The fauna of Tell Aswad (Damascus, Syria), early Neolithic levels. Comparison with the northern and southern Levant sites

Daniel Helmer, Lionel Gourichon

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3. The fauna of Tell Aswad (Damascus, Syria), early Neolithic levels. Comparison with northern and southern Levant sites

Daniel Helmer and Lionel Gourichon

The first occupation levels at Tell Aswad, a Neolithic site located in the central Levant near Damascus (Syria), dates to the end of the Early PPNB period. These architectural levels had yielded a low amount of faunal remains but their chronological position and the geographical location of the settlement make their study of great archaeozoological interest. The archaeological material found in these occupation levels shows affinities with both northern and southern Levant sites: for instance, the flint tools are rather southern-related in a typological point of view but the knapping technology produced northern-type supports. The study of the faunal remains provides also some similarities with both regions: importance of the hunting of small game and also presence of caprines since the oldest level.

The present study addresses two issues: 1) Ovis*,* Capra*,* Sus *and* Bos*; were they domesticated at the beginning of the settlement? 2) How did these taxa take part in the particular dynamics of the northern and southern areas regarding the animal domestication? Different statistical methods – Principal Component Analysis (PCA), Log size index (LSI) and Mosimann's method – are here applied on the same biometric data in order to study the variations of the bone size as well as those of the shape.*

According to the results obtained, sheep were domestic in the early levels and the status of the goats and pigs is also probably domestic. However, nothing can be asserted for the bovines because of the lack of measurements. The comparison with other regions shows different evolutions of the livestock. If it seems to have been acculturation from the North, the adoption of some techniques was made in a way that was particular to the South.

Keywords Domestication, Pre-pottery Neolithic, *Bos, Sus, Capra, Ovis*, acculturation, Near East.

Introduction

Tell Aswad is a Neolithic tell located in the Damascene basin, 20km southeast of Damascus City (Syria). The settlement was discovered in 1966 and two sounding pits were first excavated in 1971 and 1972 (Contenson 1995). The recent excavations conducted by D. Stordeur and B. Jammous from 2001 to 2007 in the same areas reviewed the initial chronological attributions made by H. de Contenson and demonstrated that the so-called 'PPNA' phase ('Aswadian') corresponds actually to an Early PPNB horizon, i.e. to the end of the 9th millennium cal BC (Stordeur 2003a; 2003b; Stordeur & Jammous 2006). The whole occupation sequence at Tell Aswad, based on the excavations of the area B, was then subdivided as follows (Stordeur *et al.* 2006):

- 'Early' phase: levels B9 to B12 (late Early PPNB)
- 'Middle' phase: levels B1 to B8 (Middle PPNB)
- 'Late' phase: levels B–5 to B0 (late Middle PPNB and transition with the Late PPNB)
- 'Pottery' phase: level A (scattered pits dated to the Early Pottery Neolithic).

In the Neolithic times, the site was settled near the shore of one of the two permanent lakes (now seasonal) supplied by the Barada and Awaj rivers coming from the Anti-Lebanon Mountains. The village is surrounded by hilly landscape westwards and dry steppe areas in other directions.[1]

The last archaeozoological study of Tell Asawad was based on the faunal assemblages found in the levels B-5 to B8 until 2005 (Helmer & Gourichon 2008). The main results indicate that cattle, goat, sheep and pig were domesticated in the MPPNB phase and that hunting played an important role in the subsistence economy, especially of small game. The presence of wild specimens was evidenced for the pigs and the goats, but not demonstrated for the sheep and the bovines.

With the 2006 and 2007 campaigns, more data have been collected from the earliest levels (748 identified remains, compared to only 112 in 2006). These layers, dated to the end of the EPPNB, are characterised by pisé architecture (reed bundles and clay) and the use of mudbricks occurring later in the level B8. Most of the flint tools are made on blades extracted from bipolar naviform cores, a technology developed in the northern Levant, whereas the typology shows close relationships with the southern corpus (F. Abbès, personal communication). This paper addresses two issues: 1) *Ovis*, *Capra*, *Sus* and *Bos* were they domesticated since the first occupations? 2) How did the animal domestication at Tell Aswad take part in the dynamic patterns particular to the northern and the southern areas?

Methods

The morphological criteria commonly used to distinguish the domestic specimens of *Ovis*, *Capra*, *Bos* or *Sus* from the wild ones (see Peters *et al.* 2005; Vigne *et al.* 2005; Helmer & Gourichon 2008) cannot be easily applied for the earliest levels of Tell Aswad because of the low number of identified remains and the absence of diagnostic anatomical parts. Only a morphometric study can explore this issue.

Contrary to what is often accepted, the biological size is not the best indicator of domestic status for the ungulates. Indeed, if size relies on both genetic and ecological factors, the observed variations in size can result from a general isometric variation, without any modification in shape, but can be due also to modifications in proportions (Mosimann 1970; Vigne *et al.* 2005). In the first case the main factor can be the environmental pressure while in the latter genetic changes or human actions can be involved. For instance, phalanges of cattle can be distorted by ploughing (distortions often considered as pathologies although they do not really alter the life span of the animal). Thus, variations in shape during a short time (i.e. some years for modifications due to work and a number of generations with genetic drift) in non-insular populations are more likely a direct consequence of human action.

In order to make a comparative study between the potential domestic species at Tell Aswad and their wild counterparts, we take into account the most abundant bones. A combination of methods is applied to the available biometric data.

