Chapter 4
Middle Paleolithic Prey Choice Inferred from a Natural Pitfall Trap: Rantis Cave, Israel

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…as archaic humans increasingly come to be seen as intelligent and capable hunters, it becomes imperative that we find new ways to explore the complex interplay between environmental or ecological factors that determined what was available on the landscape and cultural factors that determined what was selected and in what proportions (Speth and Tchernov 2007: 199).

Introduction

One of the most desired goals in paleoanthropology is the interpretation of human behavior in relation to the natural environment. What did Paleolithic humans choose to exploit out of the spectrum of resources naturally available to them, and why? The agreement of the archaeological remains (e.g., procured game and plants, lithic raw materials and minerals) with their (often implicitly assumed) natural availability, or the divergence of human preferences from the natural affordances, is potentially informative about human behavioral ecology, cognitive capabilities and social structure (e.g., Klein 1989; Stiner 2002; Grayson and Delpech 2008; Adler and Bar-Oz 2009). It may reveal expansion of the spectrum of utilized resources stemming from demographic pulses, cognitive shifts, socio-cultural factors or technological innovation/intensification. Ultimately, it serves to answer whether the course of human evolution and Paleolithic human behavior were by and large determined by environmental factors, or whether the social networks and cognitive or innovative capacities of humans had an equally great, or even greater influence (e.g., Gamble 1999; Kaufman 2002; Bar-Yosef 2004; Klein 2009; Speth 2010).

Specifically in the field of zooarchaeology, one of the most basic questions is human prey selection versus natural availability of game. Did Paleolithic humans largely base their hunting choices on the natural availability of game in their environment, or diverge from this availability to acquire rarer animals for whatever reason, such as greater fit to their technology, ease of hunting, greater prestige or better taste? The prey-choice patterns of past human populations convey a great deal of information regarding hunting capabilities, hunting technology, ecological adaptation and social factors, sometimes intertwined. However, isolating prey-choice patterns requires one to take into consideration the pool of resources locally and temporally available to the hunters (for recent discussions on Late Pleistocene prey choice patterns see Faith 2008; Dusseldorp 2010; Weaver et al. 2011). If the prey choice of hunters, as attested to by archaeofaunal remains in their camps, closely resembles the 'natural' living community, this could be taken as evidence of non-selective or environmentally-determined hunting. On the other hand, if the hunted spectrum markedly diverges from the natural presence and relative abundance of game species, then specific prey-choice patterns can be determined and explanations for these patterns may be sought. Thus, in theory, the presence and relative abundance of game species in an archaeofaunal assemblage should be compared to the presence and relative abundance of a non-anthropogenic assemblage, reflecting the 'live' community through different mechanisms.

However, this kind of comparison is rarely made, because finding a natural control against which to compare the anthropogenic faunas is challenging. Many regions of the world do not possess natural collections of Pleistocene faunas that are unbiased by hominin predation and thus can provide a proxy for the availability of animal resources. In fact, the natural availability of game in a spatio-temporal setting suitable for comparison to the archaeological record is hardly ever known, but is instead inferred from the archaeological remains themselves (thus creating circular reasoning), or estimated from independent paleoenvironmental proxies that correlate tentatively with the archaeological record.

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This study aims to focus on a subset of this problem, namely the prey-choice patterns of human hunters in the Middle Paleolithic (MP) period of the Levant (ca. 250–47 ka). My approach here is to use the finds from the newly discovered site of Rantis Cave, interpreted as a natural pitfall trap whose contents reflect the structure of a faunal 'live community' in MP times, as a natural control against which to compare the relative taxonomic frequencies in the anthropogenic faunas. The outcome of this exercise is the isolation of a hunting pattern that diverges from the natural availability of game. I will argue that this pattern could be interpreted as a case for specific human prey-choice during the Levantine MP and discuss its possible implications.

The Middle Paleolithic Archaeofaunas of the Southern Levant

The Middle Paleolithic of the Southern Levant figures prominently in debates concerning human evolution, as it has yielded important Neanderthal and anatomically modern human (AMH) fossils, numerous cave and open-air sites displaying rich cultural layers, and has been the focus of a great deal of groundbreaking research since the 1930s (e.g., Garrod and Bate 1937; Bar-Yosef and Vandermeersch 1993; Kaufman 1999; Shea 2003 and references therein; Weinstein-Evron et al. 2003; Bar-Yosef and Meignen 2007; Hovers 2009). This small, yet archaeologically-rich and intensively-explored region, displays marked ecological variability, making it an ideal area to explore the nature of game procurement relative to what was available in the environment. Faunal studies concerning the MP period of the Levant effectively commenced with Bate's (1937) now-classic quantitative account of mountain gazelle (*Gazella gazella*; hence referred to as simply 'gazelle') and Mesopotamian fallow deer (*Dama mesopotamica*; hence 'fallow deer') frequencies in the Mount Carmel caves (Tabun and el-Wad). She attributed shifts from fallow deer to gazelle dominance in the Pleistocene faunal assemblages to changes in regional vegetation and paleoclimate. An abundance of woodland-dwelling fallow deer was taken to indicate a humid phase and contracting 'open' biomes, while the steppe-adapted gazelles signaled desiccation and contracting woodlands. Bate's conclusions were later widely debated, because of unsystematic methods of collection and analysis that could alter the relative frequencies, inappropriate tallying methods and the lack of taphonomic and contextual data clarifying how these animals reached the cave in the first place (Jelinek et al. 1973; Davis 1982; Speth and Tchernov 2007; Bar-Oz et al. in press). As human hunters were responsible for accumulating most of the

faunal remains in these caves (Marín-Arroyo in press), this debate cannot be truly resolved unless the issue of human prey-choice, and its adherence to the relative paleoenvironmental abundance of game species, is addressed.

Detailed zooarchaeological and taphonomic studies have shown in recent years that the MP archaeofaunas of the Southern Levant were largely the result of systematic human hunting, carcass transport, butchery and discard throughout this ca. 200 ka period (e.g., Speth and Tchernov 1998, 2007; Rabinovich and Hovers 2004; Rabinovich et al. 2004; Stiner 2005; Speth and Clark 2006; Yeshurun et al. 2007a). The ungulate species present in these assemblages are similar (chiefly *G. gazella, D. mesopotamica, Bos primigenius, Cervus elaphus, Capra aegagrus* and *Sus scrofa*), but some variations have been noted in their relative frequencies. These variations are hard to interpret, given the still-small number of published archaeofaunal assemblages for this region and period and the variety of taphonomic processes that may have acted on the assemblages. Recovery and analyst biases in old excavations, differential transport patterns aimed at reducing carcasses of larger ungulates (e.g., Rabinovich and Hovers 2004; Speth and Clark 2006; Yeshurun et al. 2007a) or reflecting different site types such as open-air localities versus cave habitations (e.g., Gilead and Grigson 1984; Rabinovich 1990; Hovers et al. 2008; Sharon et al. 2010), and differential post-depositional fragmentation (Yeshurun et al. 2007b) could all alter the relative taxonomic abundance of ungulates in these sites. Another, more elusive factor is, of course, human hunting preferences, which are the subject of this paper.

