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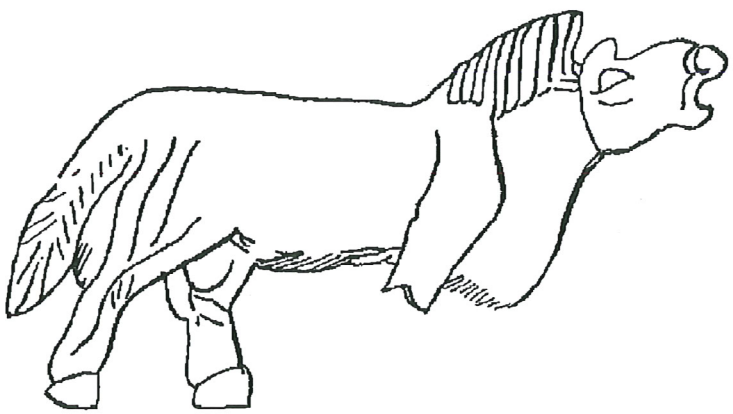

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VOLUME B

BONE AND SPECIES DISTRIBUTION IN LATE PPNB BASTA (JORDAN) - RETHINKING THE ANTHROPOGENIC FACTOR

Cornelia Becker[1]

Abstract

The term "anthropogenic factor" is understood here as a sum of all human activities that influenced the character of this particular bone assemblage excavated in Late PPNB Basta. I would mainly like to address three points from these many and varied aspects: The impact of human activities on nature in this part of the Southern Levant, the choice of species as a mirror of human subsistence strategy practised by the inhabitants and the accumulation history of the bone material within the architectural context of this site.

Résumé

«Facteur anthropogénique» est entendu ici comme une somme de toutes les activités humaines ayant influencé le caractère de l'assemblage osseux des niveaux PPNB anciens de Basta. Parmi ces aspects nombreux et variés, je voudrais aborder surtout trois points: l'impact des activités humaines sur la nature dans cette partie du Levant Sud, le choix des espèces comme reflet des stratégies de subsistance humaine pratiquées par les habitants et l'histoire de l'accumulation du matériel osseux dans le contexte architectural de ce site.

Key Words: Basta/Jordan, Late PPNB, Bioclimatological Setting, Exploitation of Resources, Accumulation History.

Mots Clés: Basta/Jordanie, PPNB Final, Contexte bioclimatologique, Exploitation des ressources, Histoire d'accumulation.

Introduction

The framework for my considerations is given by the socio-economic development during the Pre-Pottery Neolithic B in the Southern Levant which is focused upon in many discussions (e.g. Bar-Yosef and Belfer-Cohen 1989; Gebel 1992; Tchernov 1998). The Late PPNB, a period which roughly refers to the second half of the 7th millennium BC, witnessed the growth of sites of considerable size and remarkable architecture. Large amounts of faunal refuse and silex were unearthed. Several impressive items such as animal and human figurines, beads and arm rings have been found. The site of Basta, for which some general information is given in the appendix, is not at all unique in this scenario as evidenced during a conference on "Central Settlements in Neolithic Jordan" (Gebel *et al.*, forthcoming). It is not a purely accidental phenomenon that Basta and other large sites were abandoned at the end of the Late PPNB. A lively picture of a similar situation can be recognised in the neighbourhood of the excavation: The old village of Basta, characterised by flat-roofed houses and narrow pathways was given up by its inhabitants years ago. It is now used as a sheep cote (Fig. 1).

The abandoned Late PPNB sites were never reoccupied. People settled in new localities, possibly using different subsistence strategies. The circumstances which led to this abandonment have been the subject of growing interest in archaeology. Gary Rollefson and Ilse Köhler-Rollefson see one of the reasons in a devastation of wildlife and a degradation of plant cover, as can be deduced from the osteological record in 'Ain Ghazal (Rollefson and Köhler-Rollefson 1989; Köhler-Rollefson and Rollefson 1990). The question arises whether or not this explanation is also valid for sites in the Southern Levant. As was already mentioned Basta, too, was deserted during this period - but why? In discussing this issue from an archaeozoologists' point of view, I particularly want to focus on the possibilities which are offered from the archaeobiological disciplines.

