THE ROLE OF HUNTING IN PRE-POTTERY NEOLITHIC PASTORALISM AND ITS ECOLOGICAL IMPLICATIONS: THE BASTA EXAMPLE (JORDAN)

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Résumé

Le rôle de la chasse dans le pastoralisme néolithique précéramique et ses implications écologiques : l'exemple de Basta (Jordanie).

La fouille du site PPNB final de Basta (près de Petra, Jordanie) a livré une grande quantité de restes animaux, principalement des moutons et des chèvres domestiques. La question discutée ici est de savoir à quel point la chasse des gazelles, des équidés, des cervidés et autres ongulés sauvages jouait toujours un rôle crucial dans la vie des éleveurs qui occupaient Basta il y a 9000 ans. Le possible impact de ces activités sur la faune de la région de Petra est examiné. De plus, l'article analyse les facteurs qui peuvent avoir influé sur la fiabilité des considérations écologiques et économiques tirées des données ostéologiques présentées ici.

Mots clés

Basta, Jordanie, PPNB final, Archéozoologie, Chasse, Anthropisation.

Summary

Excavations at Late PPNB Basta (near Petra, Jordan) have yielded large amounts of animal remains, mainly from domesticated sheep and goats. The degree to which the hunting of gazelles, equids, cervids and other wild ungulates still played a crucial role in the life of the pastoralists inhabiting Basta 9000 years ago is discussed, as is the possible impact of these activities on the fauna in the Greater Petra region. In addition, the paper focuses on those factors that might influence the reliability of ecological and economic considerations, as ascertained from the osteological data presented.

Key Words

Basta, Jordan, Late PPNB, Archaeozoology, Hunting, Human impact.

Introduction

Archaeozoological research over the last decades has produced solid information that goat and sheep husbandry had become an established form of subsistence strategy in the Levant during the Late Pre-Pottery Neolithic B (= Late PPNB; Legge, 1987; Bar-Yosef and Meadow, 1995: 82ff.). From that period onwards, herding of domesticated ruminants was a dominant factor of economy being characteristic for a "pastoral" way of life. Although we seem to know a lot about pastoralism in general, this topic is still full of questions. For instance where does pastoralism originate; how can it be defined explicitly; does pastoralism rely exclusively on the management of domestic ruminants; how far can the whole variety of pastoral strategies, including transhumant elements, be evidenced by slaughter and consumption refuse at all (e.g. Chang and Koster, 1986; Wattenmaker and Stein, 1986; Schepartz, 1989; Cribb, 1991; Rollefson and Köhler-Rollefson, 1993 *versus* Perrot, 1993 and Ducos, 1993; Meadow, 1996)?

The faunal material excavated in Late PPNB Basta provides an excellent opportunity to approach this problem. Basta is among the largest sites of the Late PPNB in the Levant, located at about 1400 m above sea level amidst a rocky limestone area, not far from the famous Nabatean site of Petra, Jordan. It was excavated from 1986 onwards under the joint directorship of H. J. Nissen (Free University Berlin) and M. Muheisen (Yarmouk University Irbid; Nissen *et al.*, 1987). The main occupation phase has lasted for about 4 to 500 years. Two radiocarbon dates are available to date: 7550-7050 calBC and 7290-7032 calBC (Neef, in press). The excavations yielded large quantities of faunal material that proved to be extremely informative.

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Preliminary archaeozoological results and discussions were already presented in some short papers (Becker, 1987, 1991a and b; Nissen, 1993). A detailed study on caprine remains will be published soon (Becker, in press). It can be already summarized that the inhabitants of Basta chiefly depended on flocks of sheep and goats, but also hunted wild animals, cultivated food plants (Neef, in press) and presumably were engaged in trading processes. The problem here is how to calculate the degree of their dependence upon pastoral and non-pastoral products and furthermore if these activities had any considerable ecological impact, comparable to the impoverishment of fauna as it is proclaimed for 'Ain Ghazal (Rollefson and Köhler-Rollefson, 1989).

In the course of several excavations at Basta (1987-1989) and laboratory work, I analyzed about 68,000 bones, being excavated both in area A and B (Becker, 1991a: 61). The paper presented here focusses on the corpus of data, deriving exclusively from area A. This material counts more than 38,000 bones of which 54.2% were allocated to species and genera (tab. 1). As can be seen in table 2, the spectrum of mammalian species is considerably broad. Hares, equids, wild cattle and gazelles are represented in larger numbers. *Ovis* and *Capra* make up the lion's share. Their taxonomic abundances are estimated from the proportions implied by definitely identifiable elements in area A (n = 1022; Becker, in press: tab. 8). Doing so, I intentionally ignore that strictly seen, more than 90% of the caprine elements neither are clearly designable to species level nor to their status as coming from a wild or domestic animal. The low rate of identificability was caused by the extremely high degree of fragmentation. In regard of the particular considerations outlined here and also based on my particular familiarity with this large material, I estimate the amount of domestic *versus* wild caprines to 85:15%. From this estimation, I finally calculated the numbers, given in tables 2-5. That in fact the largest part of the caprine bones derive from domesticated animals can be emphazised from various metrical analyses[1] and the age profil. The latter evidences particular slaughtering patterns which are typical for the keeping of domesticated sheep and goats (Hesse, 1982). Most obviously meat was the main target of the Basta pastoralists, as seen from the survivorship curves (fig. 1) which compare recent data and those from Basta[2]. Indications of a specialised pastoralism, focussing on milk and wool, are not visible (cf. Levy, 1983). The same goes for transhumant activities which in