First, the variations in bone size and shape are examined through a principal component analysis (PCA) of the raw values for every measure of a given bone (e.g. GLi, Bd and Dl of the astragalus, cf. von Driesch 1976). The first component of the PCA provides, to a large extent, information about the changes or differences in the isometric size, while variations in shape are rather expressed by the second component (Lleonart *et al.* 2000). Because bone allometries are growth differences observed on some parts of the bones, they can be generally identified in two ways: 1) all the measures decrease but at different speed, then some parameters are not necessarily correlated with the isometric size; 2) one measure decreases whereas another increases or remains stable, then the correlation between the two measures is negative.

Because the corpuses dated to the EPPNB are generally small, the method of Log size index (LSI) is also used here to check the potential variations in size (Meadow 1999). Our standard dataset is not based on a single modern animal, contrary to the usual procedure, but on the means of several biometric data collected from different PPNA, EPPNB and MPPNB sites: eight sites for the *Bos* genus (Mureybet, Jerf el Ahmar, Dja'de el Mughara, Tell Aswad, Halula 1/9, Göbekli, Nevalı Çori and Cafer Höyük), four for *Capra* (Cafer Höyük, Tell Aswad, Halula 1/9 and Maghzaliyah), 13 for *Ovis* (Mureybet, Jerf el Ahmar, Göbekli, Halula 1/9, Nemrik, Sotto, Kultepe, Maghzaliyah, Ras Shamra VC and VA, Qdeir, El Kowm 2, Cafer and Bouqras) and four for *Sus* (Mureybet, Jerf el Ahmar, Göbekli and Tell Aswad) (Helmer in press). This 'internal' analysis of the biometric variations allows a more accurate identification of the allometries (see |Appendix for the selected measurements). This global standard made from various Neolithic specimens from Turkey, Syria and Iraq is called 'NE referential' (NE for Near East).

Lastly, our morphometric study is improved by applying the method developed by J. E. Mosimann (1970; see also Lleonart *et al.* 2000). This method aims, on the one hand, to remove for every measurement all the information related to size and, on the other, to isolate the isometric size by reducing the shape effect. This is obtained by calculating indices using logarithmic functions, i.e. respectively: a shape index for each measure (LSR, Log Shape Ratio) and an index for the global isometric size.

The limitations of the dataset used for comparison rely fundamentally on four points: 1) the number of available biometric data for the EPPNB levels of Tell Aswad; 2) the number of sites in the northern and southern Levant which have yielded a sufficient amount of specimens per taxa; 3) the number of sites where the required measurements were taken and published; 4) the choice of sites where only wild ancestors are present for composing the wild standard. In order to avoid as much as possible the influence of potential

major climatic changes for the comparison with the wild populations, we choose to use data from the Early Holocene (PPNA, second half of the 10th millennium and early 9th millennium cal BC) when it is assumed that the ungulates were not already domesticated. If the corpus is suitable for *Bos*, *Ovis* and *Sus* (from Mureybet, Jerf el Ahmar, Göbekli, Körtik), this is not the case for *Capra* because of the lack of available data for this period. By default, we will use the corpus from Cafer Höyük (Early and Middle PPNB) where both wild and domestic goats have been identified (Helmer 2008).

Material

The total number of identified specimens at Tell Aswad is 9682 remains, compared to 7964 in 2006 (Table 3.1). As a whole, there is no real change except a slight evolution in the earliest levels (632 remains of large mammals, three of rodents, three of hedgehogs, 113 of birds and some small fish bones). With these recent data, no new taxa was added to the previous list which comprises (Helmer & Gourichon 2008), in addition to four domestic ungulates (*Bos*, *Ovis*, *Sus* and *Capra*), red fox (*Vulpes vulpes*), wolf (*Canis lupus*) and dog (*Canis familiaris*), badger (*Meles meles*), jungle cat *(Felis chaus*), cat (*Felis silvestris/catus*), sand cat (*Felis margarita*), three equids (*Equus* cf. *asinus*, *E.* cf. *hemionus*, *E.* cf. *hemippus*), two gazelles *(Gazella subgutturosa* cf. *marica* and *G. gazella*), Mesopotamian fallow deer (*Dama mesopotamica*), and hare (*Lepus capensis* format *syriacus*).

The correspondence analysis of the NISP per taxa (Fig. 3.1), after weighting the raw data on a pro-rata basis (see Helmer & Gourichon 2008), shows a clear time effect along the axis 1 (contribution of 59.2%): the values are more or less regularly distributed from the earliest level (B12) to the most recent (B-5), with the exception of the assemblages found in the Pottery Neolithic pits (level A). The first component also indicates a partition between wild (birds, hares, small carnivores, gazelles) and domestic taxa (*Capra*, *Ovis*, *Sus*). We can interpret this trend as follows: a) in the first levels (B12 to B9), hunting takes an important part, especially the hunting of small game (birds, hares and carnivores); b) in the early Middle phase (levels B8 to B5), the hunting of gazelles is significant but the part of small game is reduced; c) in the late Middle phase (B4 to B1), the goat husbandry is predominant; d) in the most recent PPN occupations of Tell Aswad (B0 to B-5), the rule played by the domestic caprines is much more substantial; and e) in the Pottery phase (level A), cattle seems to have been predominant. However, if the overall distribution is progressive, the most obvious disruption appears between levels B5 and B4, with a shift from *Gazella* to *Capra*, although no change has been stratigraphically noticed through the Middle phase of Tell Aswad during the excavations.