Holding the paleoenvironment roughly constant by considering only faunas from the Mediterranean climatic region of the Southern Levant (Danin 1988), which most probably covered a similar territory in this region during the MP (Enzel et al. 2008), may enable the consideration of taphonomic biases and subsequently anthropogenic prey preferences. But while pre- and post-depositional destruction processes of vertebrate faunas are relatively well-understood and their study is enabled by the actualistic and experimental literature, the study of human prey choices suffers from a lack of a 'natural control' in this region.

Importantly, in recent years several Levantine MP large-mammal faunal collections that were accumulated mainly by natural agents (e.g., carnivore dens and pitfall traps) have been recognized, thereby providing the necessary comparative framework for the presence and abundance of game on the paleolandscape that was available for human exploitation. These are Geula Cave (Monchot 2005), Rantis Cave (Marder et al. 2011) and perhaps the area beneath the 'chimney' of Tabun B (Garrard 1982; Marín-Arroyo in press). The case of Rantis Cave is especially illuminating. In the next section I present this newly discovered site and

argue that the cave acted as a natural pitfall trap for un-gulates, reflecting the ungulate composition through different, non-anthropogenic accumulation processes. I then compare the relative frequency of animal species selected for procurement in archaeological sites (usually by systematic hunting) to the relative frequency of species at Rantis Cave to elucidate human subsistence, in particular the choice of certain animals over others by MP hunters.

Rantis Cave

Rantis Cave is a unique site for the Pleistocene Southern Levant, containing a rich faunal assemblage along with meager evidence for human occupation. This recently discovered filled doline in west-central Israel yielded micro- and macromammalian remains, as well as a few lithic

