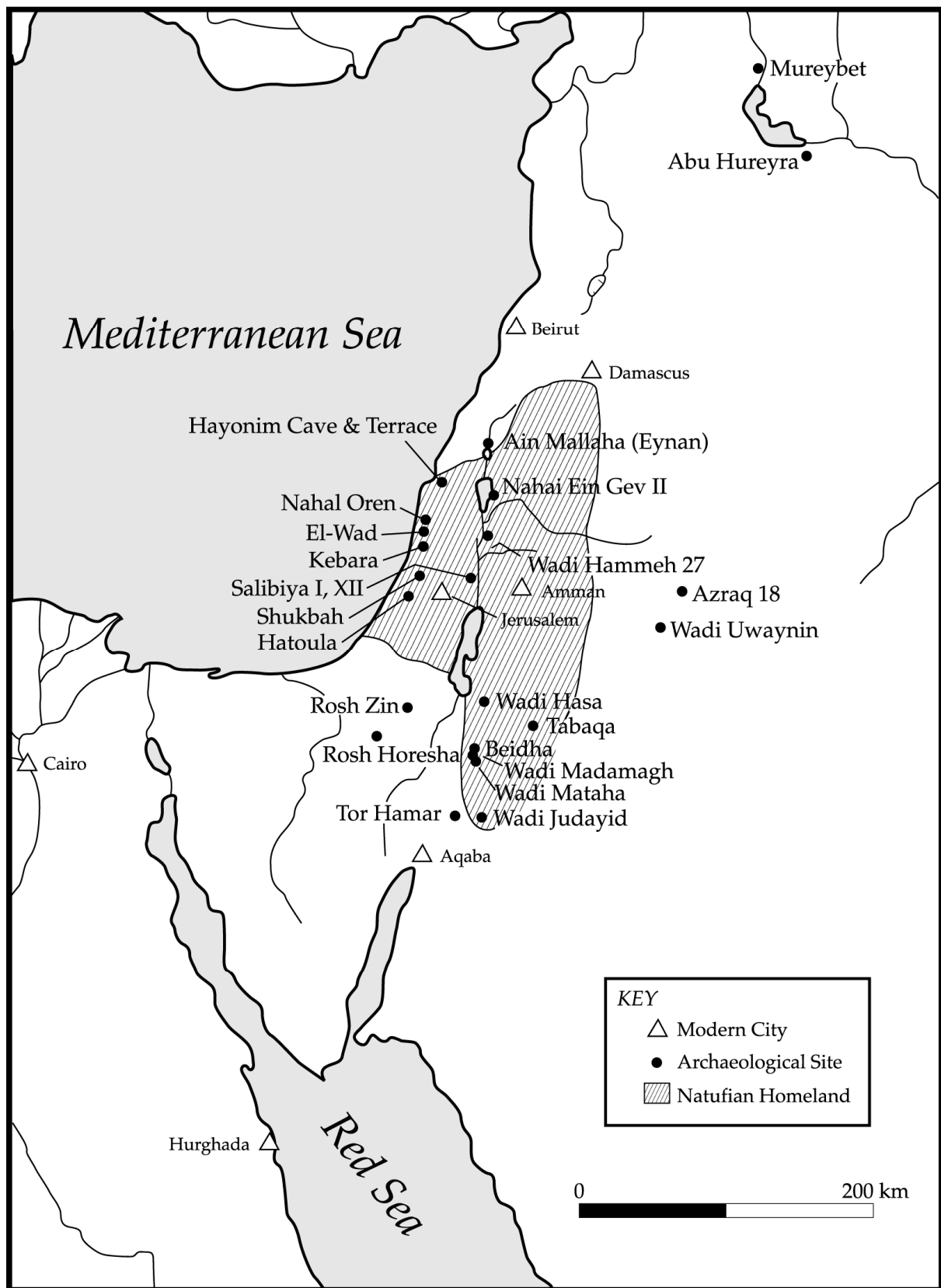


Fig. 1. Map of the Levant showing the location of Wadi Mataha relative to other Epipaleolithic sites.

Test areas

Excavations consisted of three test trenches: Test Area 1 at mid-slope, Test Area 2 on the upper slope, and Test Area 3 on the lower slope (Fig. 2).

Test Area 1

This area at mid-slope contains Early Natufian material associated with a semicircular masonry wall standing up to four courses high. In 1999, 11 square meters were excavated to clarify the nature of the structure. No floor features were found but a fragment of a finely crafted, basalt shaft straightener with incised geometric decoration and a small piece of carved stone, were uncovered at floor level. Lithic material was uniformly Early Natufian, i.e., lunates with bifacial Helwan retouch. Faunal remains were poorly preserved compared to the upper slope (Excavation Area 2).

Test Area 2

Both Late Natufian and Geometric Kebaran materials are present in this area which lies on the upper slope of the site. Bedrock mortars are present on a sandstone bedrock shelf abutting the east edge of the excavated area. Late Natufian levels are characterized by dark, middeny sediments containing small, steeply backed lunates with bipolar retouch and crude notches and denticulates. On the eastern