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Fig. 1a. The old village of Basta (Photo: M. Nissen)

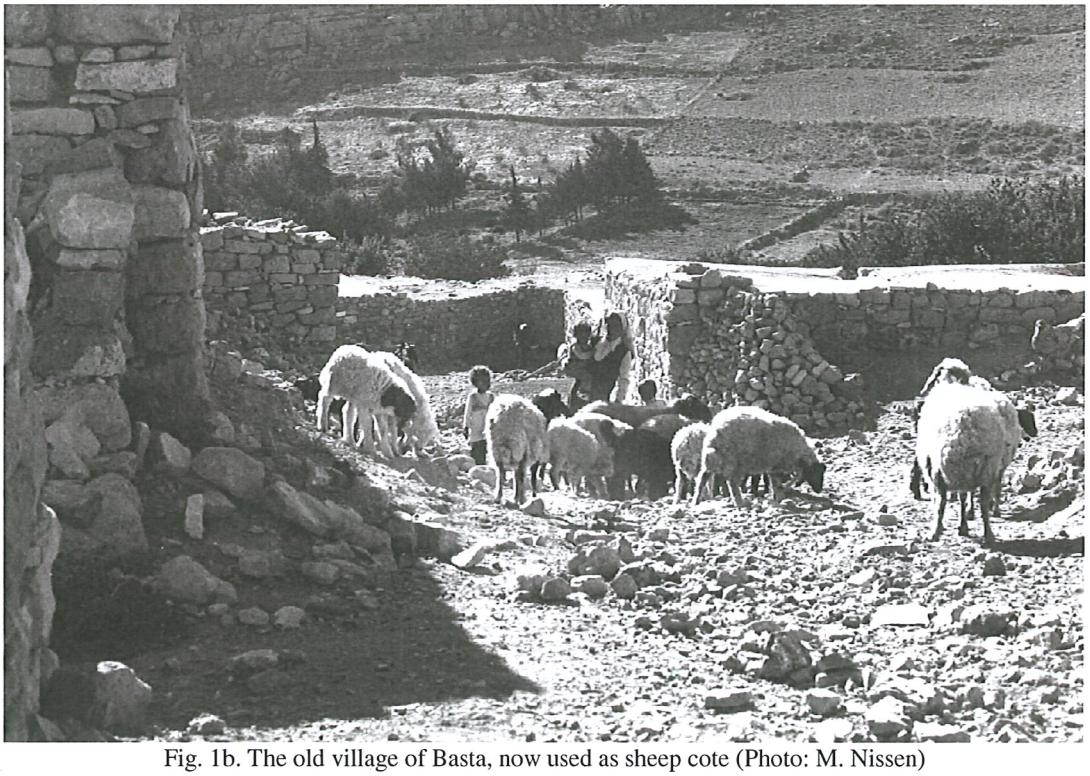

Fig. 1b. The old village of Basta, now used as sheep cote (Photo: M. Nissen)

Archaeobiological background

Jordan is a country with a remarkably high variation in landscapes and bioclimatic zones. Over small distances, the rainfall variability is as great as the (potential) diversity in plant cover. More than 90 % of Jordan lies in the arid zone with less than 200 mm precipitation (Neef 1997: 604). In the Basta region the mean annual precipitation accounts for about 150-170 mm. In figure 2 the division in bioclimatologic zones from subhumid to arid is outlined, calculated from a quotient (Q) of rainfall/temperature (after Neef 1997: 606). As can be deduced from this graph, Basta is located in the semi-arid to moderately arid zone with relatively low mean temperatures: a mean minimum of 0° C is evidenced in the coldest month. The mean average temperature in January rises to 6° C and 18° C during summer months, respectively. Both, temperature and precipitation make the Basta area marginal for rain-fed agriculture. Only the site of Beidha is exposed to a comparable bioclimatic regime. Many other archaeologically well-known locations such as 'Ain Ghazal, Tell Hesban or the Eastern Desert sites enjoy temperate to warm conditions and have been placed in other bioclimatologic zones (Fig. 2).

The present environment of Basta hardly gives an impression of the prehistoric situation. Today, the vegetation as well as the natural wildlife have been greatly reduced. The typical surrounding landscape is almost bare of trees and bushes except in small remote regions or areas with artificial watering (cf. Fig. 1a). Hence, the analysis of the botanical samples from the Late PPNB revealed a contrasting picture. In the vicinity of the settlement plant cover displayed a manifold character and was much richer than today (Fig. 3). In accordance with the particular climatic conditions, xerophilous trees such as almond, juniper and pistachio were quite common. Additionally, hydrophilous trees and shrubs, characteristic of riverine vegetation such as *Tamarix*, *Fraxinus* and *Populus/Salix* were evidenced. The Basta inhabitants could reach three completely different ecozones within one day's walk (cf. the given km in Fig. 3 upper line): a nearby region of gently undulating hills and the wadi bed with fringe forest, some kilometres to the east a large flat steppe areas with scrub steppe vegetation and to the west and south heavily dissected lower mountains and plateaus with open forest (Figs. 4, 5). This diversity in the surroundings is reflected in the slaughter and consumption refuse, if we take the spectrum of species hunted as an indicator of the proximity of specific habitats (Becker 1998).