Bovines (*Bos primigenius/taurus*)

The referential used for the aurochs (*Bos primigenius*) comes from the following PPNA sites: Mureybet III, Jerf el Ahmar and Göbekli III. The PCA includes also cattle remains from Early and Middle Aswad, Halula 1/9 and 10/19, Bouqras 11/5, Dja'de el Mughara, Mureybet IVA and IVB, Göbekli II, Gürcütepe and Nemrik V. There is only one measurable astragalus in the earliest occupations of Tell

Table 3.1. Faunal remains found at Tell Aswad. Distribution of the NISP throughout the levels of occupation: 'Pottery' phase (level A), 'Late' phase (B-5 to B0), 'Middle' phase (B1 to B8), 'Early' phase (levels B9 to B12).

Taxa	A	B-5	B-2	B0	B1	B2	B3	B4	B5	B6	B7	B8	B9	B9/10	B10	B11	B12
Carnivora indet.	1	1	2	4	1	1	1	5	1	1		2					
Vulpes sp.	3		3	2	1	2	1	12	2	1		5	2	2			3
Canis sp.			1			1						1					
Meles sp.								1	2				1				
Felis silvestris	1		1			2		5	1			2			1		
Felis chaus							1	3	1	1	1				2		1
Equus sp.	18		5	2	6	3	5	13	2	1		1	1	1	2		1
Sus sp.	50	36	76	5	19	30	45	198	23	10	25	22	9	7	12	1	10
Bos sp.	98	38	46	12	9	25	30	59	30	26	29	49	10		8		3
Total small ruminants	*475*	*458*	*710*	*155*	*255*	*304*	*332*	*781*	*273*	*188*	*291*	*347*	*114*	*103*	*172*		*110*
Total *Ovis/Capra*	*210*	*319*	*444*	*64*	*141*	*204*	*189*	*428*	*119*	*79*	*148*	*81*	*46*	*54*	*72*	*2*	*35*
Ovis sp.	15	9	33	3	5	4	2	34	6	2	7	2	2	2	2		2
Capra sp.	81	108	203	21	68	93	81	149	44	41	79	31	18	23	29		15
Gazella sp.	162	55	114	31	61	59	84	225	119	77	106	221	53	28	77	3	69
Dama sp.	1							3		2							
Lepus sp.	6	6	7	10	5	12	29	141	16	3	6	21	3	1	14	1	8
NISP	652	539	851	190	296	380	444	1218	351	231	352	450	140	138	211	7	136
Hedgehogs				1		1	2		1				2		1		
Rodents				1	1			1	4			3			1		2
Birds	12	9	16	4	11	27	56	64	76	6	31	83	8	24	46	6	29
Tortoise					1		1	2	1								
NISP total	664	548	867	196	309	408	503	1285	433	237	383	536	150	162	259	13	167

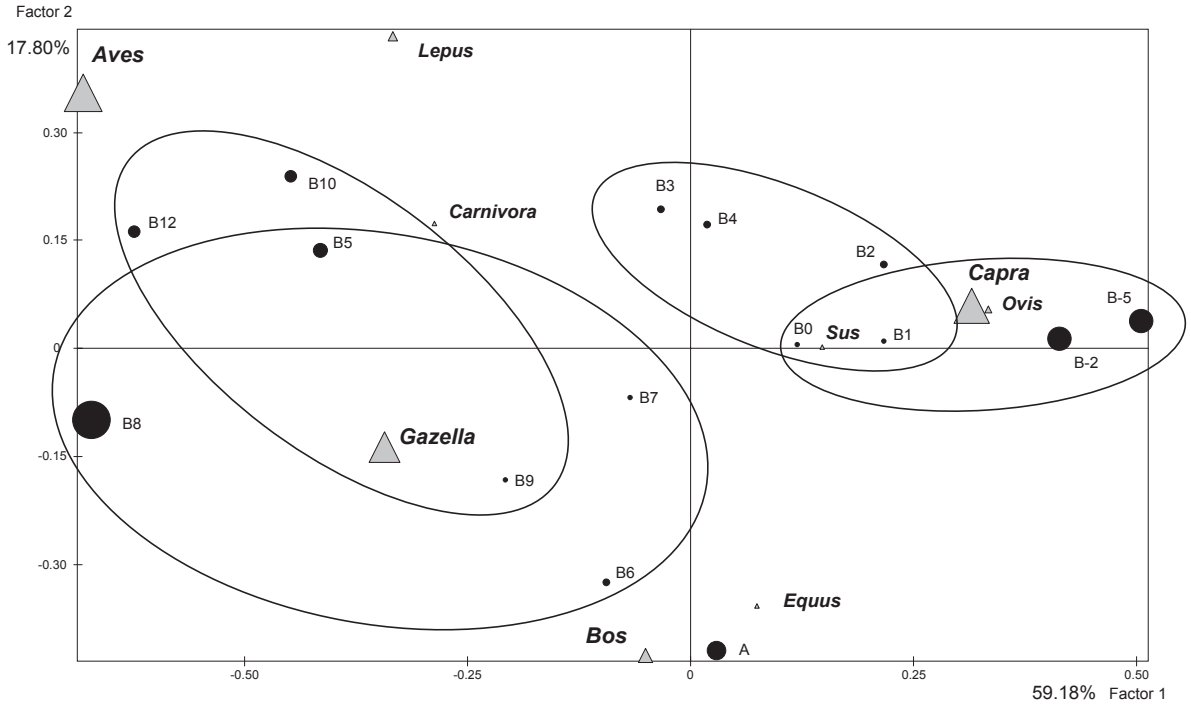


Fig. 3.1. Distribution of the frequencies of the main taxa identified at Tell Aswad (Equus, Bos, Gazella, Ovis, Capra, Sus, Carnivores, Lepus, Birds) according to the first and second axes of the component analysis (SPAD software).