Table 1: Basta, Area A. Faunal remains. Rate of identification.

Category	*Bone count*	*%*	*Bone weight*	*%*
Identified	20829	54.2	99675	80.7
Not identified	17604	45.8	23776	19.3
Total	38433	100.0	123451	100.0

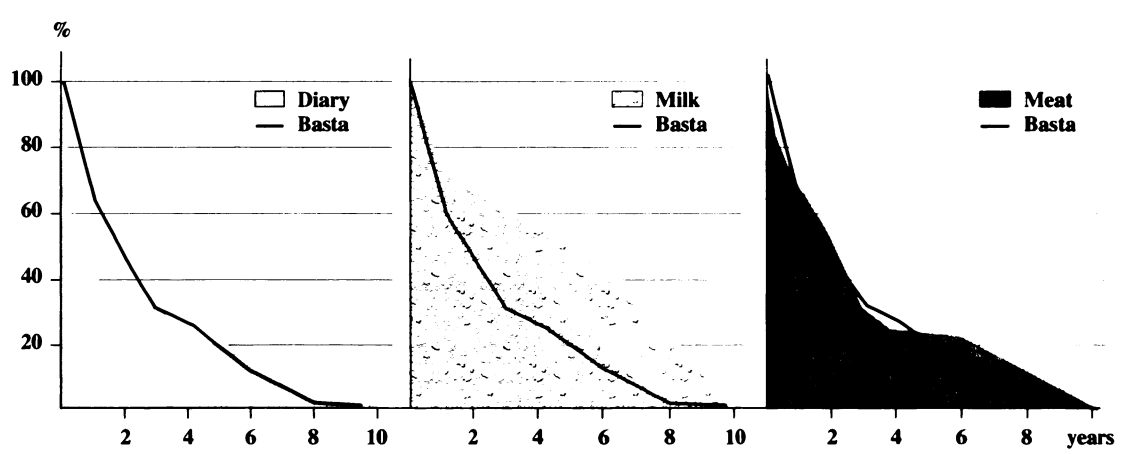

Fig. 1: Caprines. Comparison of survivership curves - data from Basta *versus* recent data (from Stein, 1987).

[1] Including divariate plotting of measurements, size index calculation and principal component analyses (Becker in press).

[2] More details are given in Becker (in press).

Table 2: Basta, Area A. Faunal remains. Mammalia. Species list in taxonomic order plus bone count (state of research 1995).

Order	Species	Bone count
Insectivora	*Erinaceus europaeus*	1
Lagomorpha	*Lepus capensis* - hare	274
Carnivora	*Canis familiaris* - dog	9
	Canis aureus - jackal	6
	Vulpes vulpes - red fox	5
	? Caracal caracal - caracal cat	1
	Martes sp. - marten	3
	Meles meles - badger	7
Perissodactyla	*Equus hemionus* - onager	431
	Equus africanus - African wild ass	
Artiodactyla	*Sus* cf. *scrofa* - wild boar	40
	Cervus elaphus - red deer	5
	Cervus dama mesopotamica - Persian fallow deer	6
	Capreolus capreolus - roe deer	2
	Bos cf. *primigenius* - aurochs	649
	Gazella subgutturosa - goitred gazelle	1769
	Gazella gazella - mountain gazelle	
	Capra aegagrus - wild goat	1800
	Capra hircus - domesticated goat	10199
	Ovis orientalis - wild sheep	771
	Ovis aries - domesticated sheep	4371

Table 3: Basta. Area A. Faunal remains. Mammalia. (the numbers for *Capra* and *Ovis* are projected).

Species/genus	Bone count	%	Bone weight	%
Capra aegagrus	1800	31.3	6701	15.0
Gazella subgutturosa/ gazella	1769	30.8	6246	14.0
Ovis orientalis	771	13.4	2872	6.4
Bos cf. *primigenius*	649	11.3	19028	42.6
Equus hemionus/ africanus	431	7.5	8682	19.4
Lepus capensis	274	4.8	393	0.9
Sus cf. *scrofa*	40	0.7	562	1.3
Cervus/Dama/ Capreolus	13	0.2	216	0.5
Total	5747	100.0	44 700	100.0

Table 4: Basta. Area A. Faunal remains. Frequencies of domestic *versus* wild animals.