The enigmatic wild sheep evidence

The faunal assemblage from Basta is dominated by *Ovis* and *Capra* remains (Table 1). Unexpectedly, bones of both genera offer a great variability in terms of dimensions. This suggests the existence not only of male and female, but above all of domestic and wild specimens. This briefly characterised situation implies a whole bouquet of problems and consequences (Becker 1991a). That counts in particular for the identification of wild sheep.

The evidence of substantial quantities of *Ovis* bones in a Late PPNB material is not surprising as such, because other Late PPNB sites such as Ghoraife and Ramad I, Jilat and Azraq have yielded sheep remains, too (Horwitz and Ducos 1998: 90). The crucial question is whether the Basta *Ovis* bones belong to domesticated specimens, wild animals or to both categories?

The assumption that *all* sheep bones identified from the Basta assemblage belong to wild animals, is less convincing. The outstanding number of fairly small-sized *Ovis* bones completely undermine this assumption. Moreover, any indication of the existence of a large population of wild sheep in the Southern Levant is lacking during Holocene periods. Identifications of sheep bones from Levantine sites which pre-date the Late PPNB, are not only few in number, but have also been proclaimed to be problematic if not irrelevant (Horwitz and Ducos 1998: 80ff).

The idea of a status of semi-domestication or management of wild *Ovis* populations can equally be set aside as long as the existence of larger groups of wild sheep in this region is doubtful in itself.

Additionally, any evidence on this matter is lacking from the Basta osteological record, e.g. from the slaughtering patterns. Moreover, if we hold to the assumption that all *Ovis* remains derive from

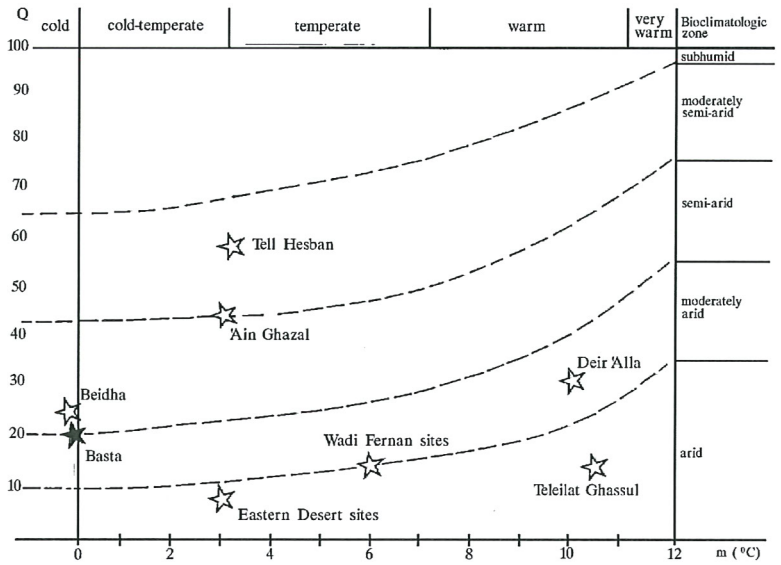

Fig. 2. Present bioclimatique setting of the sites. Q= quotient of rainfall/temperature, m= mean minimum temperature of the coldest month (after Neef 1997: 606)