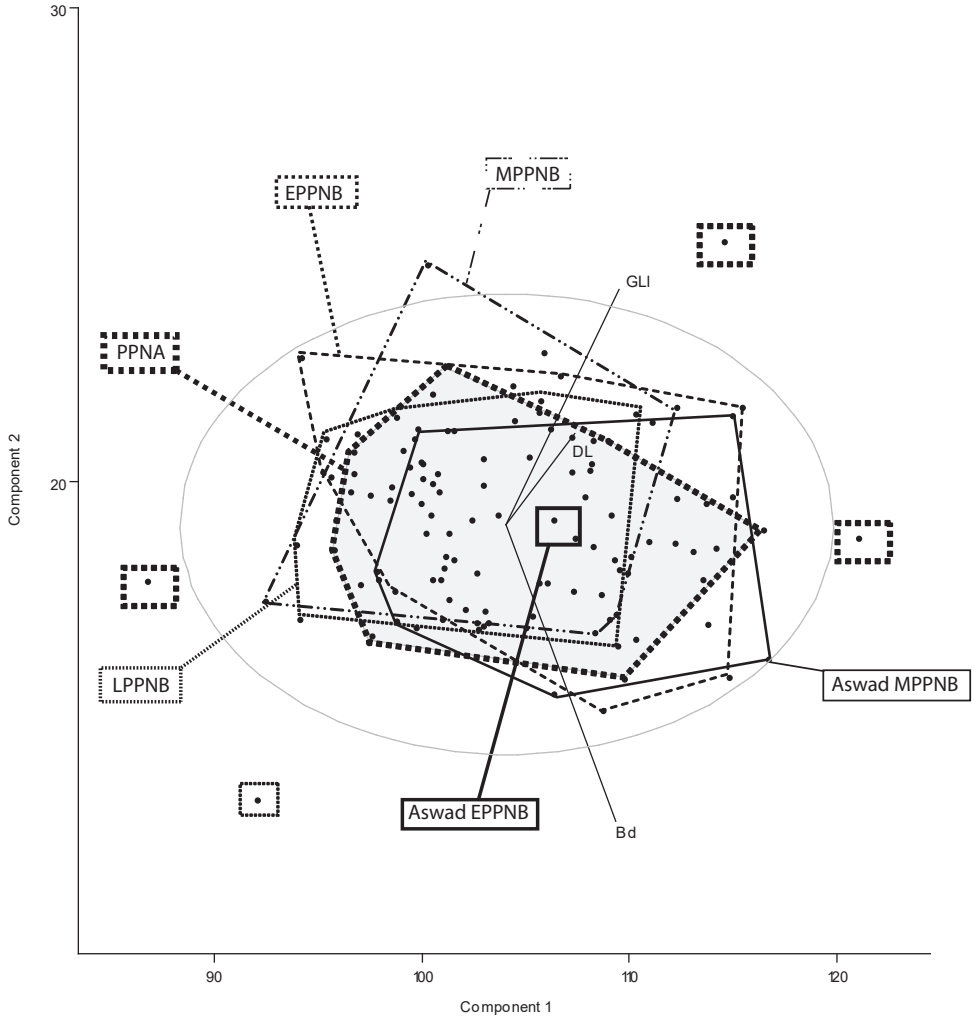


Fig. 3.2. Size comparison of the astragali of Bos from Tell Aswad with the PPNA aurochs (in grey) and bovines from other Early, Middle and Late PPNB sites. Principal component analysis (Past software).