Category	Bone count	%	Bone weight	%
Domestic	14579	70	54272	54
Wild	6250	30	45403	46
Total	20829	100	99675	100

the strict sense of the term cannot be evidenced from the Basta bone record. Neither do we know how many nomadic herdsmen once belonged to the Basta community nor can we estimate in what distance flocks of sheep and goats were kept - far beyond the bounds of cultivated land or in the vicinity of the site?

Goat as well as sheep husbandry was well advanced at Basta. The probability that the urus and the wild boar were already involved in the process of domestication is less clear and still open. Only the dog can be added to the number of fully domesticated species. If we lump together all assignable animal remains, the relation of domestic *versus* wild animals amounts to 70:30 on the basis of bone count.

If we now consider the relative abundance of particular wild ungulates, wild goats and gazelles dominate with almost 31% each (tab. 3). Wild sheep, urus and onagers plus African wild asses come to 13%, 11% and 8%, respectively. The species mentioned are of different size and weight. Thus, they provide differing amounts of meat. We know that this quantity and the weight of the animals' skeleton are correlated with each other (Uerpmann, 1973, 1992). Using this method, differing fragmentation patterns as well as varying age profiles, which presumably do occur among the species considered here, can be neglected. Despite some critical voices (e.g. Casteel, 1978; Gilbert and Singer, 1982), an intersite comparison of bone weight therefore is far more decisive than the pure bone count in order to assess which quantities of meat each species once delivered. If we consider the bone weight, wild cattle and equids exhibit 43% and 19%, whereas wild goats (15%), gazelles (14%) and wild sheep (6%) are now placed at the third to fifth rank (tab. 3). If we investigate the relation of domestic *versus* wild on this basis, then the data of wild animals increases from 30% to 46% (tab. 4). These impressive results underline that although caprine husbandry was a crucial element of food procurement, the consumption of game still was of substantial importance. That meat from hunted animals

was consumed to such a high degree should have awakened interest for secondary products within the management of domestic sheep and goats - if we indeed understand the role of flocks as a capital which should not exclusively be consumed. This management of caprines is called "carnivorous pastoralism" (Prescott, 1995: 166). Anyhow, it is not surprising that in this early phase of pastoral strategies, the corpus of data from Basta does not yet reflect the exploitation of milk and wool. We cannot exclude that a development in this direction might have been on its way already.

Critical factors of interpretation

If we now turn to the aspect of ecological implications, some crucial points should be discussed in advance. Any further interpretation of the data highly depends on an undisputable identification and quantification of all species represented here. Unfortunately several obstacles prevent final conclusions.

1) After decades of research and discussions, the identification of sheep and goat elements is hopefully on the way to being solved (Boessneck *et al.*, 1964; Payne, 1969; Clutton-Brock and Uerpmann, 1974; Noddle, 1978; Davis *et al.*, 1982; Clutton-Brock *et al.*, 1990; Buitenhuis, 1995), although some scepticism should be got in, anyhow. If a material is very small and fragmented, there may be doubts about the validity of osteological identification. However, in the case of the abundant Basta finds, the chance of gaining experience with sheep-goat-differentiation is great. Consequently any confusion for example between sheep and ibex - which E. Tchernov (1993: 24) is suspicious of - or ibex and goat - as A. Wasse (1994: 25) claims - is in my opinion rather small.

2) No common agreement has yet been reached where to draw a metrical line between bones of domesticated and wild caprines within the same complex. If the existence of domesticated animals at all or the ratio of domestic *versus* wild animals is an unknown quantity, a reconstruction of subsistence strategies or ecological development is difficult, if not pointless. Again the data base from Basta is large enough to indicate from the intersite where to draw this line with some confidence (Becker, in press).