artifacts (Marder et al. 2011). The cave, a filled chamber with a roof opening, is located on the western slopes of the Samaria Hills, within the western flanks of the Ramallah anticline, at an elevation of 220 m above sea level (Fig. 4.1). The site lies in the Mediterranean phytogeographic zone of the Southern Levant (Danin 1988), in an area of low limestone hills forming the transition from the coastal plain to the highlands. Today the region experiences a Mediterranean climate with rainy winters and dry summers. Mean annual precipitation is 600 mm and mean annual temperature is 19 °C. The cave is an isolated karstic chamber, truncated by an abrasion-denudation terrace, and subsequently filled by sediments.

The site was discovered in 2004 during construction activities. A cave chamber, filled with brown *terra rosa* soil with numerous animal bones and sporadic flint artifacts, was noticed in the section (Fig. 4.2a, b). A salvage excavation was conducted at Rantis Cave on behalf of the Israel
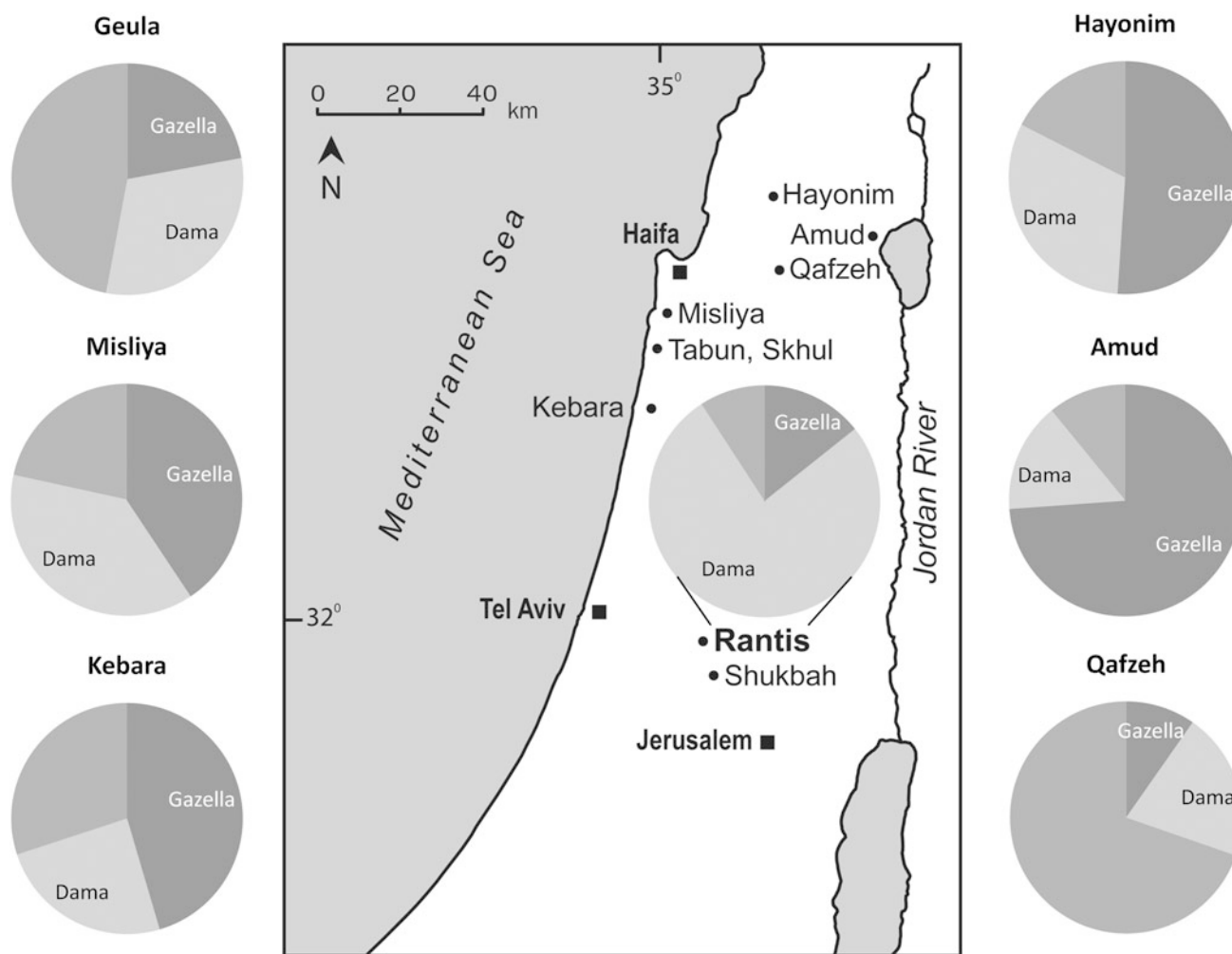
Fig. 4.1 Map of Israel showing the Middle Paleolithic cave sites mentioned in the text. All are located within the present-day Mediterranean climatic zone. The *pie charts* present the relative taxonomic composition in each site, simplified to three groups: *Gazella*, *Dama* and all other ungulates
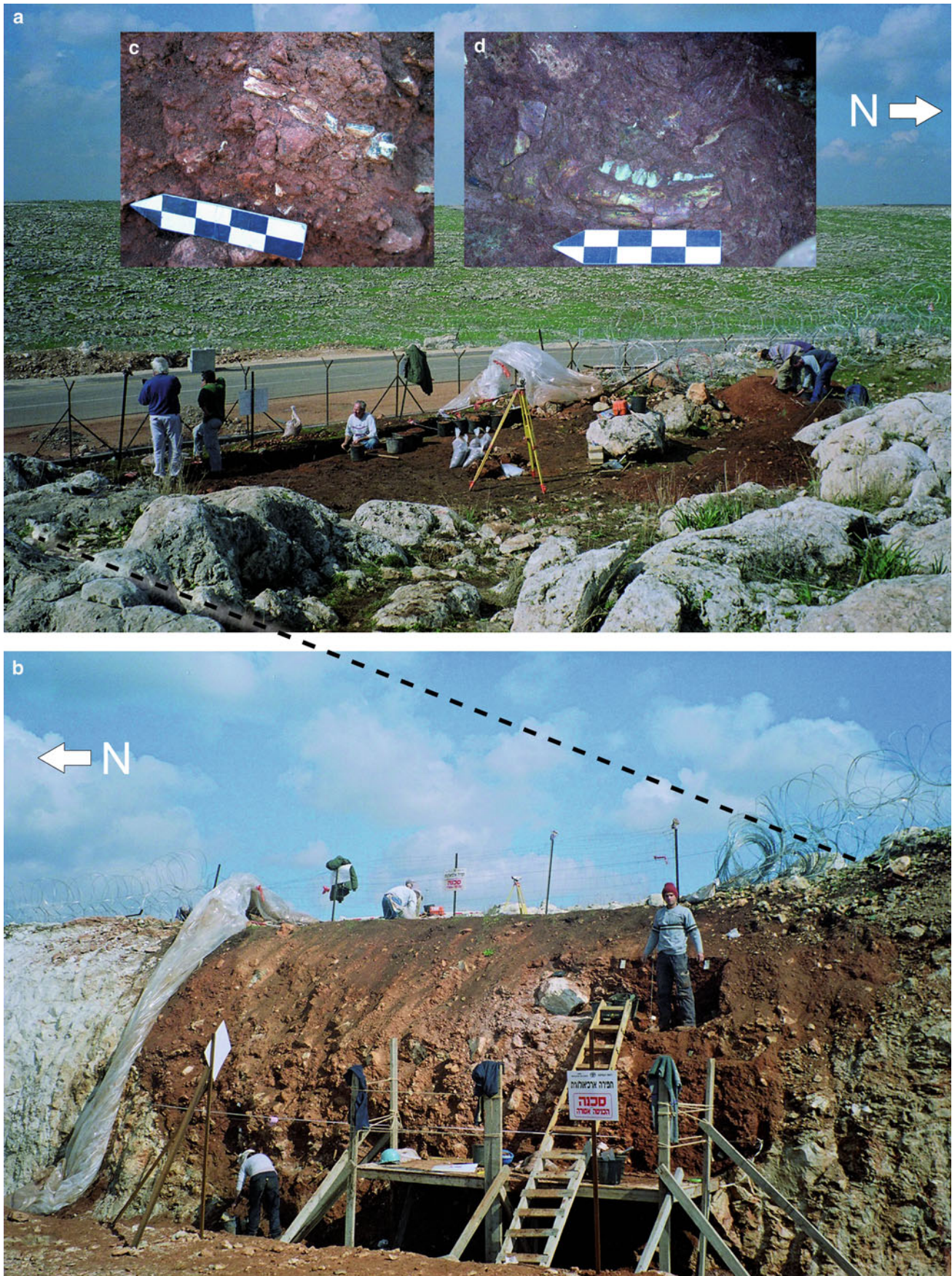
Fig. 4.2 Rantis Cave during excavation. **a** *Top view* showing the round outline of the doline, interpreted as an ancient pitfall trap; **b** *Side view* of the cave, exposed during road construction. Note the clear borders of the filled cave; **c** Fallow deer metapodial, showing its high degree of completeness and severe in situ attrition; **d** Fallow deer mandible in situ