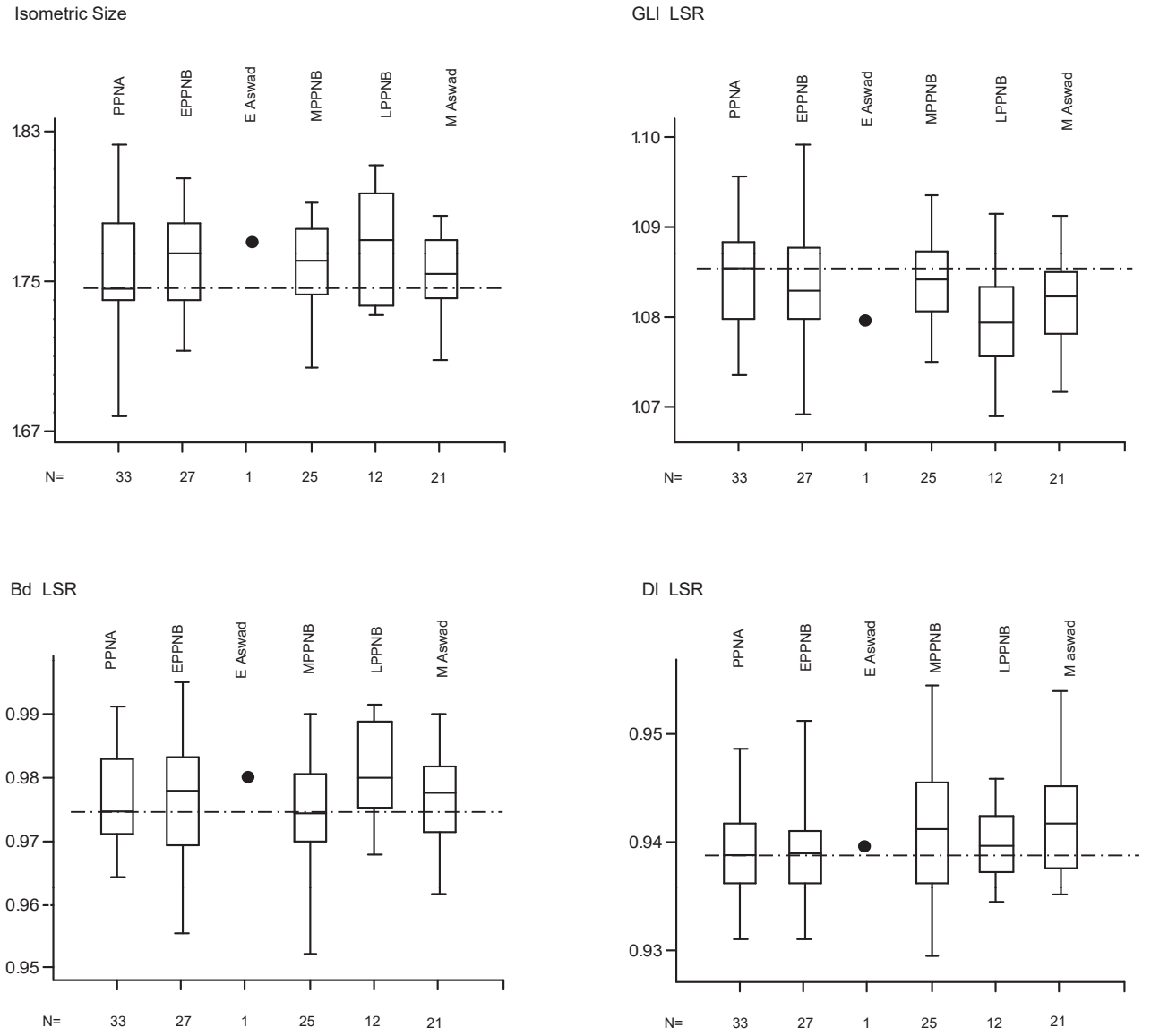


Fig. 3.3. Shape comparison of the astragali of Bos from Tell Aswad with the PPNA aurochs and bovines from other Early, Middle and Late PPNB sites (Mosimann's method). Box plots showing the indices of isometric size and the shape indices (Log Shape Ratios) for GLl, Bp and Bd (Past software). The dashed line indicates the median for the PPNA aurochs. E Aswad = Early phase; M Aswad = Middle phase.

Aswad and 12 from the Middle phase. The measurements taken into account in the analysis are GLl, Bd and Dl.

It is self-evident that little information can be deduced from the single bone from Early Aswad, apart from the fact that it fits well within the variation range of the aurochs astragali and the other specimens from later levels of Tell Aswad (Fig. 3.2). Indeed, the bone size considered as a whole is not a pertinent criterion for distinguishing wild and domestic cattle (Helmer *et al.* 2005), as illustrated in Figure 3.2 where a slight shift of the distribution appears only in the MPPNB.

The indices of isometric size obtained from the Mosimann's analysis are higher within the domestic groups (Early, Middle and Late PPNB) than for the aurochs (Fig. 3.3). The correlation indices show that the first component is correlated with the isometric size (ISi/axis 1: r = 0.996; Puncorr = 0.0000), whereas the second component is independent (ISi/axis 2: r = –0.017; Puncorr = 0.855). This latter therefore indicates the presence of allometries.

The shape indices (LSR) for Bd and Dl (Fig. 3.3) are also higher than the aurochs median but, on the contrary, the length (GLl) is much smaller: the domestic astragali are stockier than those of aurochs. Since the corpus from Tell Aswad (including the single astragalus found in the earliest phase) shows the same variations both in the raw biometric data than in the shape indices, this assemblage can be interpreted as mostly or entirely 'domestic'. Evidence of allometries for *Bos* confirms here our previous diagnosis made by using other methods (Helmer & Gourichon 2008).

Fig. 3.4. Comparison of the biometric data (LSI) of Capra from Tell Aswad with C. nubiana from Wadi Faynan (Jordan) and the goats (C. aegagrus/hircus) from SW Turkey: Körtik (PPNA) and Cafer Höyük (Early and Middle PPNB).