3) A particularly thorny problem in Basta and every other site in this part of the Levant is the identification of gazelle species. Theoretically one might expect three species: *Gazella subgutturosa, G. gazella* and *G. dorcas*. The osteology of these closely related species has not been researched in detail until now. Except for horncores and complete skulls, specific identification of isolated and fragmented postcranial elements beyond the genus level is extremely difficult. Although differences in absolute size do occur, the variations of bone measurements do overlap considerably. Furthermore, these data are influenced by the geographical provenience of particular populations; the shifting of distribution areas in prehistoric periods has not been evidenced yet (Uerpmann, 1982: 27). However, it is important to know more than simply "gazelles are represented in the bone material here". Their biological demands, their behaviour and their preferred habitat differ; some are migratory, others not; some have small, others large home territories; furthermore they have a divergent distribution history in the southern Levant (Mendelssohn, 1974; Simmons and Ilany, 1975-1977). In the Basta material only a few horncores, identifiable with some confidence, support the assumption that *G. gazella* as well as *G. subgutturosa* are represented here (Becker, 1991a: 68). The postcranial elements, to a certain extent inhomogeneous from their morphological character, most probably belong to these two species as well. Nonetheless the presence of some *dorcas* bones cannot totally be excluded. The existence of goitred gazelles this far south is most controversial. They have otherwise been identified only in 'Ain Ghazal (Köhler-Rollefson *et al.*, 1988: 425). Independently from my research, Söffner (1996) analysed some gazelle bones from another excavation area in Basta and nearby Ba'ja. In both cases, he identified horncores from *G. subgutturosa*. The author quite convincingly argues that a small subspecies of the goitred gazelle, *Gazella subgutturosa marica*, was distributed in the steppe region east of Basta (Söffner, 1996: 122). Mountain gazelles for their part once were wide spread over large areas in the eastern Mediterranaen region, mainly on the plateaus and hills west of Basta. Most remarkably, all Natufian and PPNA sites in the southern Levant have evidenced bone remains of *G. gazella* only (Tchernov, 1994: 55ff.), although today the distribution area of *G. dorcas* covers large parts of the southern Sinai. *G. dorcas*, the smallest species among the three, is a typical northern African faunal element. It is not known precisely when *G. dorcas* really entered the Sinai peninsula (before, during or long time after the Neolithic).

4. Another problem concerns the quantification of equid bones which actually are the remains both of *E. hemionus* and *E. africanus*. Although the evidence is sparse, we know today that the African wild ass once was not only widespread over the whole of Saharan Africa, but also over parts of the Arabian peninsula. In prehistoric

times, the range overlapped with that of the onager in the southern Levant and reached even the Basta region (cf. Uerpmann, 1987b: 25ff). In the equid material excavated, an undisputable identification was only possible from completely and almost completely preserved elements which are in the minority (Becker, 1991a: 71)[3]. Among these, the ratio of *E. hemionus versus E. africanus* comes to 50:50%.

5. Before we use the faunal list as a direct indicator for ecological considerations, the effect of the anthropogenic filter, biassing faunal samples, has to be taken into account. I do not want to expand on these arguments here (see Gilbert and Singer, 1982; Becker, in prep.), but just touch on this important topic to avoid a too much simplistic view on the data. It is quite plausible that the spectrum of species listed here is correlated to the fauna living in the vicinity of Basta at that time. People selected the most profitable and most conveniently accessible species. The availability depended on species biology, migration patterns, herd densities, escape distance and speed, topography of the landscape and so on. Furthermore, through processing of carcasses and distributional patterns, the choice of the excavation area, sampling methods and taphonomic loss the bone material is filtered to an unknown extent (Studer, 1992; Lyman, 1994). The absence or presence of a species in a bone material may even be dictated by particular hunting habits, culinary taste, taboos on particular species or the like (Buitenhuis, 1996). Consequently, consumption residue does not neccessarily offer a clue for reconstructing or understanding paleo-ecology in all its dynamic aspects, yet it offers even larger clues for human behaviour. Some colleagues even suspect that certain results might be an artefact of the analysis rather than reflecting the presumed reality beyond the data.