Antiquities Authority in 2005, directed by O. Marder and R. Lupu, in an area of 12 m². The sediments were systematically sieved. Faunal remains were the most ubiquitous find (Fig. 4.2c, d); only a few lithic artifacts were found scattered among various levels, and no hearths, living levels or other human-made features were encountered, in stark contrast to most other MP cave sites in the region (compare Albert et al. 2003; Bar-Yosef and Meignen 2007; Shahack-Gross et al. 2008). Micromammal remains were numerous and dominated by the social vole *Microtus guenetheri*. Preliminary taphonomic observations suggest that the micromammals were probably deposited by raptors (Marder et al. 2011).

Attempts were made to date the Rantis Cave sediments using paleomagnetic, OSL and Th/U techniques. The soil sequence of the cave is of normal magnetization and the age is therefore younger than 780 ka. A flowstone close to the bottom of the section was dated by U-Th to yield an age of ∼140 ka, indicating that most of the cave fill (from 0.5 m above the cave bottom upwards), as well as human and animal activities, postdate ∼140 ka. Unfortunately, due to the complex depositional processes in the cave, including recent pedogenesis at the upper layer, OSL dating efforts have been unable to provide finer chronological resolution, even though the age of a significant portion of the sediment grains corresponded to the Th-U age. The small lithic assemblage (n = 39, including chips) was assigned to the Levantine MP period, in agreement with the radiometric dates. Thus, the Rantis Cave fill can be assigned to the later half of the Levantine MP (Marder et al. 2011: Table 1).
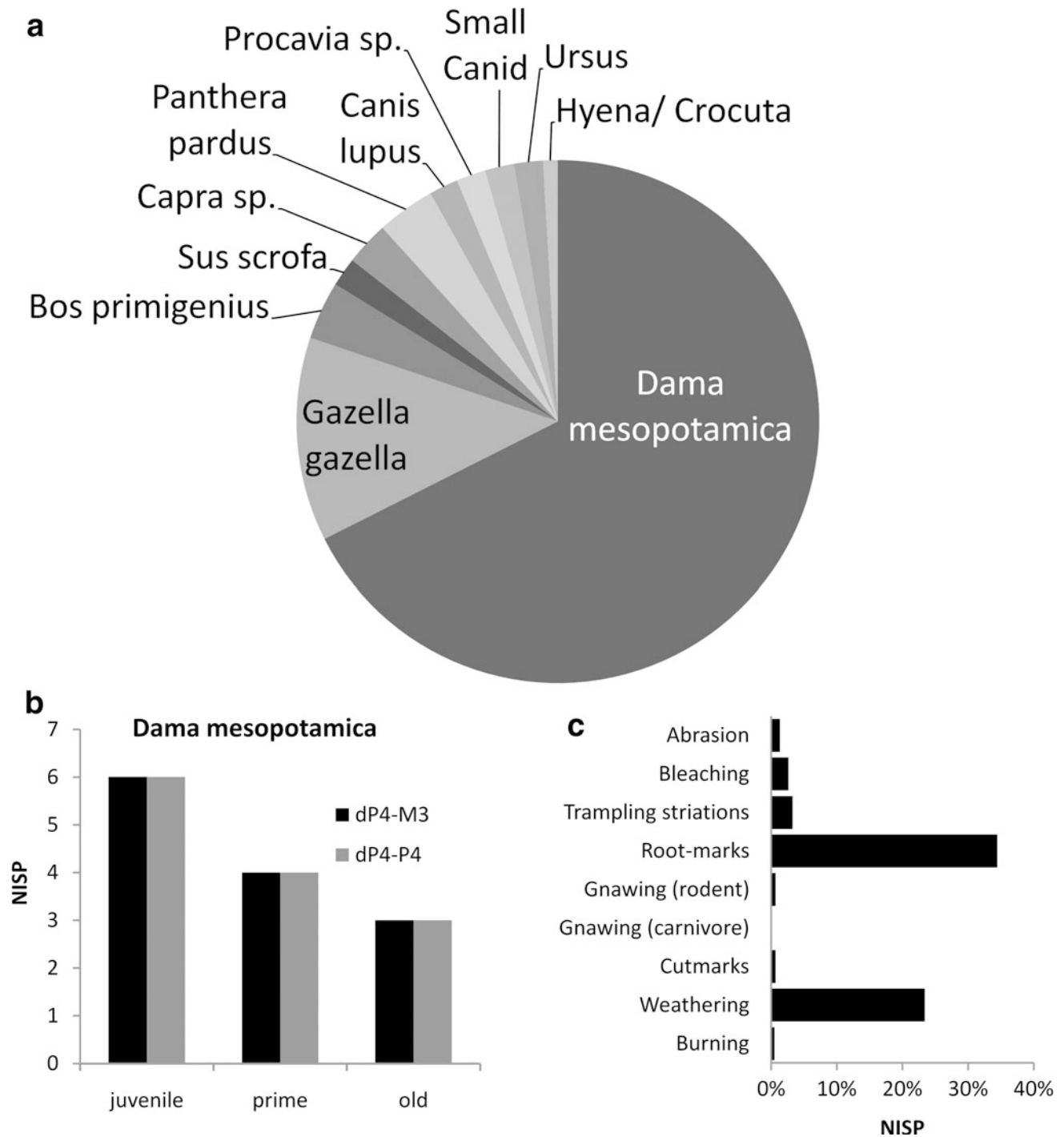
The Large Mammal Assemblage of Rantis Cave

A detailed description of the large mammal assemblage and the methods used in the analysis are given by Marder et al. (2011). A summary of the most relevant characteristics is given here. The bone assemblage of Rantis Cave is quite fragmented, although complete bone elements do occur. The identified assemblage (Number of Identified Specimens; NISP) consists of 241 bone and tooth fragments, representing a minimum number (MNI) of 22 individual animals. Ungulate species (NISP = 228, including 130 fragments identified to size-class) dominate the assemblage, followed by carnivores (NISP = 11) and two hyrax (*Procavia* sp.) specimens. The most common species (Fig. 4.3a) is Mesopotamian fallow deer (*D. mesopotamica*, 68 % of NISP). Other ungulates represented are mountain gazelle (*G. gazella*, 13 %) and to a lesser extent, aurochs

(*B. primigenius*), goat (*Capra* sp.), and wild boar (*S. scrofa*). A similar representation was also found for specimens that were identified to size-classes corresponding to the three major ungulate species (i.e., gazelle-size, fallow deer-size and aurochs-size). Species representation is similar among stratigraphic phases. The carnivore remains include five species: leopard (*Panthera pardus*, NISP = 4), wolf (*Canis lupus*, NISP = 2), brown bear (*Ursus arctos*, NISP = 2), a single undetermined species of hyena (*Hyaena/Crocuta*) and a small canid (Fig. 4.3a; see also Marder et al. 2011: Appendices 1, 2).

The age structure of the ungulate species was analyzed on the basis of tooth eruption and wear, following Stiner's (1990, 2005) three-cohort age system (juvenile, prime adult and old adult). The fallow deer dental sample was the largest and the only one with a satisfactory, albeit small, sample size (n = 13). The fallow deer age structure may resemble a 'catastrophic' age profile, where juveniles form the largest age class (n = 6), followed by prime-age adults (n = 4) and to a lesser extent by old adults (n = 3; Fig. 4.3c). This mortality profile is considered to conform to a hypothetical age profile of a living herd (Klein and Cruz-Uribe 1984; Stiner 1990). However, since little data are currently available on the natural age structure of Mesopotamian fallow deer, the interpretation of the Rantis age profile cannot by itself provide strong evidence for the depositional origin; suffice it to say that such an abundance of juveniles is unusual in the context of Levantine MP cave sites (e.g., Speth and Tchernov 1998; Yeshurun et al. 2007a).

The bone cortical surfaces generally are reasonably well preserved, enabling the search for various types of surface modifications. Human-induced butchery and consumption marks are nearly absent in the assemblage. Only a single burned specimen (a gazelle petrous bone), and one cut-marked specimen (a fallow deer mandible) were noted. None of the bones bear evidence of hammerstone percussion marks. Indications of animal modifications were also extremely rare in the assemblage. No unambiguous carnivore gnaw marks were found, despite systematic microscopic analysis, and only a single rodent gnaw mark was detected. Most bone surface modifications in the assemblage are the result of abiotic post-depositional agents, such as subaerial weathering, root marks, trampling striations and a few bone edges that underwent abrasion and rounding (Fig. 4.3b). The bone surface modification data suggest that neither humans nor carnivores played an important role in the formation and modification of the Rantis Cave assemblage and that the bones were exposed to the elements and buried slowly. Similarly, processes such as fluvial transport do not seem to have modified the bone assemblage further. It should be noted that little intra-site variation was found (Marder et al. 2011).