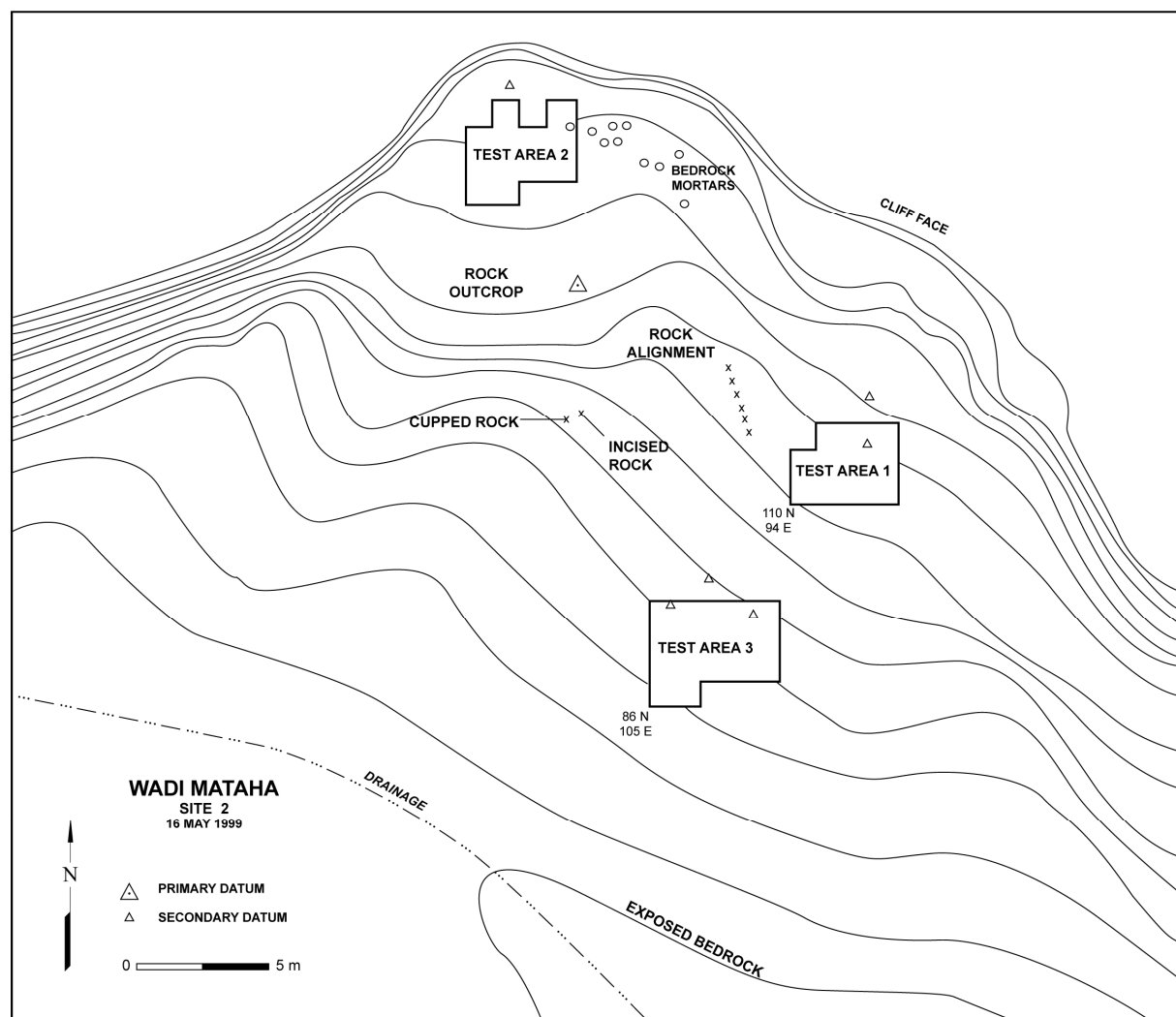


Fig. 2. Map of Wadi Mataha showing location of test areas.

edge of the excavations, sediments appear to have been disturbed by colluvial debris deriving from the cliff above. This activity eroded a channel into the midden depositing sandstone cobbles and red, sandy sediments and mixing a rich Late Natufian bone and lithic assemblage with some Nabatean pottery and modern glass.

Late Natufian features include a roasting area with a dark midden and abundant small cobbles and, stratigraphically below and slightly downslope, a patchy surface of flat stones with several *C. ibex* horn cores and domestic items including pestles and chipped stone tools lying on it. The surface appears circumscribed by an arcing alignment of sandstone boulders. Below this surface was a burial consisting of two individuals: a complete, articulated adult male buried face down with the lower legs tightly flexed over the upper legs, and the fragmentary remains of an infant lying adjacent to but slightly above and to the east of the adult. Associated with the adult burial were a large blade of non local chert and a breached stone bowl with a crudely finished base. The stratigraphic placement and associated chipped stone diagnostics argue that these burials are Geometric Kebaran in age. Lithics from this lower level are characterized by the absence of lunates and frequency of steeply backed, pointed bladelets.

Test Area 3

Seventeen square meters were opened to determine whether the lower slope had been occupied. Excavations revealed a yellow brown sediment and rubble fill across the entire area with Early Natufian material embedded in it. Lithics are similar to those from Test Area 1; i.e., lunates with bifacial Helwan retouch. Three pit features containing ashy sediments, lithics, and faunal material document the use of the lower slope at least during the Early Natufian.

Table 1. NISP list of Wadi Mataha bones from the 1997 and 1999 excavations.