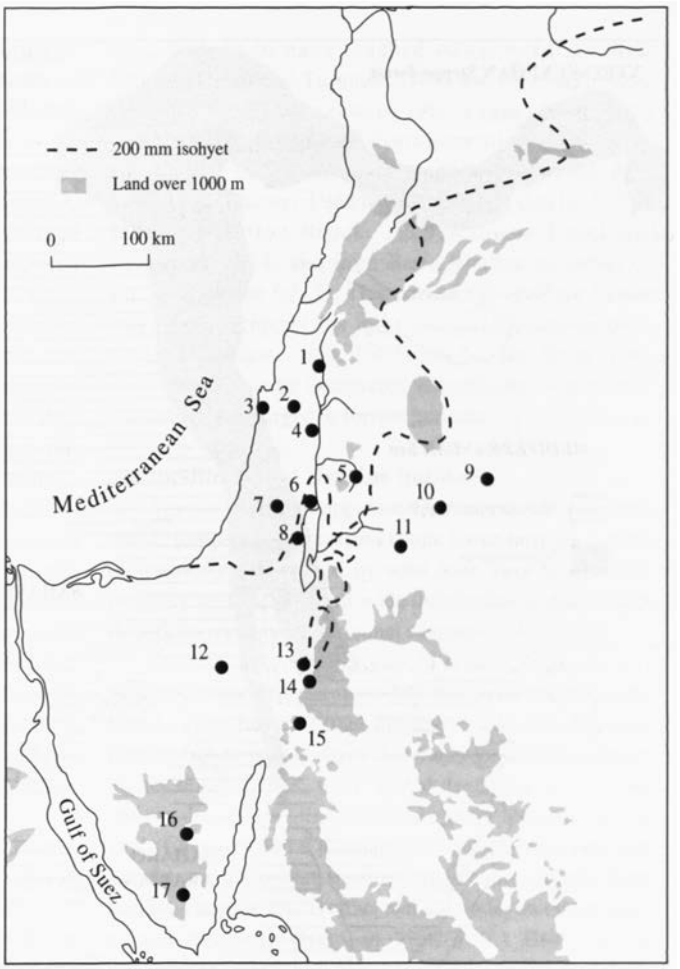

Fig. 2: Prehistoric sites mentioned in the text. The numbered localities are: 1, Beisamoun; 2, Yiftahel; 3, Nahal Oren; 4, Munhatta; 5, 'Ain Ghazahl; 6, Jericho; 7, Abu Gosh; 8, El-Khiam; 9, Dhuweila; 10, Azraq; 11, Wadi Jilat; 12, Abu Salem/Rosh Horesha; 13, Beidha; 14, Basta; 15, Wadi Judayid; 16, Wadi Tbeik; 17, Ujrat el-Mehed (drawing: P. Kunz).

6. The information about the potential PPNB fauna of the southern Levant is still very patchy. This is caused not only by the low number of comparable sites (fig. 2). These sites exhibit very different characters varying from large settlements/towns such as Basta, villages such as Beidha (Hecker, 1982) to hunting camps such as Azraq (Martin, 1992), Jilat (Martin *et al.*, 1994) or Dhuweila (Garrard *et al.*, 1994, 1996). They are located in different ecozones with different plant cover and wildlife and thus exhibiting different subsistence strategies which clearly constrast one from each other (cf. vegetational map in Bar-Yosef and Belfer-Cohen, 1989a: 449 reproduced in fig. 3; Helms and Betts, 1987; Bar-Yosef and Belfer-Cohen, 1989b; Horwitz, 1993). Furthermore, sample size varies considerably as does the status of analyses and publication, concerning all data neccessary.

[3] More than three-quarter of the equid remains from Basta are heavily fragmented and thus only identifiable at a genus level.

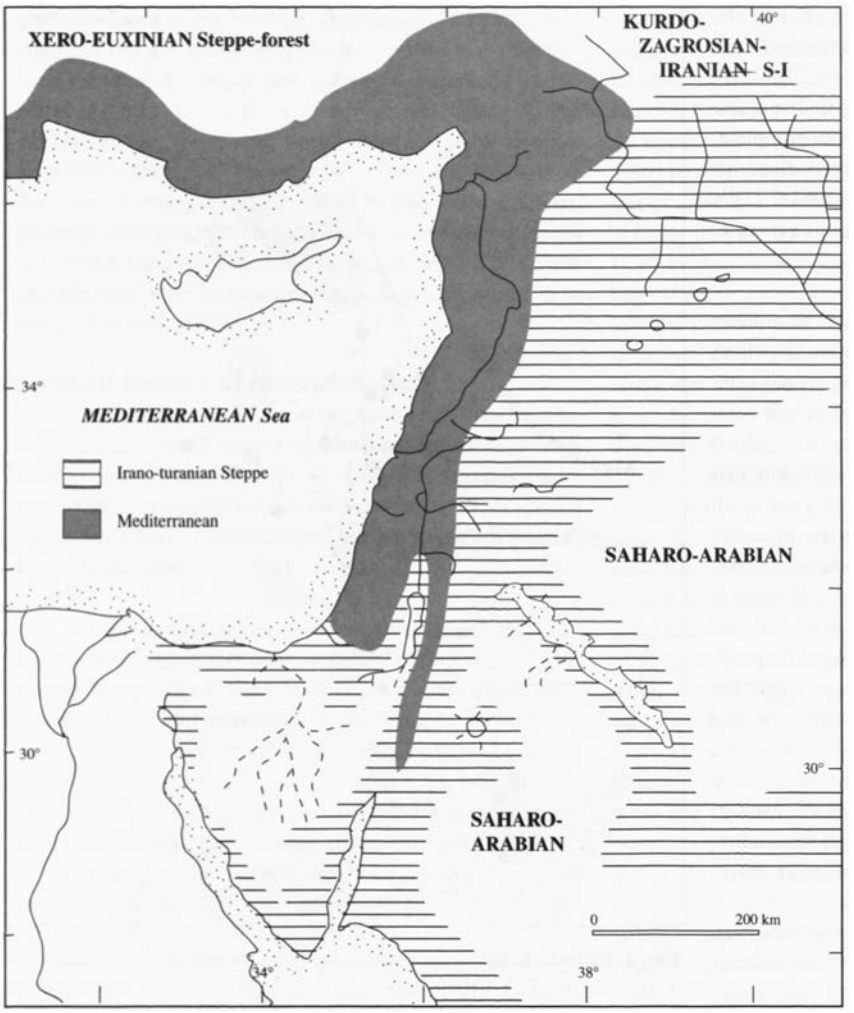

Fig. 3: Vegetational map of the Levant (from Bar-Yosef and Belfer-Cohen 1989a: 449).