Fig. 4.3 The Rantis Cave large-mammal assemblage (see also Table 4.1). **a** Taxonomic composition based on specimens identified to the species level (n = 130); **b** mortality profile of Mesopotamian fallow deer according to two possible dentition sequences (dP$_4$-M$_3$ and dP$_4$-P$_4$); **c** taphonomic variables (all species and size-classes combined)

Interpretation

Taking into consideration the very limited anthropogenic signature at the site and on the faunal remains themselves, as well as the fact that carnivore remains are few and scattered, that signs for carnivore consumption are lacking, and that the age profile of the fallow deer is unusual, I interpret the large-mammal remains of Rantis Cave as an accumulation resulting from natural deaths either in the cave or in its immediate vicinity (Marder et al. 2011). Such 'natural death' sites are known globally, created either because of the existence of a pitfall trap or by a catastrophic

event (e.g., Shield Trap Cave, Oliver 1989; Untermassfeld, Kahlke and Gaudzinski 2005), but they are very rare in the Pleistocene of the Southern Levant (a notable exception is Bear's Cave in the Upper Galilee of Israel, Tchernov and Tsoukala 1997, and possibly also the area beneath the 'chimney' of Tabun B, Garrard 1982; Marín-Arroyo in press). Humans and carnivores were intermittently attracted to Rantis Cave, possibly exploiting the dead ungulates (though positive evidence for this is nearly absent), but they never lived in it.

Several processes can explain the natural deaths of large mammals in Rantis Cave. Some of the animal remains may have been washed into the cave, yet its interfluve location suggests that it has not been significantly affected by surface streams. This is reinforced by the fresh, unabraded state of most of the artifacts and bones. However, some water probably accumulated within the doline. The animals most likely were attracted to the water, and then were trapped in the sinkhole, with the vertical and overhanging walls offering no escape route. The probable standing water and the geometry of the sinkhole likely ruled out occupation by non-flying animals and by humans (Fig. 4.2). Thus, Rantis Cave probably acted as a natural pitfall that trapped the animals inhabiting the landscape (Marder et al. 2011: 777).

Comparison of Rantis Cave to Anthropogenic Assemblages

Several important cave and open-air sites are known from the MP period in the Southern Levant, yielding predominantly anthropogenic faunas. Since Rantis Cave reflects the 'living' ungulate composition through non-anthropogenic accumulation, the relative frequencies of the animal species selected for procurement in the archaeological sites (usually by systematic hunting) may be compared to the relative frequency of species at Rantis Cave in order to elucidate hominin subsistence, in particular the choice of certain animals over others by MP hunters.

Here, only MP sites that belong to broadly the same topographical, ecological and cultural *milieu* are compared, that is, cave sites from the Mediterranean phytogeographic zone of the Southern Levant. I selected only assemblages that were retrieved and analyzed using modern, relatively unbiased methods (Marean et al. 2004), such as full retention of bone elements, and published in enough detail to allow comparison. Other faunal assemblages, such as those of the key site of Tabun Cave, Mount Carmel, were not used in the comparison because of the highly biased nature of the faunal collections that were excavated in the 1930s. I also refrained from using open-air sites from the Southern Levant, some of which have yielded important faunal collections, such as

Quneitra (Davis et al. 1988; Rabinovich 1990), Far'ah II (Gilead and Grigson 1984), and more recently 'Ein Qashish (Hovers et al. 2008), Nahal Mahanayeem Outlet (Sharon et al. 2010) and Nesher-Ramle Quarry (Zaidner et al. 2010). These sites, with the possible exception of the recently discovered and particularly rich occupation of Nesher-Ramle Quarry, probably represent shorter visits and/or fewer repeated occupations of human groups that left behind their animal food refuse, sometimes following less intensive processing than at the repeatedly occupied cave sites; the role of open-air sites in the game-provisioning systems of the Levantine MP is yet to be explored and is outside of the scope of this paper. It is nonetheless clear that such sites cannot be directly compared to caves for the purpose of quantifying relative taxonomic abundance, because of the differences in transport and processing considerations associated with caves and open-air sites. Faunas found in cave sites represent MP meat procurement as the averaging of numerous episodes of hunting, transport, butchery and consumption. The abundance of aurochs, in particular, as well as other large ungulate taxa, is elevated in open-air sites in comparison to caves.

An additional factor is keeping the environmental location of sites as similar as possible, so that habitations surrounded by broadly similar settings, and supposedly similar animal communities, are compared. For this purpose I focused on the small, topographically mild and well-studied region of the Mediterranean Southern Levant, excluding faunal assemblages from the caves of the more humid and more wooded Mediterranean Northern Levant and from the deserts or semi-deserts to the east and south (e.g., Griggo 2004). The selected sites are all located in a small and defined region, exhibiting considerable similarity in their mammal communities along a north-south humidity gradient (Danin 1988; see Belmaker and Hovers 2011). Rantis Cave, the southernmost of the considered sites (Fig. 4.1), is thus expected to yield a somewhat more xeric Mediterranean fauna. This expectation was met by the micromammal data (Marder et al. 2011), requiring an explanation for the abundance of woodland-adapted fallow deer at the site. Preliminary tooth mesowear analysis indicated that at Rantis Cave fallow deer, animals that are normally browsers, included a relatively high proportion of graze in their diet (Marder et al. 2011), in accordance with the southern location of the site. This highlights the adaptive flexibility of this species and attests to the fact that the immediate environment of Rantis was not more wooded than that surrounding the northern sites, and thus would not be expected to capture more woodland animals.

As the selected sites are widely spaced in time, the issue of climate change through the MP requires a note here. The extent and nature of climate fluctuations and their implications for human ecology and the natural availability of

game in the Southern Levant have long been the focus of debate (e.g., Bate 1937; Jelinek et al. 1973; Davis 1982; Garrard 1982; Tchernov 1992; Bar-Matthews et al. 2003; Vaks et al. 2006; Shea 2008). Much data from various proxies (e.g., pollen, isotopes, paleohydrology, archaeofaunal and archaeobotanical remains) exist for the reconstruction of paleoenvironments in the Levantine MP. The proxies that reflect human ecology in the most direct manner, i.e., animals and plants exploited or otherwise deposited at the sites, generally point at remarkable taxonomic persistence throughout the MP period in this region, with changes in the relative frequency of species seemingly unrelated to global climatic events. Some moderate climatic fluctuations notwithstanding, it thus seems that the heart of the present-day Mediterranean ecosystem of the Levant displays remarkable persistence through glacial and interglacial periods, even if adjacent regions such as the eastern deserts and North Africa experienced more marked climate changes (e.g., Bar-Matthews et al. 2003; Lev et al. 2005; Vaks et al. 2006; Belmaker 2008; Enzel et al. 2008; Frumkin et al. 2011; Belmaker and Hovers 2011; Yeshurun et al. 2011; Marder et al. 2011; but see Tchernov 1992; Shea 2008 for a different view emphasizing climatic fluctuations and linking them to human ecology). At this stage I proceed with the assumption that, in this coarse-grained level of analysis, the MP archaeofaunas of the Mediterranean Southern Levant may be used in inter-site comparisons, with the natural presence and abundance of large-mammal species not remarkably transformed over time by environmental fluctuations.