Taxon	N	%	Taxon	N	%
Ungulates			Reptiles		
Aurochs (<i>Bos primigenius</i>)	13	1.0	Lizard (Sauria/Agamidae)	7	0.5
Equid (<i>Equus</i> spp.)	10	0.8	Snake (Columbridae)	4	0.3
Goat (<i>Capra aegagrus</i> / <i>Capra ibex</i>)	256	19.7	Land Tortoise (<i>Testudo graeca</i>)	290	22.3
Caprine (Probably <i>Capra</i>)	168	12.9	Total	301	23.1
Sheep? (<i>Ovis orientalis</i>)	5	0.4	Aves		
Gazelle (<i>G. gazella</i> / <i>G. dorcas</i>)	222	17.1	Gallinaceous Birds (Galliformes)	3	0.2
Caprine/Gazelle	27	2.1	Partridge (<i>Alectoris chukar</i>)	73	5.7
Fallow Deer? (<i>Dama mesopotamica</i>)	2	0.2	Falcons/Hawks/Vultures (Falconiformes)	11	0.9
Total	703	54.1	Buzzard (<i>Buteo</i> sp.)	13	1.0
Carnivores			Common Buzzard (<i>Buteo buteo</i>)	1	0.1
Dog/Wolf (<i>Canis</i> sp.)	5	0.4	Long-Legged Buzzard (<i>Buteo rufinus</i>)	2	0.1
Cat (<i>Felis</i> sp.)	1	0.1	Eagle (<i>Aquila</i> spp.)	2	0.1
Fox (<i>Vulpes</i> sp.)	16	1.2	Honey Buzzard (<i>Pernis apivorus</i>)	1	0.1
Marbled Polecat (<i>Vormela peregusna</i>)	2	0.1	Sparrowhawk (<i>Accipiter</i> sp.)	2	0.1
Total	24	1.8	Osprey (<i>Pandion haliaetus</i>)	1	0.1
Small Mammals/Rodents			Griffon Vulture (<i>Gyps fulvus</i>)	1	0.1
Hare (<i>Lepus capensis</i>)	32	2.5	Egyptian Vulture (<i>Nephron percnopterus</i>)	1	0.1
Mole Rat (<i>Spalax ehrenbergi</i>)	10	0.7	Falcon/Kestrel (<i>Falco</i> sp.)	6	0.4
Jird (<i>Meriones</i> sp.)	14	1.1	Perching Birds (Passeriformes)	2	0.1
Vole (<i>Microtus guentheri</i>)	10	0.8	Crow/Raven/Jackdaw (<i>Corvus monedula</i> ?)	1	0.1
Mouse (<i>Mus</i> sp.)	4	0.3	Starling (<i>Sturnus vulgaris</i>)	1	0.1
Rodentia	8	0.6	Unidentified Aves (<i>Aves</i> sp.)	73	5.6
Total	78	6.0	Total	194	14.9

Dating

Two AMS radiocarbon dates on humic acids from animal bone recovered from Test Area 2 place the Geometric Kebaran occupation at $14,140 \pm 130$ BP and the Late Natufian at $11,200 \pm 50$ BP. The second date came from a level stratigraphically above the earlier date and associated with steeply backed lunates.

Faunal remains

The faunal assemblage from Wadi Mataha was increased considerably during the 1999 excavations. The sample contains some 18,032 bones, 1,300 (7 %) of which were identifiable specimens, representing at least 31 different species (see Table 1). All components produced sizable assemblages. Bones from Geometric Kebaran and Late Natufian levels are extremely well preserved, although some from Early Natufian contexts are heavily encrusted with cemented sand deposits. Excavators insured thorough recovery by means of dry screening, point-proveniencing of most large bones, and picking through the remaining sediments to recover previously unnoticed small bones. As a result of these techniques, a full range of taxa, including a variety of microfauna, are represented in the assemblage. Analysis of all taxa was completed as far as possible using comparative collections at Harvard University's zooarchaeological laboratory and Museum of Comparative Zoology under the direction of Richard Meadow.

The sample contains many of the typical desert/steppe species as presented in the initial analysis (Whitcher *et al.* 1998), as well as a greater variety of small mammals and rodents, birds, and carnivores. Caprines, including those identified to the genus level (*Capra*) and those identified to the sub-family level (ovicaprid), are dominant at 33 percent of the total NISP, followed by gazelle at 17 percent, and a few bones from aurochs and equids. Small taxa are also common and are represented primarily by land tortoise (*Testudo graeca*), hare (*Lepus capensis*), and partridge (*Alectoris chukar*), and a wide variety of raptors. Although gazelles dominate the faunal assemblages of Natufian sites located in forest and coastal areas, the caprine dominated assemblage at Wadi Mataha resembles the large mammal component from the semi-arid steppe east of the Dead Sea, such as Beidha and Wadi Judayid 2, where both caprines and equids occur with greater frequency (see summary in Byrd 1990:176). Other species favoring more wooded areas such as deer, wild boar, as well as waterfowl are extremely rare or absent from these sites.

All bones are highly fragmented, and a few large mammal bones show evidence of impact cones and fractures, most likely produced during processing for marrow. Over 21 percent of the bones show signs of burning or scorching, although most do not exhibit the characteristic spit marks of cooking over an open fire. Bones are burned to varying degrees; some are wholly charred or oxidized and others exhibit differential levels of burning on multiple surfaces, indicating exposure to heat sometime after disposal. Almost half of the burnt specimens are from the Late Natufian level, most from near or around, but not inside of a roasting pit feature. Very few bones exhibit evidence of butchering, probably due to the high degree of fragmentation of bones from all levels, and the inability to see the surface of heavily encrusted bones from Early Natufian features. A small number of bones are worked: two are grooved, while a few others exhibit polishing, grinding, smoothing, or shaping to some degree. Most are medium to large mammal long bones, and none are complete or formal tools. Other taphonomic features noted on the bones include a few instances of rodent and carnivore gnawing, heavy root etching, and weathering.

Ungulates

Ungulates account for over 55 percent of the sample. Caprine bones, including those identified as *Capra* and those identified to the family level, are predominant, representing 33 percent of the assemblage followed by gazelle at 17 percent. Other ungulates include 13 aurochs bones and 10 identified as equid (both about 1 percent of total NISP). Human modification is evident in the extremely high fragmentation of most bone and a high incidence of burning on identified ungulate bones from all contexts, particularly the Late Natufian levels.

Goat

The 176 bones identified as *Capra* sp. could belong to either ibex (*Capra ibex*) or wild goat (*Capra aegagrus*), both of which are known to have inhabited the southern Levant since the late Pleistocene (Harrison 1991; Davis 1982). At Wadi Mataha, the habitats of the two species apparently overlapped, with the ibex perhaps favoring the more arid canyons below the site and to the south, while the lush hills above and to the north may have provided suitable grazing grounds for wild goat herds (see Uerpmann 1991:116). The two species are distinguished primarily by differences in their horn cores. Ibex horn cores have flattened anterior surfaces, while aegagrus horns have a sharp anterior keel (Harrison 1991:184). Both species were identified at nearby Wadi Madamagh (Perkins 1966:66) and *C. aegagrus* at Tor Hamar (Henry and Garrad 1988:14), both nearby Epipaleolithic rock shelters. Horn cores from both *Capra* species were also identified from the Natufian levels at nearby Beidha (Hecker 1975). Twelve horn cores from Wadi Mataha clearly have flattened surfaces, two of which exhibit a rectangular cross section, both characteristic of *C. ibex*. None could be positively identified as *C. aegagrus*.