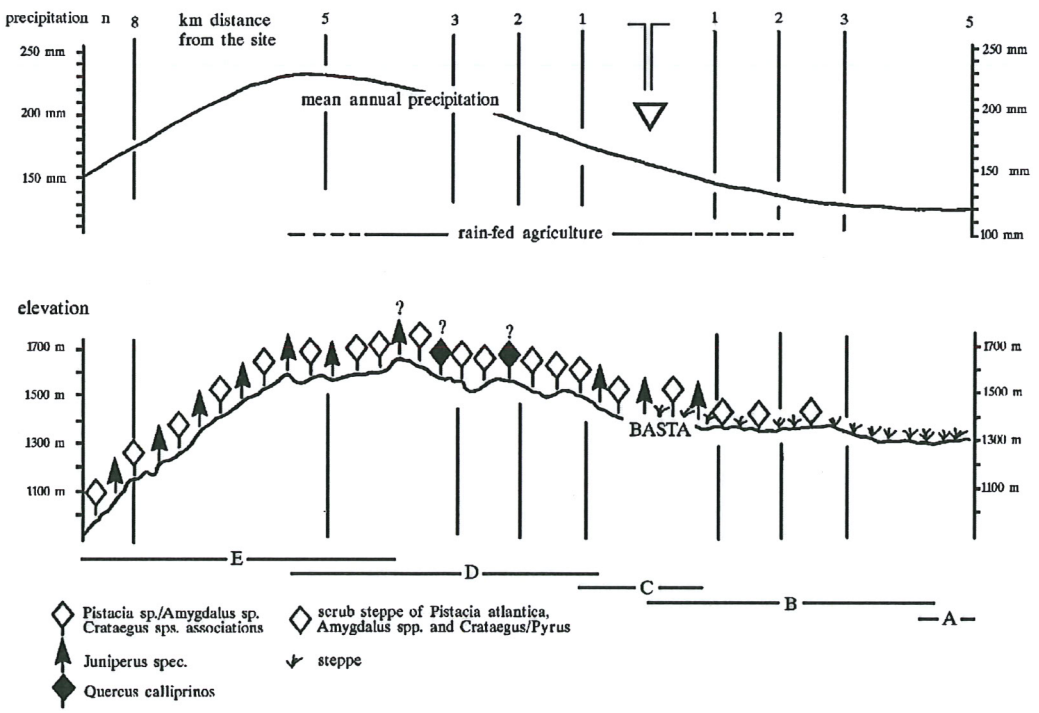

Fig. 3. Changing biological conditions in km-distance from the site, east-west transsection. Above: present day mean annual precipitation. Below: supposed late 7th millennium BC vegetation. A- arid steppe, B- steppe with transition to a forest steppe, C- steppe forest with dominance of Juniperus/Pistacia, D- forest steppe with dominance of pistacia, possibly Quercus, E- forest steppe with dominance of Juniperus/Pistacia (from Neef, forthcoming)

Table 1. Counts and percentages of identifiable bones from Late PPNB sequences in Basta and 'Ain Ghazal (*data from von den Driesch and Wodtke 1997)

	BASTA		'AIN GHAZAL*	
Genera/family	**bone count**	**%**	**bone count**	**%**
Bos	649	3.2	163	3.8
Ovis and Capra	17141	84.2	3237	74.9
Gazella	1769	8.7	410	9.5
Cervidae	13	< 0.1	-	-
Sus	40	0.2	313	7.2
Equus	431	2.1	119	2.7
Carnivora	31	0.2	69	1.6
Lepus	274	1.3	12	0.3
Erinaceus	1	< 0.1	1	< 0.1
Total	20349	100	4324	100

wild animals, hunting activities around Basta must have been extremely intensive, considering the large amount of indisputable *Ovis* finds. That would have led to a progressive depletion of wildlife within the presumed occupation sequence - a process which should have influenced the Basta economy significantly and would have left corresponding traces in the faunal record in general.

On the other hand, if we imagine that all specimens from Basta were domesticated, including the very large ones, we would have to reconsider our metric evaluation of "wild", because some of these postulated "domestic" animals from Basta clearly attain and even surpass the dimensions of wild sheep from Palaeolithic sites (cf. Becker, forthcoming Pl. 11).

To conclude, as I have argued in greater detail elsewhere (Becker, forthcoming), the large-sized elements in the Basta *Ovis* material are assigned to wild sheep and the medium- and small-sized to domesticates with a broad zone of metric overlap. Domesticated animals (at least 85 % of the material) outnumber the wild ones by far. The latter presumably are remnants of a population that once migrated into the Southern Levant and disappeared during the PPNA in most parts of the region (Horwitz and Ducos 1998). Well past the PPNA, the Basta environment offered a suitable habitat for sheep: hilly and mountainous terrain with typical steppe vegetation plus steppe forest (Geist 1977). This area may have been one of the rare refugia for this species. Moreover, one may not totally reject the possibility that the Basta inhabitants had contact with people from hunting camps located at greater distances. In this way, goods such as smoked or dried venison (from wild sheep) might have reached the settlement, although, for different reasons, I consider this a less feasible theory.

It is further suggested - and I completely agree with L. Horwitz and P. Ducos (1998: 92) - that an autochthonous domestication of sheep in the Southern Levant is highly improbable. Domesticated sheep, which made their appearance at the onset of the Late PPNB in Basta and other Southern Levantine sites, were supposedly introduced by human groups either from the Damascene basin or from the Taurus-Zagros region (Ducos 1993). For sheep and possibly also for goat I would not suggest Basta to be a location directly related to any initial domestication process, but a site where fully domesticated animals were kept and slaughtered. This assertion will be investigated in another contribution (Becker, in prep.).