Having concentrated on analytically reasonably unbiased faunal assemblages from the MP caves of the Mediterranean Southern Levant, six sites provide a good comparison to the natural accumulation at Rantis: Misliya, Kebara and Geula caves in Mount Carmel, Hayonim and Qafzeh caves in the Galilee and Amud Cave at the margin of the Jordan Rift Valley (Fig. 4.1; Table 4.1). All of these sites except Geula are primarily composed of repeated human occupations full of faunal and lithic remains, sometimes with hearths and sometimes with AMH or Neanderthal burials. Taxonomic composition, bone-surface modification data, bone fragmentation data and ungulate age profiles indicate that the ungulate collections accumulated as a result of systematic hunting of mostly prime-age individuals and their subsequent transport to the cave (sometimes preceded by initial field butchery), where they were processed, consumed and usually discarded on the spot (Speth and Tchernov 1998, 2001; Rabinovich et al. 2004; Rabinovich and Hovers 2004; Stiner 2005; Speth and Clark 2006; Yeshurun et al. 2007a; and see a summary in Table 4.1). The assemblages in these sites therefore largely represent the hunters' choices. Geula Cave, which recently underwent a taphonomic analysis by Monchot (2005), is different in its

unique carnivore- and porcupine-rich species composition, the ubiquity of carnivore and porcupine gnawing marks on ungulate bones, the absence of human tool marks and scarcity of lithic artifacts and anthropogenic features. All of these point to Geula being sporadically visited by humans, but primarily serving as a hyena den and porcupine lair (Monchot 2005). The ungulate assemblage at Geula thus represents mostly the kill or scavenging activities of hyenas and may be an additional important reference for discerning MP human prey-choices, one that was formed by different processes than we see in the natural pitfall at Rantis on the one hand and in the anthropogenic caves on the other hand.

The two most abundant ungulates in all of the assemblages except Qafzeh are *Gazella* and *Dama*, which are the most ubiquitous big-game procured during the entire MP period in the Mediterranean Southern Levant and which continues until the terminal Pleistocene (Bate 1937; Davis 1982; Bar-Oz et al. in press). The relative frequencies of gazelle and fallow deer specimens out of all ungulate specimens that were identified to the species level were compared and plotted on a scattergram (Fig. 4.4). This inter-site comparison reveals that Rantis Cave is especially rich in fallow deer, significantly more than any anthropogenic cave site examined (*Dama* vs. other ungulates at Rantis vs. Misliya: $\chi^2 = 41.91$, $p < 0.001$; Rantis vs. Hayonim: $\chi^2 = 88.3$, $p < 0.001$; Rantis vs. Qafzeh: $\chi^2 = 144.65$, $p < 0.001$; Rantis vs. Amud: $\chi^2 = 148.13$, $p < 0.001$; Rantis vs. Kebara: $\chi^2 = 141.57$, $p < 0.001$) and also significantly more than at Geula Cave, interpreted as a hyena den ($\chi^2 = 81.87$, $p < 0.001$).

Figure 4.4 reveals that at Rantis alone fallow deer greatly outnumber gazelle, while at four out of five anthropogenic sites (Misliya, Hayonim, Amud and Kebara) the two species are either equally represented or gazelle clearly outnumber fallow deer. At Qafzeh Cave *Dama* outnumbers *Gazella*, but the two species together comprise just about one-third of NISP, as the unique faunal composition of Qafzeh is dominated by *Cervus*, *Dama* and *Bos* in roughly equal proportions—the only MP site in the Southern Levant to yield such a faunal composition. The natural (hyena-porcupine) site of Geula is also different than the four abovementioned caves, in that *Dama* somewhat outnumber *Gazella* there and in the relatively high abundance of *Bos*.

To conclude the intersite comparisons, it seems that fallow deer were available in the landscape in great numbers, and in any case were not rarer than gazelle, as their abundance at Rantis points out. The fact that gazelles were transported in roughly equal or greater numbers to four out of five cave habitations and usually comprise over 40 % of identified ungulate specimens could point to the deliberate human decision to hunt gazelle rather than the abundant fallow deer during the MP of the Southern Levant (Fig. 4.4).

Table 4.1 Zooarchaeological and taphonomic data used in this study

Reference	Misliya Yeshurun et al. (2007a)		Hayonim Stiner (2005)		Qafzeh Rabinovich et al. (2004)		Rantis Marder et al. (2011)		Amud Rabinovich and Hovers (2004)		Kebara[a] Speth and Clark (2006)		Geula Monchot (2005)	
Ungulate NISP														
Gazella	98	40.7 %	1,912	51.1 %	91	9.7 %	14	14.3 %	291	73.9 %	8,810	45.4 %	221	22.1 %
Dama	91	37.8 %	1,178	31.5 %	193	20.6 %	75	76.5 %	60	15.2 %	4,752	24.5 %	309	30.9 %
Capra	8	3.3 %	8	0.2 %	97	10.4 %	3	3.1 %	18	4.6 %	182	0.9 %	13	1.3 %
Cervus	6	2.5 %	155	4.1 %	198	21.1 %	0	0.0 %	5	1.3 %	1,557	8.0 %	44	4.4 %
Sus	11	4.6 %	176	4.7 %	62	6.6 %	2	2.0 %	17	4.3 %	759	3.9 %	118	11.8 %
Bos	26	10.8 %	281	7.5 %	171	18.2 %	4	4.1 %	1	0.3 %	2,902	15.0 %	209	20.9 %
Capreolus	1	0.4 %	11	0.3 %	5	0.5 %	0	0.0 %	1	0.3 %	N/A		38	3.8 %
Equus[b]	0	0.0 %	22	0.6 %	78	8.3 %	0	0.0 %	0	0.0 %	424	2.2 %	21	2.1 %
Dicerorhinus	0	0.0 %	2	0.1 %	35	3.7 %	0	0.0 %	1	0.3 %	N/A		22	2.2 %
Alcelaphus	0	0.0 %	0	0.0 %	7	0.7 %	0	0.0 %	0	0.0 %	N/A		5	0.5 %
Hippopotamus	0	0.0 %	0	0.0 %	0	0.0 %	0	0.0 %	0	0.0 %	N/A		1	0.1 %
Total	241	100.0 %	3,745	100.0 %	937	100.0 %	98	100.0 %	394	100.0 %	19,386	100.0 %	1,001	100.0 %
Taphonomy														
Burning	*Frequent*		*Frequent*		Present		*Absent*		**Frequent**		Present		*Absent*	
Cutmarks	Present		Present		Present		*Very rare*		Present		Present		*Absent*	
Carnivore gnawing	*Scarce*		*Scarce*		Present		*Absent*		*Scarce*		Present		**Frequent**	
Age profile of dominant ungulates	Prime-dominated		Prime-dominated		Mainly adults		'Catastrophic'		Prime-dominated		Prime-dominated		Prime-dominated	
Inferred primary agent of accumulation	Human hunting, butchery and consumption		Human hunting, butchery and consumption		Human hunting, butchery and consumption		Natural pitfall trap		Human hunting, butchery and consumption		Human hunting, butchery and consumption		Hyena den and porcupine lair	