Anyhow, a sterile scepticism will lead to nothing. We have to work with the information at hand to reconstruct the former ecological setting indicated from the Basta bones. It can be divided into three main types: the steppe environment, the mountainous-hilly region and the steppe-forest and riverine habitats.

Ecological setting

Steppe environment

There are two species in the Basta ungulate material which can be called typical inhabitants of a steppe environment: *Equus hemionus* and *Gazella subgutturosa*. They feed on a large variety of food plants and are able to profit by meagre halophytic vegetation.

E. hemionus is also known as the half-ass, the Asiatic wild ass or the onager. During summer months, groups of 10-20 onagers occupy a territory of 10-15 square kilometres around a water-hole. In winter, when the water regime is more favourable, the territory might be enlarged five times. The animals have to drink every day, although they tolerate up to three days without water. According to season, their diet varies greatly. Onagers prefer lush low-growing plants, but also feed on salty herbaceous vegetation. During the year onagers tend to change their territory. Unfortunately exact observation concerning these routes do not exist for the Levant (Heptner *et al.*, 1966; Groves, 1974; Clutton-Brock, 1992: 36ff.).

Gazella subgutturosa is among the largest and heaviest species of the gazelles (shoulder height up to 61 cm, weight 14-23 kg). Concerning their demands, goitred gazelles are even more unpretentious than sheep and goats. Unfortunately the behaviour of the goitred gazelle in the Near East is not as well known and studied as that of the dorcas and mountain gazelle. Observations made earlier in this century suggest that at least in spring and early summer, these gazelles do live in large herds, composed of animals of every age and sex. Goitred gazelles have large home territories and migrate over distances of hundreds of kilometres (Legge and Rowley-Conwy, 1987).

Mountainous-hilly region

To the west and southwest of Basta, the topography changes and biotopes with different fauna can be expected. As already mentioned, *Gazella gazella* (mean weight 25-18 kg) inhabited the western plateaus and, to a certain extent, mountainous environments. This species prefers open country with few trees and bushes, it grazes and browses a large

variety of plants, even succulents. In contrast to *G. subgutturosa*, *G. gazella* changes very little in terms of actual migration. It is basically sedentary and lives within rather restricted home ranges. Females and young animals of the mountain gazelles, however, are more sedentary than bachelors which move in groups of varying sizes around the margins of territories controlled by dominant males. Gazelle densities range from 70 per square kilometre in watered areas to about 10 in steppe environment (Baharav, 1974).

Mountain gazelles share this habitat with the African wild ass *Equus africanus*. These elegant, fine-limbed animals inhabit not only rocky landscapes but also grass covered plains and hilly ranges. They thrive well in any dry, stony area with scrub vegetation and a supply of water within two or three days reach. Wild asses move quickly in difficult terrain and are good climbers (Clutton-Brock, 1992).

Wild goats (*Capra aegagrus*) are also typical mountain dwellers. They inhabited the craggy terrain of the Levant. Because of their agility, they reach herbs and leaves of shrubs in even extremely difficult terrain. They have relatively short escape distances, feeling safe in this highly structured and remote ground. They are hard to follow for hunters. Although wild goats are good and fast climbers, their slow gait on level ground makes them vulnerable to predation and thus restricts their home range here, which is seldomly more than 25 square kilometres (Rollefson and Köhler-Rollefson, 1993: 40). Wild goats are well known from many Late Pleistocene and Early Holocene sites in Lebanon, Syria, Jordan and Israel as far south as Basta. At that latitude their distribution seemed to overlap with the ibex (*Capra ibex*) which is thought to have inhabited the Negev, Sinai and southern Jordan, although the ibex evidence is somehow debatable. So far, ibex are only encountered in Beidha, in Middle PPNB contexts of Wadi Tbeik (Tchernov and Bar-Yosef, 1992) and in Late PPNB layers of Ujrat el-Mehed (Dayan *et al.*, 1986; see fig. 2). In both cases ibex is the dominant species. Populations of Nubian ibex are sparse, yet widely distributed in the Sinai peninsula even today (Baharav and Meiboom, 1982).

In contrast to wild goats, wild sheep (*Ovis orientalis*) are less restricted to particular habitats. They thrive well on many types of shrub vegetation. These animals are not only good runners, but also agile climbers. Consequently, they can be found in relatively flat areas (as long as there is enough shelter), in hilly regions and even in mountainous terrain. A high structured landscape characterises their main home range. Bones from wild sheep are well known from several Epipalaeolithic and aceramic Neolithic sites in northern Syria (just recently Cavallo, 1997), Iraq and Jordan. Their natural range in Western Asia seemed to have reached down as far as Wadi Judayid (Henry and Turnbull, 1985) and Abu Salem/Rosh Horesha, in the Negev (Davis, 1982; Legge, 1996). There is less agreement about the distribution of wild sheep during the Late PPNB. However, there are some finds from Munhatta (Ducos, 1968), Beisamoun (Davis, 1978), Jericho (Clutton-Brock, 1979; Clutton-Brock and Uerpmann, 1974) and from Basta (Becker, in press; for site location see fig. 2). This part of the southern Levant may in fact pinpoint the most southern borderline of its range (Uerpmann, 1983, 1987a and b). The Basta specimens could also be interpreted as remnants of a population which was larger in former periods.