Subsistence strategy

The frequency of wild versus domesticated specimens and the repertory of wild species are the key issues needed to reconstruct former economic strategies and the exploitation of natural resources. The Basta faunal material was not only counted but also weighed, thus providing a clue for the calculation of the amount of meat/venison that was consumed. From the Basta faunal record it can be concluded that domesticated animals provided 54 % and wild mammals 46 % of the meat diet (cf. Becker 1998, Tab. 4). Among the wild mammals, the greatest meat procurement was derived from

Fig. 4. Dissected mountainous region near Wadi Musa (Photo: M. Nissen)

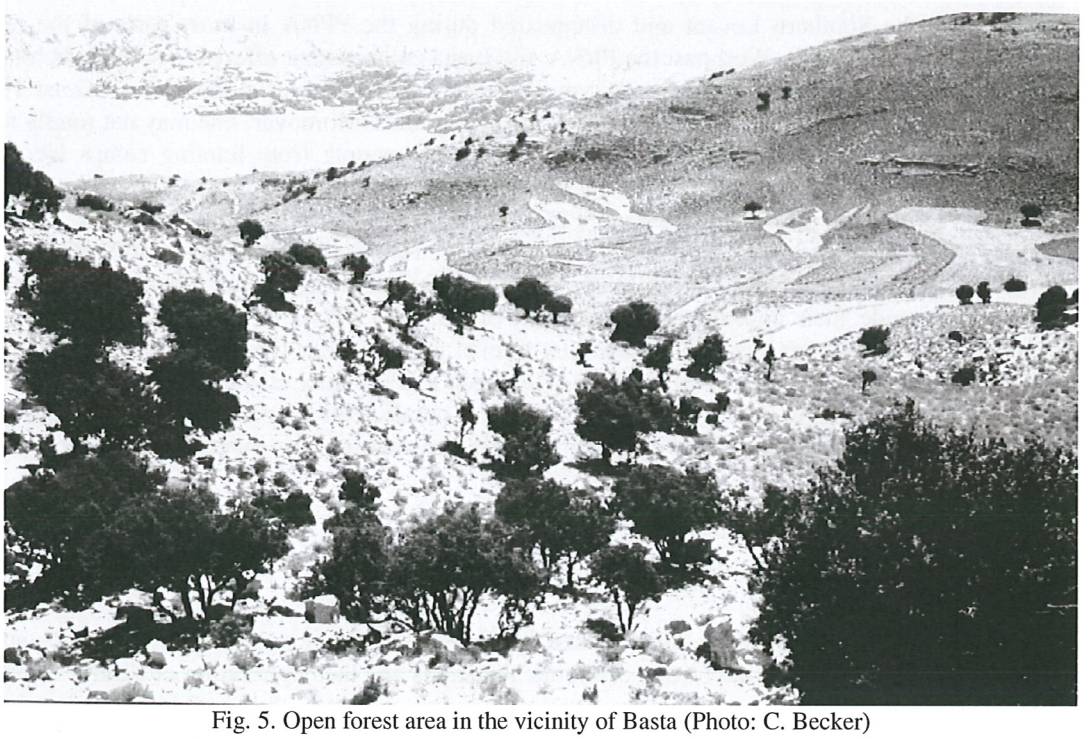

Fig. 5. Open forest area in the vicinity of Basta (Photo: C. Becker)

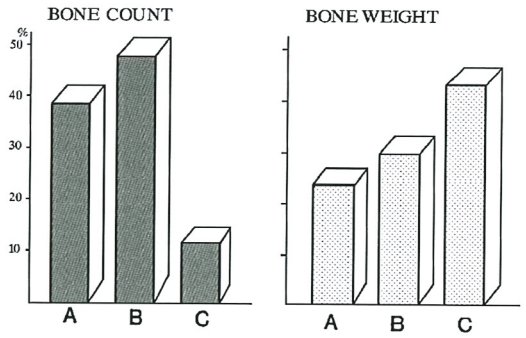

Fig. 6. Reconstructed exploitation of habitats (A-C). relative distribution of wild speies per bone count (total number = 5747) and bone weight (total weight in gram = 44,700). A- arid steppe (onager, gazelle, hare); B- mountainous region (wild goat, wild sheep, wild ass); C- wadis and hilly regions with open forest (wild cattle, boar, cervids)

wild cattle (42 %) and equids (19 %) whereas wild goat (15 %) and gazelles (14 %) are ranked third and fourth.

Considering the bone count, the most frequently hunted game obviously were gazelles and wild goats (each 31 % of all wild mammals; Becker 1998, Tab. 3).

From these data we can also project the exploitation of different ecozones (Fig. 6). Based on the bone count, species roaming the mountainous regions such as wild goats, wild sheep and wild ass predominate (48.5 %). Onagers, gazelles and hares which prefer the arid steppe areas, also occur often (39 %).