Gazelle

Gazelle bones comprise 18 percent of the total NISP. All bones fall within the size range for the mountain gazelle (*Gazella gazella*); (after Horwitz *et al.* 1990). The range of the smaller dorcas gazelle (*Gazella dorcas*) probably did not extend this far north of the Sinai until after the PPNB period (Tchernov *et al.* 1986/7). Although incomplete, the shape of five horn cores at Wadi Mataha are elliptical in cross-section and more closely resemble *G. gazella*.

Of the measured gazelle bones, 10 appear to be from males (1 astragalus, 1 calcaneus, 2 metacarpals, 3 first phalanges, and 3 second phalanges) and 8 are very small and most likely from females (1 calcaneus, 1 patella, and 5 second phalanges). Sex could not be determined for an additional 18 bones as most fall within the lower range of female and higher range of male animals (based on Horwitz *et al.* 1990).

Sheep?

Five bones are tentatively identified as sheep (*Ovis orientalis*): one radius, one metacarpal, two second phalanges, and one third phalanx (following Bossneck 1969). Two are from Late Natufian contexts and three from the Early Natufian. Sheep are known to have inhabited the northern Levant in the late Pleistocene and have been found as far south as the central Negev, suggesting that wild sheep populations extended south along the narrow semi-arid steppe bordering the fertile crescent (Davis *et al.* 1982:87). Sheep favor more open, hilly areas than goats and would have preferred the gentler, hilly uplands to the north rather than the craggy terrain near the site.

Bos primigenius

Cattle normally prefer a more wooded habitat, but have also been identified in the Natufian levels at nearby Beidha. *B. primigenius* bones at Wadi Mataha include 3 skull fragments, 3 molar fragments, 1 scapula, 2 humeri, 1 radius, 1 metacarpal, 1 carpal and 1 distal sesamoid. Eight of the thirteen bones are burnt. The distal radius is unfused, indicative of an immature individual probably less than 3.5 years of age (after Silver 1969).

Equids

Equid bones are commonly found in steppe/desert sites, and three equid bones were recovered from the Natufian levels at nearby Beidha. At Wadi Mataha, 10 bones are identified as equid, two of which are immature. They include two upper right second premolars, three second phalanges, one left central tarsal, one distal metatarsal, one left calcaneus, one distal sesamoid, and one distal metopodial. Of these, six were complete enough for measurement: two of the second phalanges, both upper premolars, the calcaneus and the distal metatarsal. All are from animals smaller than horse (*Equus ferus*), but most are larger than the Syrian Onager (*Equus hemionus*) measurements from Çayönü (after Meadow 1986). Of the three species of equid known from this region of the Levant (*Equus africanus*, *Equus hydruntinus*, and *Equus hemionus*), the size of Wadi Mataha bones most closely approximate those identified as wild ass (*Equus africanus*). [*E. africanus somaliensis* second phalange from Uerp-

mann (1991:20) measures GL: 42.5, Bp: 44.0, Dp 27.5 Bd: 41.5, SD: 38.0, and *E. africanus africanus* (Uerpmann 1991:22) metatarsal measures Bd: 40.5, Dd: 30.6, dTm: 23.5 DTm: 26.1].

Small Animals

Small taxa, including carnivores, small mammals such as rodents, reptiles, and birds, are abundant on site, comprising 44 percent of the total NISP. Reptile bones, comprising almost exclusively land tortoise bones along with a few lizard and snake specimens, are the most common small animals in all contexts, and represent 23 percent of the total NISP. Carnivores are relatively few, comprising less than 2 percent of the sample, while birds are well represented at almost 15 percent. The majority of birds are partridge, although a diverse range of raptors and a few small birds are also present. Human use of these small taxa is suggested by a large number of burnt tortoise and hare bones distributed throughout all contexts, the high degree of fragmentation of most bones, and evidence of cone fractures on some tortoise carapace and plastron fragments.

Carnivores

A total of 23 bones were identified as canids: five unidentified dog/wolf (*Canis* sp.), one unidentified cat (*Felis* sp.), 16 foxes (*Vulpes* sp.), and two marbled polecats (*Vormela peregusna*). *V. peregusna* prefers more forested areas (Harrison 1991:131), and Wadi Mataha is probably near the fringe of its habitat. Foxes are found in nearly all regions, except for extreme deserts areas (Harrison 1991:117). Three different species of fox are currently found in the Levant, although the largest species, the red fox (*Vulpes vulpes*) is most common. The sixteen bones identified as *Vulpes* sp. From Wadi Mataha are most likely from this species. *Vulpes* sp. is represented primarily by feet bones (both first and second phalanges), although examples of skull pieces (mandible, maxilla) and limb bones (femur, ulna, and radius) are also present. A high number of feet bones suggest they may have been slaughtered primarily for their pelts and skinned prior to transport to the site (see Crabtree *et al.* 1991:166). Both *V. peregusna* specimens are left mandibles.

Small Mammals

The number of small mammals increased dramatically in the 1999 excavations. Hare are best represented with 32 bones and were identified as *Lepus capensis*, as this is the only lagomorph known to have occupied the region in the late Pleistocene (Harrison 1991:213). Hares are represented primarily by metacarpals and mandibles, although first phalanges, and limb bones (ulna, radius, humerus) are also present. Identified rodents include 10 bones from mole rats (*Spalax ehrenbergi*), 14 from jirds (*Meriones* sp.), 10 from voles (*Microtus guentheri*), and 4 from mice (*Mus* sp.). An assortment of both cranial and postcranial elements from most species suggest many rodents probably died within their own burrows, although other, non-human agents such as raptors and small carnivores may have also introduced rodent bones into occupation deposits. Rodent bones exhibit varying levels of preservation; most are highly fragmented and eleven are burnt, perhaps suggesting a cultural use for some species.