Steppe-forest and riverine habitats

The so-called steppe-forest environment with open wood (juniper, pistachio) and fringe forest near the borders of wadis were inhabited by wild boar, cervids and most probably wild cattle. Their wide distribution is indicated by their occurrence in many faunal samples of this region.

Cervids are generally said to require large areas of high and dense vegetation to find cover and adequate food plants. They have a broad biological tolerance although Persian fallow deer (*Cervus dama mesopotamica*) tolerates higher temperatures, whereas red deer (*Cervus elaphus*) and roe deer (*Capreolus capreolus*) prefer temperate woodland (Chapman and Chapman, 1975). Also wild pigs (*Sus scrofa*) are quite heat sensitive and require steady water supply. They are omnivorous and live today in dense thickets and reed jungle (Harrison, 1968: 375f.). Their presence in the Basta material implies a substantial expence of dense vegetation.

Similar demands can be quoted for the urus or aurochs (*Bos primigenius*), although we do not know the detailed biology of this extinct animal. A species ranging over so vast an area in former times would be expected to show considerable variability in its biological demands. Aurochsen are said to be non-obligatory grazers, but presumably did not survive exclusively on grass and herbs but also consumed leaves. Woodland refugia in sheltered valleys and along the wadis might be their preferred habitat. Wild cattle however can be found at nearly every site, seemingly independent of the different water regime in these regions. Due to their physiological and metabolic conditions, modern races of cattle cannot withstand drought and evaporation that easily (Schmidt-Nielsen, 1964: 71ff.). Anyhow, the adaptability of the wild forebears may have been broader than can be deduced from the biology of animals living nowadays (Epstein and Mason, 1984; Uerpmann, 1987b: 71ff.).

Table 5: Basta, Area A. Mammalia. Distribution of species to habitats.

Environment	Bone count in %	Bone weight in %
Steppe/arid	39.3	24.6
Mountainous/hilly	48.5	31.1
Steppe-forest/wadi	12.2	44.3

Discussion and conclusions

In summary, the Basta bone sample provides data which reflect the exploitation of a broad spectrum of animals, that live in very different biotopes. Judging from the bone count of species, the Basta material witnesses an increased exploitation of the mountainous and hilly regions. Based on the bone count, it reaches 49% (tab. 5). But the patterns of exploitation also concentrated regularly on the steppe environment (39%). This is not surprising, since Basta is located in the Irano-Turanian steppe zone with typical steppe vegetation, dominated by grasses and dwarf shrubs (Neef, in press). The focus on the more humid regions near wadis (12%) with a much richer plant cover was much more restricted. Again we are confronted with slightly differing results, if we consider the bone weight: the meat requirement from the steppe environment decreases from 39% to 25%, the one from the hilly-mountainous region from 48% to 31% in accordance with an increase of the so-called forest element from 12% to 44% (tab. 5). This is due to the repertoire of species living in this particular habitat, which are nearly all of large body size (aurochs, cervids) and/or of heavy weight like the wild pigs.

It is undisputable that the inhabitants of Basta supplemented their diet with game. Question is if this was an alternative food supply of seasonal significance, a neccessity in times of husbandry crisis or crop failure or some sort of luxurious food the whole year round. Furthermore, we don't know if the inhabitants practised hunting by themselves or if they profitted from an exchange system with people living in the steppe areas - people who still practised hunting on a larger scale. I think it is a generally accepted view that the inhabitants of Basta were involved in a net of communication and commerce. The existence of exchange systems and trade routes can be traced archaeologically within the Late PPNB. In addition to local networks, long-distance exchange e.g. with obsidian from Anatolia (Gratuze *et al.*, 1993) and with shells from the Red Sea is reflected in Jericho, Yiftahel, Abu Gosh and 'Ain Ghazal (Bar-Yosef and Meadow, 1995: 80; see fig. 2). From PPNA contexts in Hatoula, S. Davis (1989: 46) has proclaimed an increase of fish which is supposed to be catched in the Mediterranean Sea and brought over 30 km to the site. Some sort of food obviously might be imported by the local people of Hatoula. Why then acquisition of game might not have been a most welcome side-effect of trading activities during the Late PPNB in the Greater Petra region also?