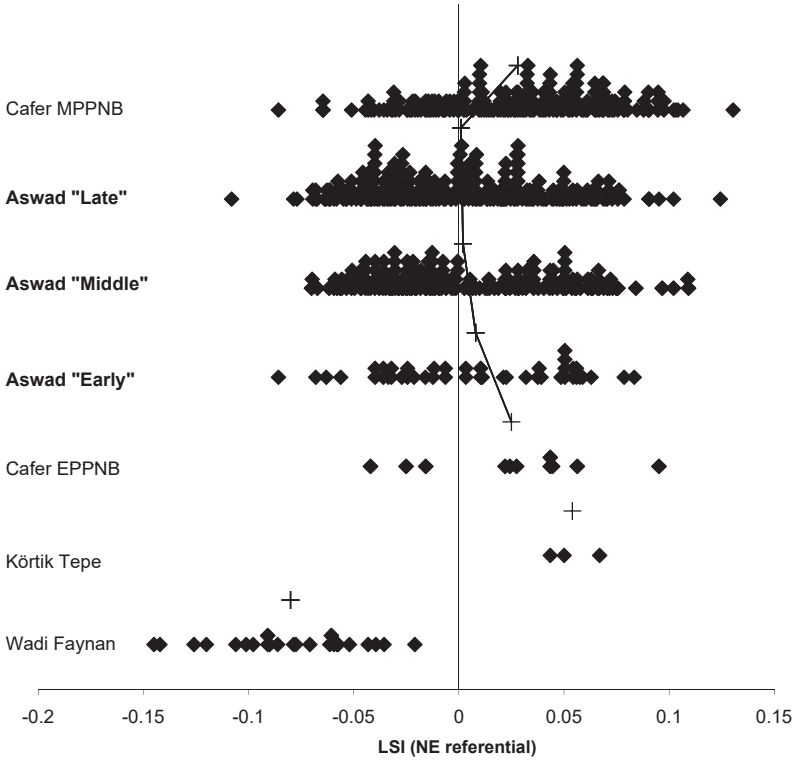
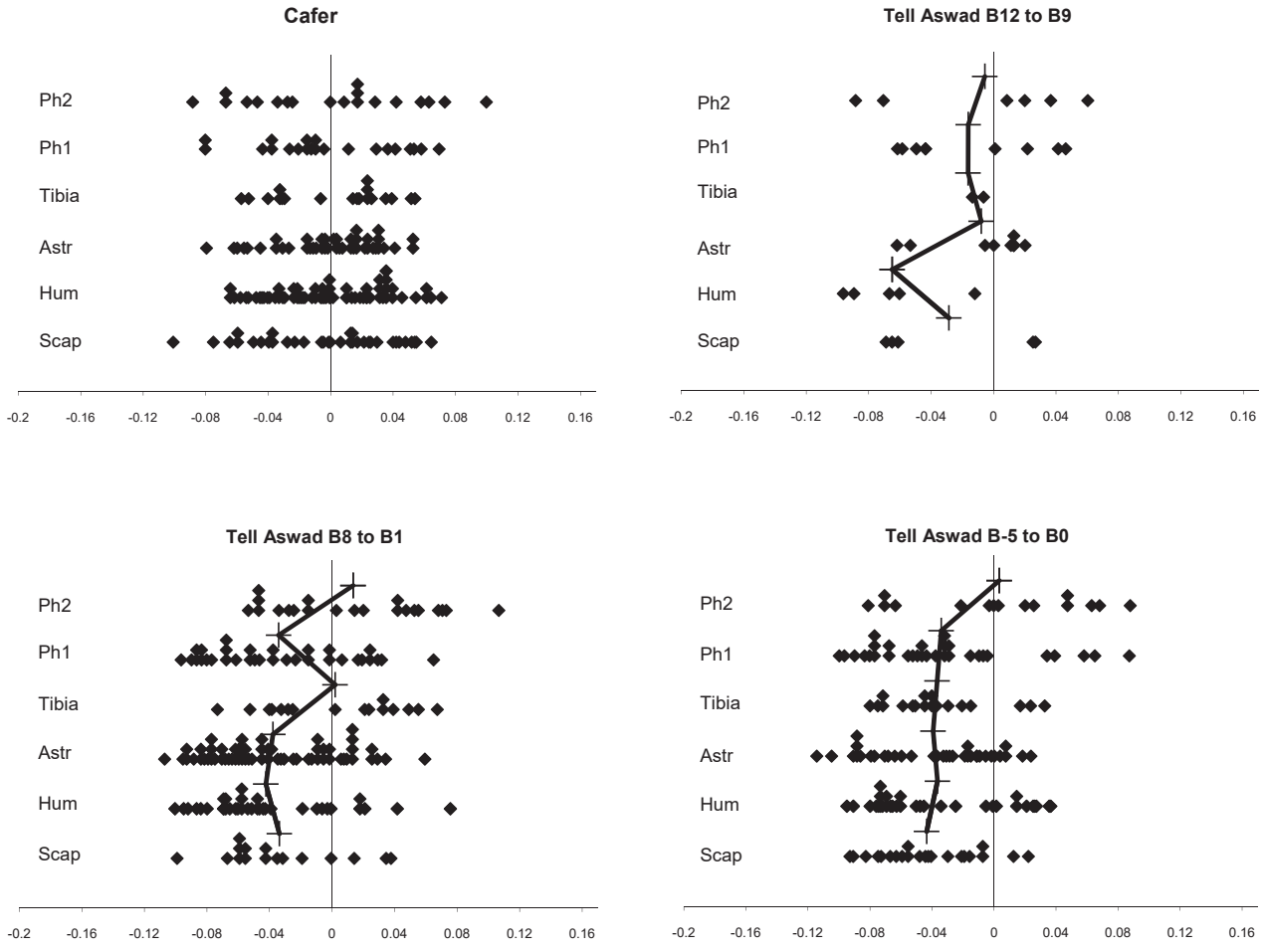


Fig. 3.5. Distribution of LSI of the most abundant measures of Capra from Tell Aswad using the data from Cafer Höyük as standard.