[a] For Kebara NISP counts are available only for the main prey taxa (*Gazella, Dama, Capra, Cervus, Sus and Bos*)

[b] Two or more equid species were probably present in the Levantine MP. They are lumped here, as in some of the reports I used
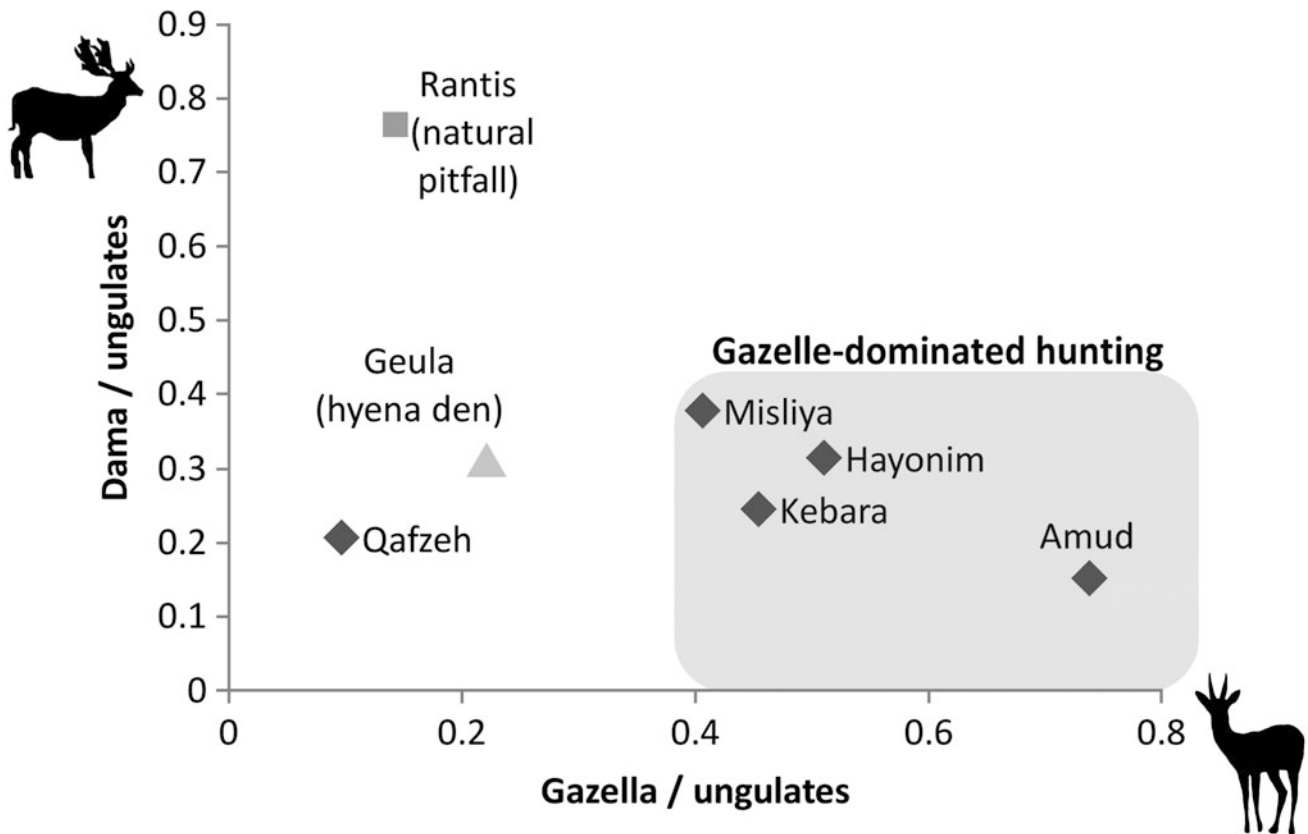
Fig. 4.4 Comparison of *Gazella* and *Dama* frequencies (expressed as their percent out of the total ungulates in the assemblage) of five assemblages that represent the hunter's choice, as well as a natural pitfall trap and a hyena den. Data are from Table 4.1

Discussion

I have shown that MP hunters who occupied caves in the Southern Levant generally procured gazelle rather than fallow deer. In light of the inverse pattern of greater fallow deer abundance in the natural control case of Rantis Cave, I interpreted this as a reflection of the human preference for hunting gazelle. Importantly, fallow deer were found to be the dominant ungulate species in two other suggested cases of non-anthropogenic accumulation in the region, i.e., Geula Cave (Monchot 2005) and the 'chimney' of Tabun Cave (Marín-Arroyo in press) and hence the pattern of fallow deer abundance in 'natural' accumulations versus gazelle abundance in anthropogenic accumulations is quite consistent. Given the rarity, or sometimes absence, of gazelle in late Lower Paleolithic cave assemblages (e.g., Bate 1937; Stiner et al. 2011), this pattern seems to commence in the early MP and continues well into the Upper Paleolithic and Epipaleolithic of the region (Davis 1982; Rabinovich 2003; Bar-Oz 2004; Munro 2009). Before I discuss possible causes and consequences of this suggestion, I should discuss some of the pitfalls of inferring human behavioral patterns from Number of Identified Specimens (NISP) values.

Zooarchaeological species abundance data, even in its raw form of NISP, may not always constitute a straightforward measure of the proportions of game that were procured. As mentioned above, aside from the hunter's choice, other factors may distort NISP values to some degree, including selective transport of body parts to the cave, intensity of processing, differential pre-depositional and post-depositional fragmentation, and analytical techniques. The early MP faunal assemblage of Misliya Cave in Mount Carmel may serve here to demonstrate these issues. At Misliya, a multivariate taphonomic analysis (Yeshurun et al. 2007a) showed that the assemblage was formed and primarily modified by human hunting, transport, butchery, consumption and discard, thus in principle allowing behavioral inferences to be drawn. However, the Misliya hunters treated the two main game species—fallow deer and gazelle—differently. The small gazelles were transported intact to the cave, while the larger fallow deer underwent some field butchery and low-bulk and meat-rich body parts were primarily transported. This pattern was demonstrated by the differential skeletal element profiles of the two animals, taking into account the density-mediated attrition of skeletal elements. Thus, counting by NISP would favor

gazelles in this case, because more gazelle elements were transported and discarded in the cave than fallow deer elements. To complicate matters, the Misliya gazelles show somewhat reduced fragmentation (higher completeness rates of most skeletal elements) than fallow deer, a pattern interpreted as stemming from stronger post-depositional actions acting on larger bones (Yeshurun et al. 2007b). Since the relative frequency of game is based only on skeletal elements identified to the species level and therefore on complete or near-complete elements (mainly teeth and long bone articular ends), gazelles may be overrepresented because of this process, too. Additionally, the most resistant elements, and those that are most easily assigned to the species level—teeth—may not suffer greater or lesser fragmentation, but are underrepresented for fallow deer as skulls were transported less often than mandibles for this species (Yeshurun et al. 2007a). A possible solution could be to base the comparative analysis presented here on Minimum Number of Individuals (MNI) counts, which theoretically may be less affected by differential transport and fragmentation. At Misliya MNI counts do not alter the relative frequency to a great extent (MNI counts are seven for *Dama* and six for *Gazella*). This, however, raises additional questions about the conceptual and statistical validity of using MNI counts for comparisons of what are essentially fragmented and time-averaged assemblages formed over the course of numerous human occupations (e.g., Grayson and Delpech 2008; Lyman 2008), a discussion which is beyond the scope of this paper. The problems demonstrated here for the Misliya game counts may exist to some extent in all other assemblages used in this study and these issues were indeed addressed in their publications (see references in Table 4.1); it is imperative, therefore, that one uses well-collected assemblages with published and detailed zooarchaeological and taphonomic analyses, allowing the recognition of biasing factors when comparing and attempting a behavioral reconstruction.