Land Tortoise

Land tortoise remains are common on this site, with 290 bones identified as *Testudo graeca*. Carapace and plastron fragments are abundant, although limb bones, scapulae, coracoids, and pelvic bones are also represented. Tortoise bones are found in all contexts, most in a highly fragmented state. About 12 percent of the shell fragments are burnt. A few nearly complete plastron and carapace pieces from Late Natufian levels could be reconstructed. Two of these show signs of cone fractures in the center of the shell, probably the result of breaking the shell with a stone while removing meat.

Birds

The assemblage contains a variety of birds, many of which have yet to be identified. Partridge (*Alectoris* cf. *chukar*) bones are most common with 73 specimens. Chukars are found in dry, semi-arid environments with sparse vegetation, and would have been available near the site. The relative element representation of chukars shows a bias towards pectoral bones (coracoid, sternum, and scapula); (Fig. 3). Wing bones (ulna and humerus) and the tibiotarsus are also well represented. Tchernov

(1993:198) notes similar element representations of chukar bones from sites in from the Natufian core area and suggests this indicates a differential transport of lean muscles attached to the pectoral girdle.

At least seven different species of raptors have been identified including buzzard (*Buteo* sp.), griffon vulture (*Gyps fulvus*), Egyptian vulture (*Nephron percnopterus*), eagle (*Aquila* spp.), sparrowhawk (*Accipiter* sp.), falcon/kestrel (*Falco* sp.), honey buzzard (*Pernis apivorus*), and osprey (*Pandion haliaetus*), as well as a number of bones of unidentified Falconiformes. The griffon vulture, buzzards, and golden eagle prefer a mosaic of habitats including high mountains, lowland deserts and plains, and nest on precipitous cliffs and rocks overlooking open areas (Forsman 1999:291). The honey buzzard, sparrowhawk, and osprey favor more wooded areas, although the spring and fall migrations of many of these raptors pass through the Levant (Forsman 1999). Unlike chukars, Falconiformes bones are represented primarily by terminal phalanges with small numbers of leg bones and very few wing or pectoral bones suggesting that perhaps they were not used primarily as food (Fig. 3). A similarly large percentage of terminal phalanges of Falconiformes has also been documented at Salibiya I, a Late Natufian site in the Lower Jordan Valley, as well as at several nearby PPNA sites (Tchernov 1993:197). Crabtree *et al.* (1992:166) have suggested that perhaps the Natufian people collected talons for ornamental or decorative purposes.

Age

The age of death of both caprines and gazelles was based on epiphyseal fusion of long bones. Following Davis (1980:133), about 29 percent of the gazelle bones are immature, with four percent killed between five and eight months of age, and the remaining 24 percent from 10 to 18 months. The number of immature bones was not large enough to permit comparisons by level, although most of the immature bones come from the Late Natufian component.

The percent of immature caprines in the assemblage is slightly higher than in the case of gazelle. Based on epiphyseal fusion alone, about 32 percent of the caprine bones are immature; one bone is from a goat aged from 13-16 months, 11 are 1.5-2.2.5 years, two are 2.5 to 3 years and one 3 to 3.5 years (based on Silver 1969). Analysis of tooth wear indicates a number of young animals including one aged less than three months, two 5.5 to 10.5 months, one 17.5 to 19.5 months, as well as some older individuals including one aged 2-3 years, one 3-4 years, and one 4-6 years (based on Payne 1973; 1985).

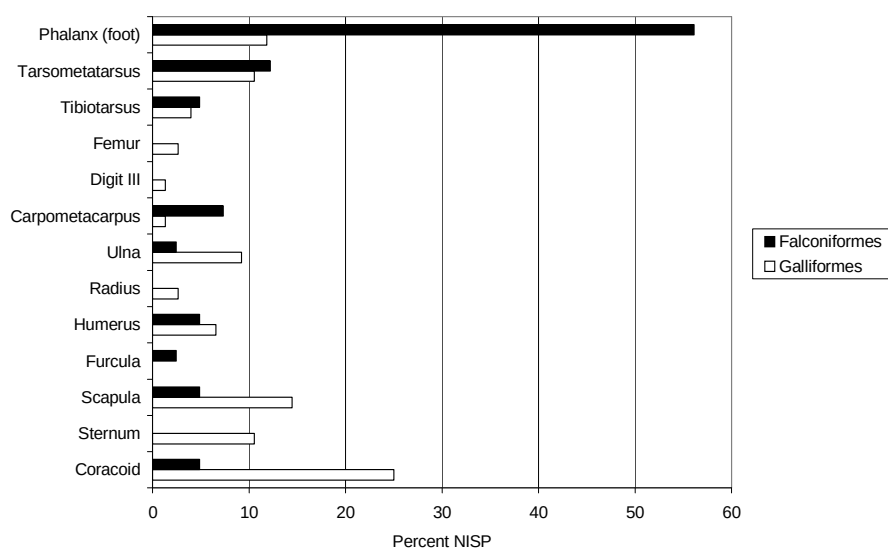


Fig. 3. Relative representation of Falconiformes and Galliformes skeletal elements.

Element representation

The large number of goat and gazelle bones allowed for analysis of skeletal part representation. The results show differences in the relative proportions of body parts between gazelle and goat. Elements are divided into five categories according to anatomical location: feet (phalanges), hindfoot (tarsals, metatarsals, astragalus, and calcaneus), hindlimb (femur, tibia, and pelvis), forefoot (carpals and metacarpals), forelimb (humerus, radius, ulna, and scapula), and cranial (skull parts, mandible, maxilla, and teeth).