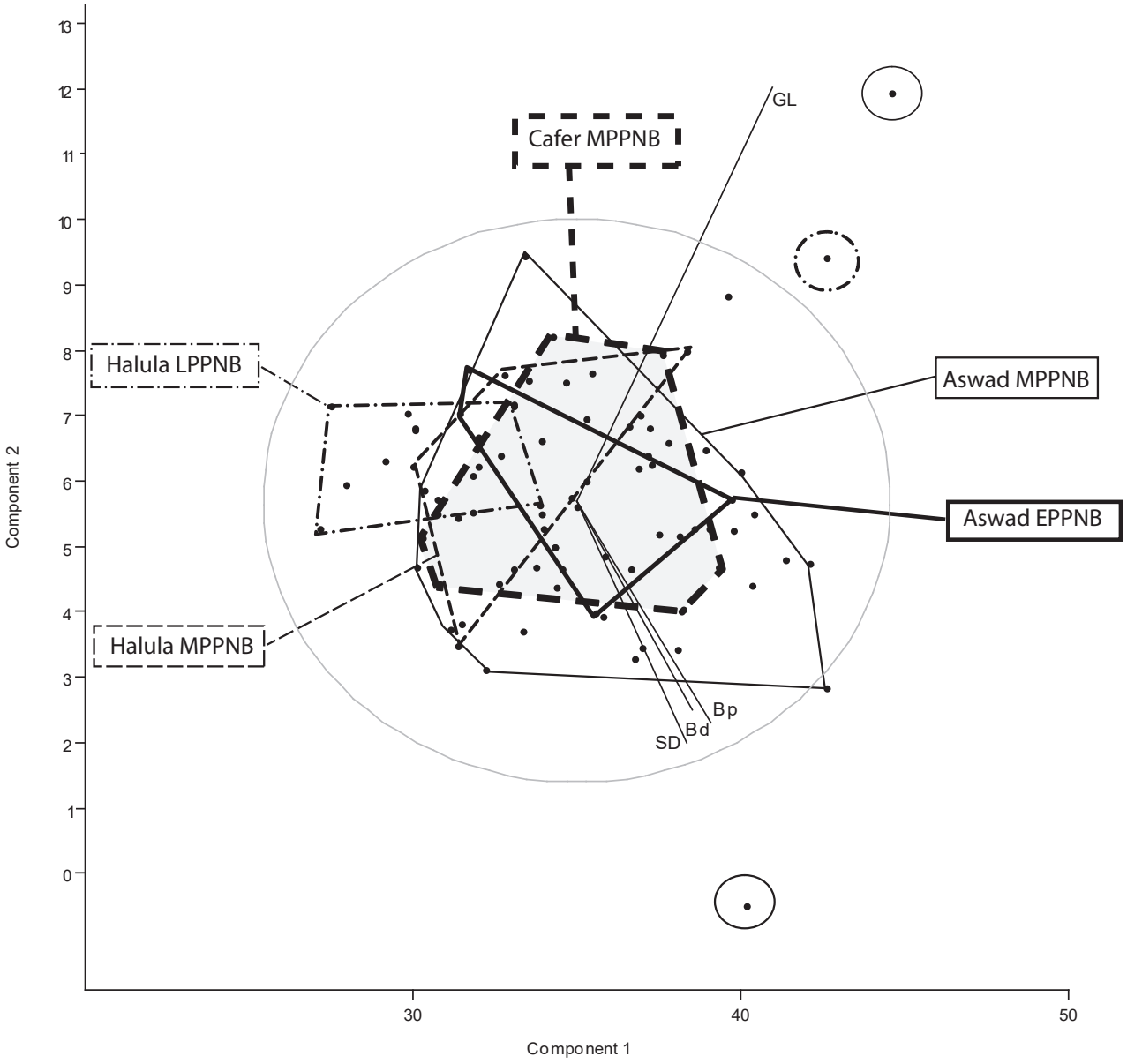


Fig. 3.6. Size comparison of the second phalanges of Capra from Tell Aswad with the goats from Cafer Höyük (in grey) and Tell Halula. Principal component analysis (Past software).

Goats (*Capra aegagrus/hircus*)

In a previous study (Helmer & Gourichon 2008), it was asserted, according to the morphology of the horncores, that the populations of goats at Tell Aswad were heterogeneous and that a wild population different from the Nubian ibex (*Capra nubiana*) was present. This assertion is verified by the distribution of the biometric data using the LSI method (Fig. 3.4). The sample from Wadi Faynan corresponds to remains of Nubian ibex found in the PPNB levels (Carruthers 2002). The LSI distribution of Tell Aswad indicates that, whatever the phase, the goats are larger than *Capra nubiana*. Since no sufficient data from 'purely' wild goats living in the past times are available, the comparison can be only made with Cafer Höyük where populations of bezoars (*Capra aegagrus*) and domestic goats are mixed, probably at parity (Helmer 2008). As a result, the mean values of Tell Aswad are slightly smaller than those of Cafer Höyük (Early and Middle phases). Moreover, there seems to be a progressive reduction of the mean value across the time, which can be expected during few centuries if the goats were domestic since the first occupations. Such a hypothesis is tested here by examining separately the biometric data of six different skeletal parts (scapula, humerus, astragalus, tibia, first and second phalanges).