One can imagine that within the easy reach of the large Basta community, faunal wildlife was exhausted, degraded. A certain need of supplementary food could have made it neccessary to intensify the contact with hunting groups living in greater distances. In this case, the inhabitants of Basta most probably would have received previously butchered carcasses. Especially for the larger species such as cervids and equids a delivery of body parts seems feasible in order to lighten excess

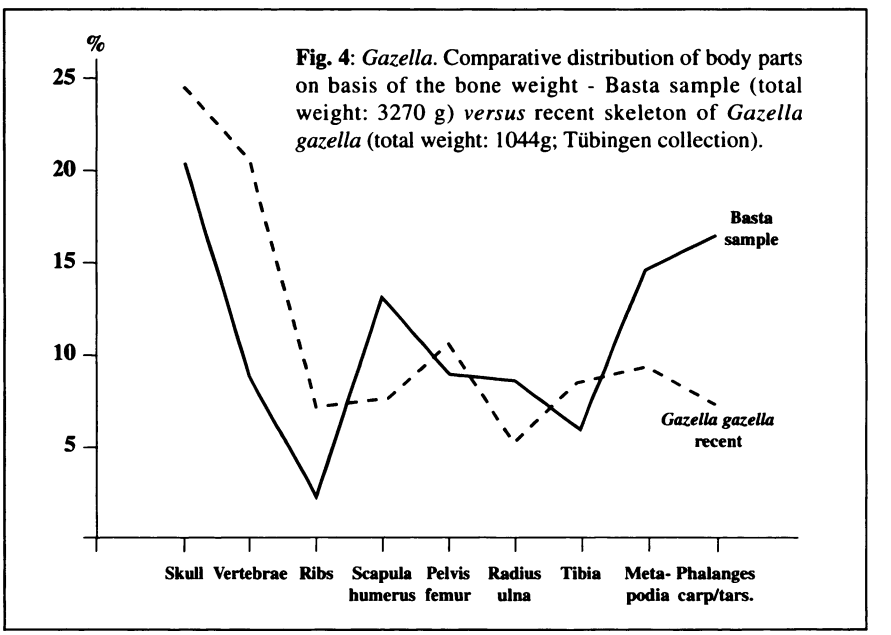

Fig. 4: *Gazella*. Comparative distribution of body parts on basis of the bone weight - Basta sample (total weight: 3270 g) *versus* recent skeleton of *Gazella gazella* (total weight: 1044g; Tübingen collection).

weight for transport. The perishability of meat and the costs of transport also have to be considered. Such an activity should be reflected in the bone sample, indicated by the selectively biassed distribution of body parts. But this is not the case.

The distribution of skeletal elements indicates that all parts of the carcasses are represented in more or less regular quantities. That accounts not only for the smaller and middle-sized species, but also for the large ones such as onagers. The distribution of the gazelle bones is a useful example (fig. 4)[4]. Although the representation of skeletal elements in the Basta faunal sample clearly is influenced by several other factors such as the low identificability of vertebrae and ribs, there is no evidence of a considerable overrepresentation of particular body parts, rich in meat. On the contrary, the relatively high amount of meatless elements such as metapodia and phalanges is striking. Consequently, there is no reason to assume that these animals were not carcassed within the boundaries of the settlement. It is from this perspective to argue that most of the game was hunted by the inhabitants of the site themselves. Many of the species indicated, for example wild cattle, wild boar, cervids and mountain gazelles inhabit small home ranges. Hunting could be pursued within the relatively restricted territories of these species, providing predictable resources for meat and raw material all year round. This type of meat procurement was facilitated by the location of Basta at the interface between different vegetational zones and altitudes (see fig. 3). The faunal data reflect an opportunistic, flexible hunt which may also be characterized as encounter-orientated. We can infer that while travelling over land to predictable resources, human foragers could encounter at any certain season specific wild animals or particularly composed groups of animals. We also have to consider time and distance, two factors which would limit the effectiveness of such activities. All these aspects would have formed the strategy for exploitation of the whole area around Basta. If we follow this line of argument, it seems quite logical to presume that, despite the large pasture requirements of sheep and goats, the environment of Basta was still rich in natural resources. Any kind of an impoverishment of wildlife can at least not be recognized in the Basta material. A dramatical impact on the natural wildlife is neither evidenced from the animal bones presented here nor from the analyses of botanical remains (Neef, in press). Whatever happened later on, is beyond the focus of our material.

Due to the broad variety of evidence, the data from the Basta faunal sample are excitingly informative and at the same time double-edged. They confront us with all the weak points in research methods but also indicate fruitful analytical pathways towards a picture of human subsistence strategies during the Late PPNB. From the osteological results and economical considerations one can state that the inhabitants of Basta did not form a completely pastoral society, but profitted from the large variety of natural resources offered in the immediate vicinity of the site, thus establishing a rather diversified system of food procuring strategies. This may illuminate either an emerging cultural complexity or the adherence to traditional patterns of food acquisition or both.

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