Gazelles are represented primarily by foot bones (over 30 percent of identifiable elements), followed by relatively equal proportions of cranial, forelimb, and hindfoot bones (near 15 percent), and fewer axial and hindlimb elements (8 and 10 percent); (Fig. 4). Caprine remains are dominated by cranial elements (over 50 percent of identified elements), with hindfoot and foot bones the next most common (12.5 percent each); (Fig. 5). All remaining skeletal parts (axial, forelimb, forefoot, and hindlimb) are relatively rare (6 to 7 percent each). Due to the potential biasing factor of large numbers of horn core fragments, which are more readily identifiable than other bones in a fragmented state, horn core fragments were excluded from the comparative analysis of skeletal proportions. While excluding horn cores does little to alter gazelle skeletal part frequencies, the percentage of caprine cranial elements is reduced to just over 20 percent, and the relative proportion of all other elements increases somewhat, particularly foot bones and hindfoot and forelimb elements. Regardless of the form of analysis, caprines and gazelles appear to have slightly different skeletal part frequencies. A high number of caprine cranial bones is probably due to preservation conditions, particularly in Test Area 1. Most cranial specimens are dense bones such as mandible fragments or teeth. Horn cores, the largest category of cranial material, were probably transported to the site independently of subsistence needs. Gazelle bones are dominated by phalanges and metapodials and in this respect appear similar to other Epipaleolithic faunal assemblages. All skeletal parts, however, are more equally represented in the Wadi Mataha assemblage compared to other sites. A high proportion of foot bones may be the result of the destruction of other long bones during intensive processing for marrow (Tchernov 1994:69). The relatively even representation of both caprine and gazelle postcranial elements suggests that entire carcasses were often transported to and processed on-site.

Seasonality

The season(s) of occupation at Wadi Mataha can be determined both through the presence of seasonally available bird species and the age of certain ungulate remains. Probably the best seasonal indicators in the faunal assemblage are the abundant and diverse species of migratory birds including several major raptor species. Most of these species, including the honey buzzard (*Pernis apivorus*), eagle (*Aquila* spp.), and sparrowhawk (*Accipiter* sp.) follow regular migratory routes through the Levant in the fall and spring. Others such as the common buzzard (*Buteo buteo*), long-legged buzzard (*Buteo rufinus*), the various species of falcon/kestrel (*Falco* spp.) and the two species of vultures (*Gyps fulvus* and *Nephron percnopterus*) can be either residents or migratory visitors in the Levant. Cumulatively, the presence of all these species strongly suggests occupation during the spring (mid-April to early June), fall (mid-September), or both seasons. As the various ungulate species represented in the assemblage have fairly delineated rutting and birthing seasons, the ages of ungulate remains also provide useful seasonality information. Gazelles, for example, give birth primarily during the spring and early summer (March to July); (Tchernov 1994:80). While no neonatal or extremely young individuals are present in the Wadi Mataha assemblage, the age of death of three of the gazelle remains is between 5 and 8 months, suggesting occupation in the fall from September to November. Estimates for the age of 13 individuals range between 10 and 18 months, possibly indicating winter or spring occupation at the site. The rutting season for the Nubian ibex occurs primarily during October and November, with females giving birth in March and April. For *Capra aegagrus*, mating takes place sometime during the autumn and the young are born in May (Harrison 1991:185). Based on the age estimates of the Wadi Mataha *Capra* remains, occupation appears to have occurred during the fall and spring/early summer. One specimen from a young animal aged less than three months and two between 13 and 16 months old indicate a late spring to early summer occupation. Bones from animals

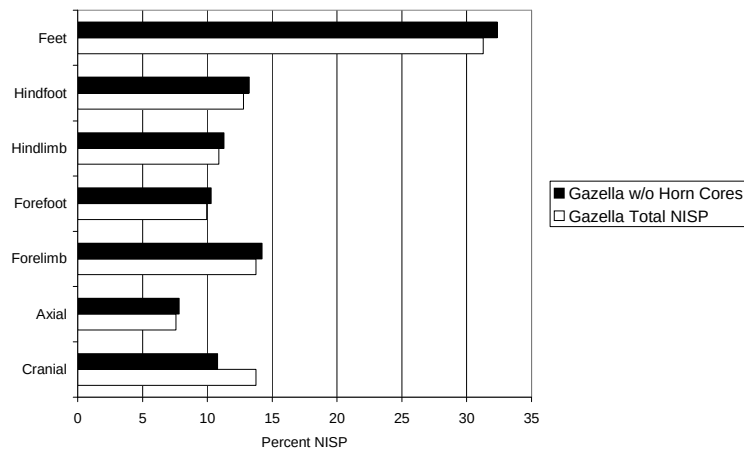


Fig. 4. Relative representation of gazelle skeletal parts both with and without horn cores.

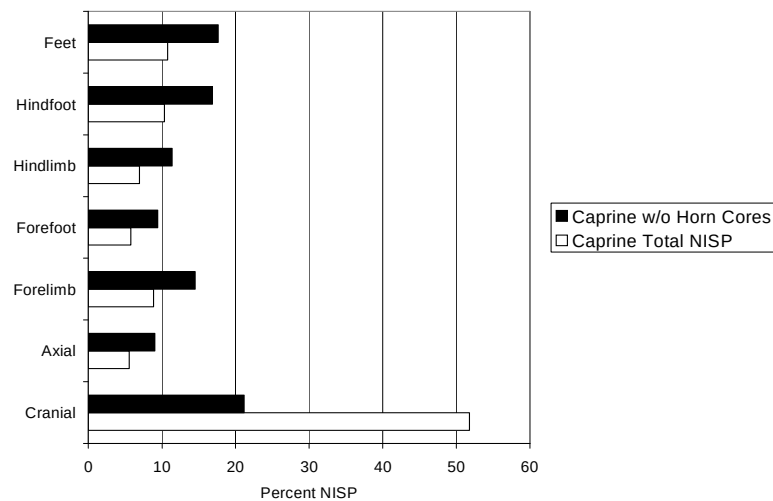


Fig. 5. Relative representation of caprine skeletal parts both with and without horn cores.

between 5.5 and 10.5 months and 17.5 to 19.5 months old suggest fall or winter use of the site. Taken together, the seasonal indicators in the Wadi Mataha faunal assemblage suggest spring/early summer and/or fall occupation at the site, although the presence of ungulate remains from a variety of age classes may also suggest use of the site during other times of the year.