In contrast, the hilly steppe-forest areas and the fringe-forest region near wadis, a habitat for species such as cervids, wild cattle and boar which need a steady water supply and shelter, comprise only a minor part (12 %). But if we consider the amount of meat the latter produced, the fraction of the cattle-boar-cervid group increases to 44 % whereas species from the other two categories are less frequently affected (Fig. 6). Even though bone count and bone weight can be evaluated differently, the certainty of a broad-spectrum exploitation in Basta still remains. The economy attained great complexity and most probably was encounter-oriented. This, in a way, sophisticated strategy most probably acted as a safeguard against depletion of particular game. Taking the maximum occupation sequence in Basta of about 500 years into consideration, I would estimate the impact of hunting activities on nature over time to have been rather discreet than destructive (for further details see Becker 1998).

Stratigraphic analysis

As mentioned in the general information sheet (see appendix), only 1 % of the settlement has been excavated. Just this fact reflects the fragmentary and highly selective character of the archaeological record. The question is, whether or not we may consider this part of the site to be representative, espec-ially concerning the faunal assemblages. We should keep in mind that the excavation activities covered about 860 m^2 and produced a prolific amount of material, some 68,000 animal bones. In the literature one can find far-reaching socio-economic interpretations which are founded on much smaller data basis. Thus, the question of the reliability of the results presented here, is "academic". Still, some criticism might be useful, if we consider the exceptional circumstances which led to the accumulation of the bone finds.

Basta is located on a steep slope. The site was covered by a thick layer of surface debris, which contained large amounts of PPNB silex artefacts plus slaughter and consumption refuse as well as a mixture of sherds from the Nabatean, Roman, Iron and Bronze Age periods. These so-called rubble layers seemed to have flowed down from the slope behind the settlement[2]. We know neither the rate of accumulation nor the precise provenance and dating of these heaps of material, although from the amount and appearance of silex artefacts, the largest part in fact derived from Late PPNB contexts. Hence, this faunal material can hardly be connected with the excavated architecture (Fig. 7). Moreover, it cannot be used as an indicator of inter-site activities. Nevertheless, not least from the chronological point of view, an interrelation between these finds and the bone assemblages described below, can be assumed.

[2] or from a presumed first floor of the ancient buildings (pers. comm. Gebel)

Table 2. Basta, Area A. Comparison of bone frequencies within different accumulation levels

	surface deposits		room fills		substructures	
Species/genera	**bone count**	**%**	**bone count**	**%**	**bone count**	**%**
Dom. sheep/goat	3802	71.6	2602	69.6	534	68.7
Dog	5	< 0.1	-		-	
Wild sheep/goat	671	13.0	459	12.3	94	12.0
Gazelles	292	5.5	415	11.1	89	11.5
Cervidae	11	0.2	2	< 0.1	-	
Cattle	308	5.8	93	2.5	23	3.0
Pigs	5	<0.1	-		-	
Equids	127	2.4	93	2.5	7	0.9
Carnivora	12	0.2	15	0.4	10	1.3
Hares	69	1.3	37	1.0	10	1.3
Birds	5	<0.1	22	0.6	10	1.3
Total	5307	100.0	3738	100.0	777	100.0

The bone debris found in substructures and rooms are from almost sealed deposits. We may conclude that most of this material is uncontaminated, although the possibility of an intermingling with some finds from rubble layers cannot totally be excluded. The faunal material from the deepest levels accumulated over a timespan of 4-500 years. It represents the main Late PPNB occupation sequence in Basta. Luckily, these samples are also very rich in bones. It has to be stressed that a precise stratigraphic subdivision within these sealed deposits has not been carried out yet. From my familiarity with the material I suppose that this procedure would not produce results other than those already outlined here.

If we now compare bone finds from different levels of recovery - substructures (channels), room fills (directly on the floors) and surface deposits (= rubble layers) - some differences do occur. The test has been carried out for the southern part of area A, summarising seven excavation units which yielded 9,822 identifiable fragments. From this data, it becomes obvious that in the substructures and room fills, bones of wild species are a little more abundant than in the surface deposits (30.4 % and 31.3 % vs. 28.3 %). In particular, the number of gazelle bones is doubled, bird bones are more frequent, whereas bones from cattle and pigs decrease or are lacking altogether (Table 2). Although these differences are not really dramatic, the incoherence of the accumulated debris can be ascertained (cf. Becker, forthcoming Pl. 1). Nonetheless, for general considerations such as the reconstruction of the economic situation during the Late PPNB in this micro-region, I decided to lump together bones from all units and levels from the Basta location. In specific cases only, the stratigraphic position of a particular bone or a group of bones is considered separately (cf. Becker, forthcoming).