Moving back to Rantis Cave, differential human transport is probably not an issue here, at least as far as the primary deposition of the material is concerned, and no marked patterns stand out when comparing the fragmentation and preservation of gazelle versus fallow deer, albeit the sample size for the former is small (Marder et al. 2011: Table S1). Still, the ecological context of this pitfall trap could affect species abundance. Had this pitfall been located in a primarily mesic environment, more woodland-adapted fallow deer would be expected to be 'sampled' by this natural hole (compare Jelinek et al. 1973). However, as evident from preliminary analysis of micromammal remains and fallow deer tooth mesowear data, the Rantis landscape was somewhat more xeric than the more northern sites located in the Carmel and Galilee (Marder et al. 2011) and fallow deer, therefore, should not be preferentially

deposited there. The great natural abundance of fallow deer in even the more xeric MP landscapes of the Southern Levant further emphasizes the peculiarly inverse prey-choice pattern seen in the anthropogenic caves.

If my suggestion of deliberate human choice for hunting gazelle rather than fallow deer is accepted, what could be the cause of such behavior? Optimal foraging models can hardly explain it. The Mesopotamian fallow deer is much larger on average than gazelle (ca. 50–100 kg vs. ca. 20 kg, respectively; Mendelssohn and Yom-Tov 1999), containing significantly more meat and fat at presumably the same cost of processing, and therefore would yield greater nutritional benefits than gazelle. Perhaps the inferred preference for gazelles is related to novel hunting technologies that are more suitable to hunting in open (gazelle-favored) terrain, such as the development of *long-distance* projectiles—the bow and arrow or spear-thrower (atlatl) and dart. The timing and place in which human populations developed the capacity for 'killing at a distance' is debated. Lithic evidence suggests that this technology came to regular use as late as the late African Middle Stone Age (MSA) or the Eurasian Upper Paleolithic (Shea 2006; Churchill and Rhodes 2009; Shea and Sisk 2010). However, gazelles—which were hunted regularly during the Levantine MP—may be more suitable for capturing with just this complex projectile technology than by spearing from close quarters, as traditionally thought for MP hunting techniques. Indeed, it is hard to envision how a small, agile and steppe-dwelling antelope such as gazelle, which tends to flee at the slightest sign of danger, could be approached closely enough to kill with a thrusting or short-range throwing spear. Close-range hunting with spears is always associated in the ethnographic literature with hunting of larger ungulates, sometimes in wooded settings where it is feasible to approach the animal without being exposed, or to ambush it (e.g., Oswalt 1973; Churchill 1993; Ellis 1997). In spite of the contradictory lithic evidence, it is not inconceivable that long-distance projectiles, perhaps made of perishable materials (see Thieme 1997), were widely used by Levantine MP populations to procure gazelles. Direct evidence for using MP stone points for hunting exists only in conjunction with hunting of larger ungulates (e.g., a wild ass vertebra with an embedded Levallois point, Boëda et al. 1999), not gazelles.

If complex projectile technology was already in use in MP times, the use of such weapons may have been better suited to capturing game that live in open landscapes, where they could be more easily encountered and captured. Such a long-distance hunting technology may have been both safer for the hunter (no need to approach the game closely) and would have provided more predictable results, because of the higher encounter rates in open (gazelle-favored) biomes as opposed to closed biomes, where fallow deer prefer to forage most of the time. Once the ability of hunting at a

distance became available, hunters might have preferred to obtain smaller ungulates (gazelles) at lower search costs than larger ungulates (fallow deer) that are harder to locate. The ecotonal settings of all the sites presented in this study would have allowed access to several types of biomes, enabling the hunters to choose their favorite hunting grounds and consequently their preferred type of weapons and prey.

Long-distance projectile technology is commonly assigned to the modern humans of the late MSA and especially the Upper Paleolithic periods (Shea and Sisk 2010 and references therein). Interestingly, the only site in this study that can be linked to AMH—Qafzeh Cave—is the one most diverging from the general Southern Levantine hunting pattern, displaying relatively low frequency of gazelles and high abundance of larger ungulates (Rabinovich et al. 2004). On the other hand, two Neanderthal sites (Amud and Kebara) conform to the common hunting pattern of preferring open-terrain gazelles (Rabinovich and Hovers 2004; Speth and Tchernov 2007) which may have necessitated some kind of long-distance projectile technology for their capture. Intriguing as these patterns may be, more human fossil data and better chronological resolution are needed to tie human types to prey preferences in the MP of the Levant.

Conclusion

Humans in the MP period of the Southern Levant habitually obtained animal meat and fat by hunting, but their choice of prey taxa—reflecting on the nature of their interactions with the surrounding paleoenvironment—is obscure because of the general lack of non-anthropogenic faunal collections from this region and period that could serve as a natural reference. The recently discovered Rantis Cave, being unbiased by human predation, may serve as such a natural reference, providing an independent measure of the presence and abundance of ungulates in the human landscape. The subsequent comparison suggests that hunters preferred to procure mountain gazelles over fallow deer, despite the ubiquity of the latter and their greater nutritional gains. This pattern seems to commence in the early MP and continues well into the Upper Paleolithic and Epipaleolithic of the region. A possible explanation (but one that relies on circumstantial evidence) may be related to the development of complex projectile technology already in the early MP period, leading to exploitation of more open habitats.

Regardless of whether these suggestions are accepted or not, Rantis Cave demonstrates the value of the newly recognized 'natural' accumulations for the purpose of reconstructing human prey-choice in the Levantine MP. Were hunting preferences based upon opportunistic encounters with game, dictated by the natural availability of game in the region (e.g., Bar-Yosef 2004; Stiner 2002); or were the hunter's preferences strongly guided instead by traditions, cognitive capacities, ease of capture, technological means or socio-political reasons (e.g., Klein 1989; Speth 2010)? With the flow of new data and the discovery of sites of various types in recent years, we may be able to progress towards deciphering this fundamental problem in a significant period of human evolution.

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