Discussion

The discrete and tight chronological sequence of Epipaleolithic occupation at Wadi Mataha offers an opportunity to both fill gaps in our knowledge of the Geometric Kebaran and Late Natufian hunting patterns in the little known steppic environment east of the Dead Sea, as well as provide a more refined perspective on subsistence changes throughout the Late Epipaleolithic period in southern Jordan (see Baadsgaard 2000 for a more detailed discussion of subsistence change).

Previous investigations of Epipaleolithic faunal exploitation patterns have been hampered by the problems encountered when comparing assemblages from slightly different environmental settings or derived from different recovery methods or research protocols. The Wadi Mataha remains are from a single site and thus, less affected by these problems (see discussion in Bar-Oz 1999).

Temporal Variation

The increased sample size from the 1999 excavations allowed comparisons between the relative proportion of different species in each occupation. NISP counts are sizable in all contexts, largest in the Late Natufian (n=523), and somewhat smaller in the Early Natufian (n=244). The Geometric Kebaran component was especially rich in faunal remains, a decent sample (n=212) was recovered in spite of more limited excavations in these levels. The relative prey abundances of each assemblage are examined by comparing the percent NISP of the various taxa represented. The animals used in this analysis include bones from *Equus*, *Bos*, *Capra*/Caprine, *Gazella*, and *Lepus*, as well as remains from four small animal groups: carnivores, rodents, reptiles, and birds. These comparisons reveal almost no change in relative species abundance between the Geometric Kebaran and Late Natufian periods, other than a slightly greater proportion of gazelle in the Geometric Kebaran sample (Fig. 6). A greater difference is apparent between both of these occupations and the Early Natufian component. The Early Natufian assemblage has a higher proportion of caprine remains relative to other ungulate species as well as significantly lower proportions of reptiles. The same species are present in all three temporal components, although the Early Natufian sample has different proportions of most animals than both the Geometric Kebaran and Late Natufian assemblages. The greatest difference lies in the higher percentage of caprines in the Early Natufian, and higher proportions of tortoise in both the Geometric Kebaran and Late Natufian components. Birds are more abundant in the two Natufian occupations.

Including the high number of caprine horn core fragments from the Early Natufian component probably over-exaggerates differences between occupation periods. With horn cores from all levels excluded from the analysis, the predominance of caprine remains in all levels is somewhat reduced, most drastically in the Early Natufian assemblage, although the proportion of most small game (rodents, reptiles, and birds) remains relatively low in this period. In the analysis without horn cores, both the Geometric Kebaran and Late Natufian assemblages have relatively equal proportions of gazelles and caprines, while caprines remain the most abundant species in the Early Natufian sample. The relative abundance of hares and carnivores remains fairly constant during all time periods. Comparisons between the ungulate proportions of each temporal period show a slight trend towards an increasing focus on caprines from the Geometric Kebaran to the Early Natufian followed by an increase in gazelle exploitation in the Late Natufian period (Fig. 7). An increased focus on caprines during the Early Natufian period may provide evidence for changing large game hunting patterns, although differences between periods are minimal and do not indicate any great change in ungulate exploitation patterns through time. The large mammal component at Wadi Mataha most closely resembles Beidha, the nearest excavated Natufian site, although the recovery methods were less thorough, inhibiting comparisons of small animal use. The proportions of caprine and gazelle are almost identical between Beidha (69.9 percent goat; 22.1 percent gazelle) and the Early Natufian component

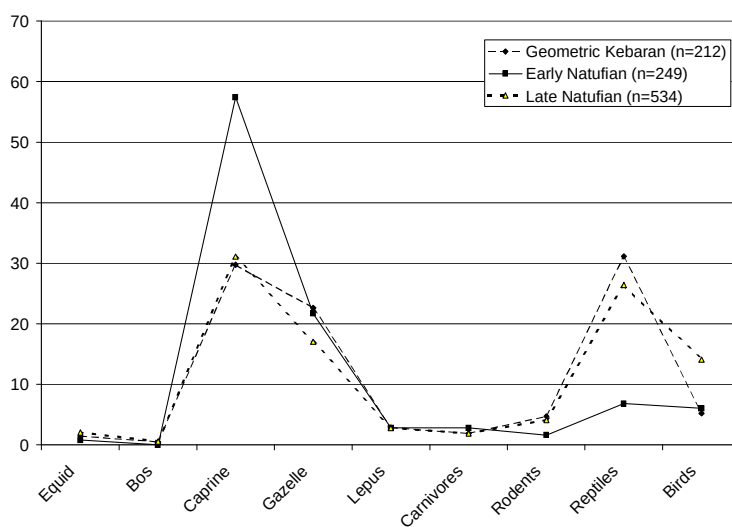


Fig. 6. Relative species abundance by time period with horn cores included.

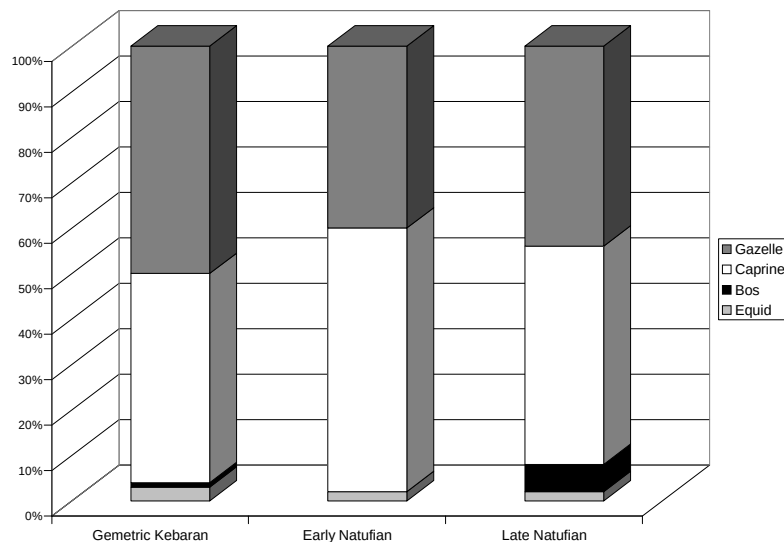


Fig. 7. Ungulate proportions by time period with horn cores included.

at Wadi Mataha (71.4 percent goat; 28.6 percent gazelle;), although cattle is more abundant at Beidha.