If we concentrate now on the horizontal distribution of the bone refuse which specifically was unearthed from the fill of the rooms, the results obtained can be summarised as follows: in all units, bone fragments of goats and sheep largely predominate. In some units, gazelle bones are a little more frequent (units 27b, 29 and 309), whereas in unit 27b mainly equid bones are found in larger numbers. Despite these differences the general impression is that of a considerable uniformity in distribution (cf. Becker, forthcoming Fig. 3).

Taking the arrangement of skeletal-part frequencies into consideration, some differences do occur, but they also seem to be only gradual. Every unit analysed contained more or less similar compositions. They comprise a high percentage of meat-bearing long bones as well as ribs and vertebrae (categories a and b). Every unit also includes a certain amount of cranium elements and meatless refuse (Fig. 8). No clear-cut grouping of material in the sense of meat storage, depositioning of consumption refuse or dumping of slaughtering waste is indicated. It can be argued that the bone refuse from the room fills accumulated *after* the rooms had been abandoned or were no longer used. If we follow this line of argumentation, any consideration of whether particular behavioural patterns related to architectural features or room functions is pointless. The results as a whole hint at primary butchering of animals and a deposition of refuse on-site, neither more, nor less.

In closing this problem area, it can be summarised that the faunal material discussed here reflects general aspects of the economic strategies practised by the inhabitants of Late PPNB Basta (and maybe of another Late PPNB site located uphill). Because *in-situ* evidence is lacking, patterns of behaviour connected with carcass partitioning, storage of meat or refuse dumping, cannot be assigned to particular parts of the settlement. From the relatively large homogeneity of bone assemblages found in some selected units, one may conclude that other sections of the settlement would yield faunal material of similar quantity and quality. In other words: the area excavated mirrors an impression that should also be relevant to other parts of the settlement which have not yet been researched.

Concluding remarks

The fact that PPNB Basta lies in a threshold area at the edge of three different ecozones has been outlined above. The whole year round this particular location offered easy access to a great variety of game. The Basta inhabitants most obviously profited from this situation. Their subsistence strategy was adapted not only to a broad range of natural resources but also to husbandry, even in the earliest phase of occupation. A mixed economy with a peak in diversity is indicated which may reflect a certain precaution against the hazards of annual fluctuations in resources. Or did the Basta people intentionally maintain older (hunting) traditions of food procurement? This idea is in a way supported by the evidence of zoomorphic figurines which were found in Late PPNB levels. They display a gazelle, a (wild?) ram, a (wild?) cattle and probably a bear (Hermansen 1997: 333ff.). Burial rites included the deposition of horncores of wild goat. Both features make it highly probable that animals, in particular wild species, were involved in ritual activities and played a role in an afterlife concept.

The broad reliance on hunting may have had another, more profane and essential reason. In Late PPNB Basta, located in a region which was marginal to rain-fed agriculture, crop cultivation was practised only to a very limited degree, as has been deduced from the archaeobotanical analyses (Neef, forthcoming). On this basis, the subsistence of a larger community could never be assured. Hence, husbandry plus hunting activities were altogether necessary to establish a balanced diet for a larger group of inhabitants (cf. Horwitz 1996).

As was mentioned at the beginning of my paper, the reason for the abandonment of large Late PPNB sites in the Levant is still under debate. The interpretation of this phenomenon as a result of an overexploitation of natural resources does not seem to be valid for the situation in Basta. Neither an impoverishment of wild fauna nor a degradation of plant cover could be evidenced here. For a comparison with 'Ain Ghazal, the different environmental situation in that northern region has above all to be taken into consideration. 'Ain Ghazal is located in an area with higher mean temperatures and a substantially higher level of precipitation (Fig. 2). Considerable differences in plant cover can be expected. As the archaeobotanical analyses have revealed, deciduous oak, for example, was one of the main forest components in the 'Ain Ghazal area (Neef, pers. com.). In addition, this landscape was much more favourable for farming and agriculture than the Basta environment. If we compare the spectrum and relative proportions of exploited animals from Late PPNB occupation levels in 'Ain Ghazal and Basta (Tab. 1), the 'Ain Ghazal sample contains a lower ratio of ovicaprines, a higher amount of pig remains (7.2 % vs. 0.2 %), no cervids at all, and fewer hare bones (0.3 % vs. 1.3 %). A detailed evaluation of all results are beyond the scope of this short contribution. Nevertheless, even the few results mentioned in fact point to divergent environments and different subsistence strategies. In both sites, not only the biological conditions, agriculture and husbandry, but also the circumstances which made life difficult or even unbearable at the end of the Late PPNB, may have contrasted greatly.