Considering that different preservation conditions may have affected the size of the small animal assemblage in the Early Natufian component, the relative proportions of small animal taxa were compared between each occupation (Fig. 8). Tortoise is most abundant in all levels followed by birds (primarily partridge), hares, and carnivores. With the exception of a few more species of raptors in the Late Natufian, the number of small animal taxa remain relatively the same. A change is more apparent in the relative proportion of these small animal taxa through time. Tortoise is much more abundant in the Geometric Kebaran small mammal sample (over 72 percent), although its proportions decrease compared to birds, hares, and carnivores in both the Early and Late Natufian components. The proportion of birds gradually increases through time, while hares and carnivores increase substantially in the Early Natufian and decrease somewhat in the Late Natufian.

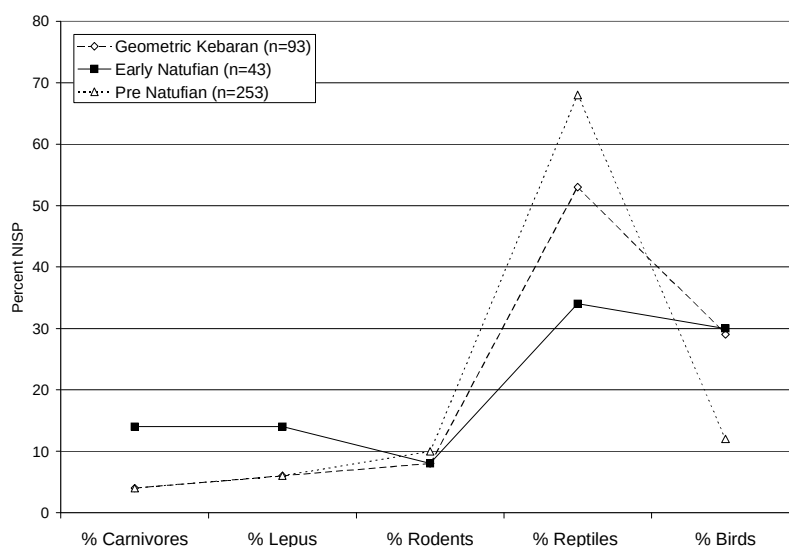


Fig. 8. Relative proportions of small animals from each assemblage.

Sedentism

While semi-sedentary encampments are common in the core Natufian homeland, the mobility patterns and degree of permanence of Natufian sites in other areas appears to have varied with respect to local ecological conditions. In steppe/desert areas, Natufian sites are smaller and exhibit signs of less intensive use than their counterparts in the Mediterranean homeland. Byrd (1990:86) describes two types of steppe/desert occupations during the Natufian period: one characterized by intensive activity and exhibiting evidence of moderate permanence, and the other distinguished by more specialized and short term use. The Natufian occupations at Wadi Mataha appear more like the former; the presence of a variety of large and small taxa, as well as a complex assortment of domestic tools and features, suggests that a broad range of activities took place on site. Multiple, deep bedrock mortars, constructed architectural features, and two primary inhumations are also evidence of intensive and prolonged use of the site. The faunal evidence, including remains from migratory birds, and the age profiles of ungulate remains indicate that hunting occurred during multiple seasons (probably spring and fall). The rodents identified in the Wadi Mataha assemblage include mouse (*Mus* sp.) bones, although none could be positively identified as a commensal species (*Mus musculus*). The mouse bones as well as most other rodent bones are most likely intrusive within occupation deposits.

Evidence for prolonged occupation at Wadi Mataha suggests that Natufian foragers in southern Jordan were more residentially stable than earlier groups. Foraging patterns probably involved the logistical acquisition of resources from semi-permanent seasonal camps and periodic residential moves. Evidence for multiple phases of occupation within each Wadi Mataha temporal component further indicates a probable recurrent seasonal use of the site. Prolonged or repeated occupation would have resulted in the over-hunting of large prey within nearby hunting territories, forcing hunters to travel greater distances to exploit large game or intensify their exploitation of small animals.

Future and ongoing research

The Wadi Mataha faunal data has begun to offer insight into Epipaleolithic animal exploitation patterns in the steppic environment of southern Jordan. The Wadi Mataha remains are one of three Early Natufian faunal assemblages and the only reported significant Late Natufian faunal assemblage from southern Jordan (see Henry 1995). The Geometric Kebaran faunal sample is one of only three Middle Epipaleolithic faunal assemblages from this region (Henry 1995; Henry and Garrad 1988). The Wadi Mataha bones, thus, have the potential to offer a much needed characterization of Epipaleolithic animal exploitation patterns in the more peripheral areas of southern Jordan. Observed temporal trends in animal use will become clearer after continued excavations, with the resulting larger numbers of identified specimens, as well as a better understanding of the features and stratigraphy of the site.

Issues of climatic variability have yet to be fully addressed. The differences between the proportion of different taxa in different components may be associated with climatic fluctuations and the resulting effects on the extent, range, and abundance of different species, particularly large game. The types and variety of animals found in the faunal assemblage suggest that the site is located near the interface of several different environmental zones. While it sits in a mountainous area marked by rugged sandstone cliffs dissected by a system of wadis, the larger region is a transitional zone between gentle hilly uplands and the semi-arid desert. Even minor climatic fluctuations may have greatly affected conditions in this intermediate environment.

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