Concerning the Basta archaeobiological record, no conclusive explanation for the abandonment of the settlement can be found, because no dramatic depletion of resources is indicated. Even an incremental deterioration of the economic conditions should be visible. This is not the case.

Fig. 7. Architecture and structures of occupation. Section of the excavated area from 1989 (Photo: courtesy of the Basta Joint Archaeological Project)

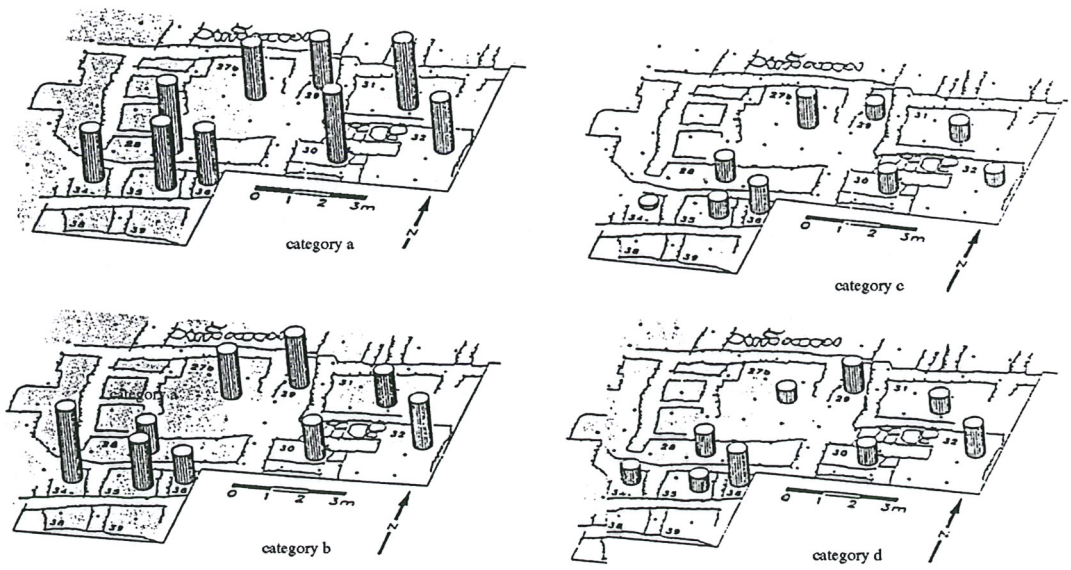

Fig. 8. Basta, Area A. Room fills and substructures. Caprine remains. Relative distribution of skeletal parts (category a: meat-bearing long bones, category b: ribs and vertebrae, category c: cranium elements, category d: meatless refuse; after Becker, forthcoming tab. 11)

Any critical circumstances must be sought elsewhere - perhaps internal reasons which have not yet been recognised yet. Concerning this question the archaeozoological analyses seem to have reached a dead-end. Other data or a combination of data might shed more light on these still enigmatic developments.

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Appendix: BASTA. Site information.

- Location: near Petra/Wadi Musa in Jordan (30°13'47''N/35°32'06''E).
- five excavation campaigns from 1986 to 1992 under the directorship of H.J. Nissen. Free University of Berlin/Germany and M. Muheisen, Yarmouk University in Irbid/Jordan.
- setting: in the lower foothills east of the southern highlands' mountain ridge, 1400 m above sea-level in a limestone area.
- ecological zone: Irano-Turanian steppe.
- permanently inhabited site.
- size: about 10-14 ha.
- excavated area: about 860 m^2.
- date: Late Pre-Pottery Neolithic B (Late PPNB).
- two charcoal samples: 7550-7050 cal BC and 7290-7032 cal BC.
- occupation sequence: 400-500 years.
- particular features: well-preserved sophisticated stone architecture, walls up to 2 m high, rooms with substructures (channels) and plastered floors (some painted red), terraces, open spaces; houses probably with a first floor; architectural concept: regular outer walls, houses were built from the outside in.
- archaeological materials: flint artefacts, stone tools, figurines, stone vessels, human remains (intra- and extramural burials), charcoal, botanical macrofossils, animal bones, artefacts of bone and marine molluscs, unburned clay (tabun).
- bone material analysed: n = 68,000 from area A and B.
- methods: hand-collection and sieving.
- preservation of bone material: good, low level of calcareous incrustation, little surface erosion.
- state of archaeozoological research: identification of mammalian species.
- forthcoming: identification of non-mammalian remains.
- faunal information see Becker 1987; 1991a, b; 1998, in print; forthcoming (manuscript closed1993); Nissen 1993; Söffner 1996.