First, when comparing the two sites using the data from Cafer as LSI standard for each kind of bone (scapula, humerus, astragalus, tibia, first and second phalanges), we observe that there is a general reduction in the mean

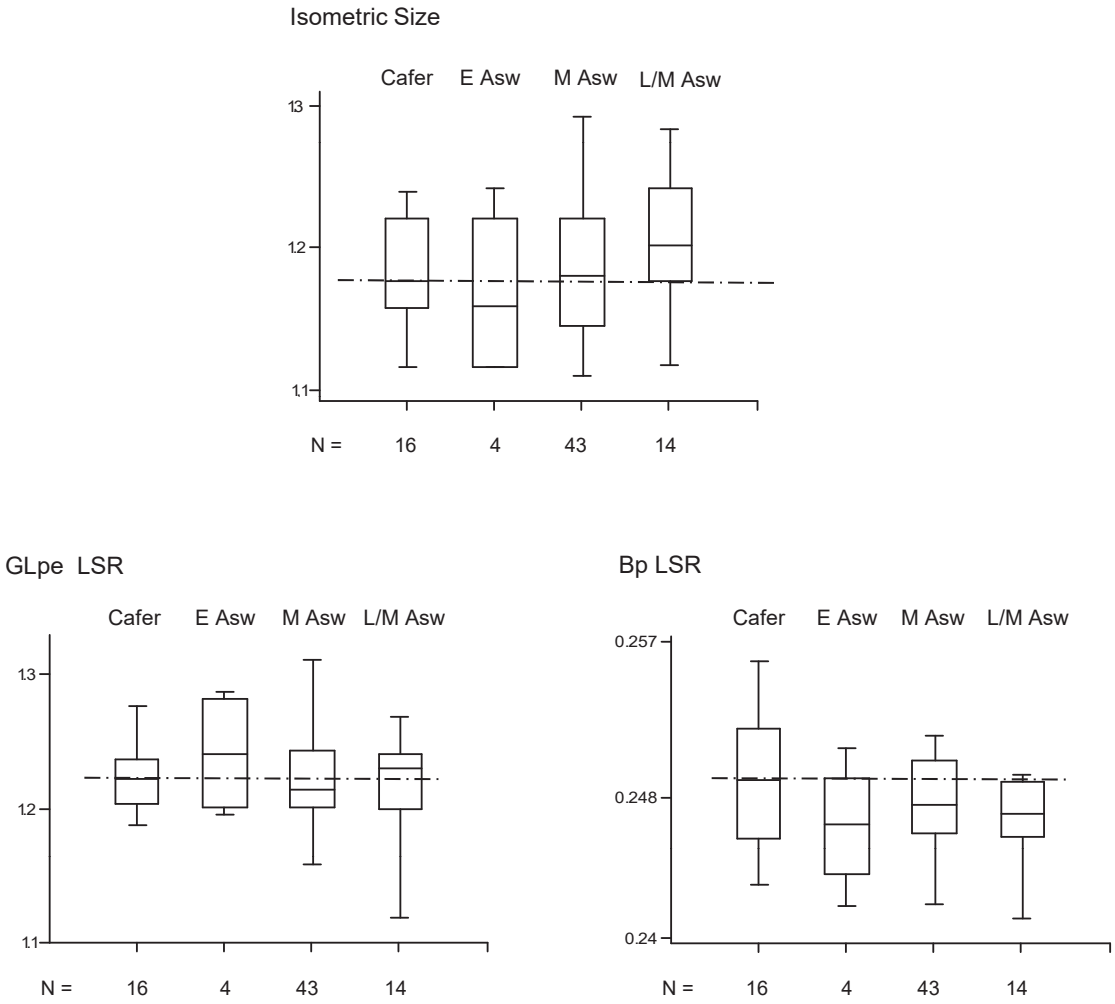


Fig. 3.7. Shape comparison of the second phalanges of Capra from Tell Aswad with the goats from Cafer Höyük (Mosimann's method). Box plots showing the indices of isometric size and the shape indices (Log Shape Ratios) for GLpe and Bp (Past software). The dashed line indicates the median for the Cafer goats. E Asw = Early phase; M Asw = Middle phase; L/M Asw = transition Middle/Late PPNB.

values from the bottom to the top of Tell Aswad (Fig. 3.5), except for the second phalanges. We will consider now the two bones representing the extremes of this allometry: the second phalanges which do not vary (or vary a little) and the astragali which change along the sequence.

The size analysis (PCA) of the second phalanges from the sites of Tell Aswad, Cafer Höyük, Tell Qarassa and Tell Halula, using GLpe, Bp, SD and Bd, indicates that the four specimens from Early Aswad do not differ from Cafer (N=16) (Fig. 3.6). For the Middle phase, the distribution is moved towards the right part of the graph, while the specimens from the later phase are much more scattered. This trend suggests that the evolution process at Tell Aswad could have started with phalanges similar in size to those of the Northern goat populations.

The isometric size of the second phalanges shows a progressive change compared to Cafer (Fig. 3.7): Early Aswad phalanges seems slightly smaller and the size starts to increase at the end of the Middle PPNB. The first component of the correspondence analysis is correlated with the isometric size (ISi/axis 1: r = 0.968; Puncorr = 0.0000), whereas the second is independent (ISi/axis 2: r = –0.238; Puncorr = 0.027, i.e. between the limit values of 0.05 and 0.01). These results evidence allometries, such as for the astragali of bovines. The shape indices show that the length (GLpe) is not a good criterion, contrary to the proximal breadth (Bp) which is much smaller at Tell Aswad, in the oldest as well as in the recent levels.

Concerning the astragalus (Fig. 3.8), the size analysis shows that although the range of variation of the Early Aswad specimens fits approximately that of Cafer Höyük, they are in average smaller. Middle Aswad and other MPPN sites follow a similar pattern with a distribution expanded to the bottom and the left, a discrepancy much more obvious for the LPPNB sites. This evolution is approximately the same as that we observed for the second phalanges.

The isometric size of the population from Early Aswad is larger than that of Cafer, but the values of the other phases

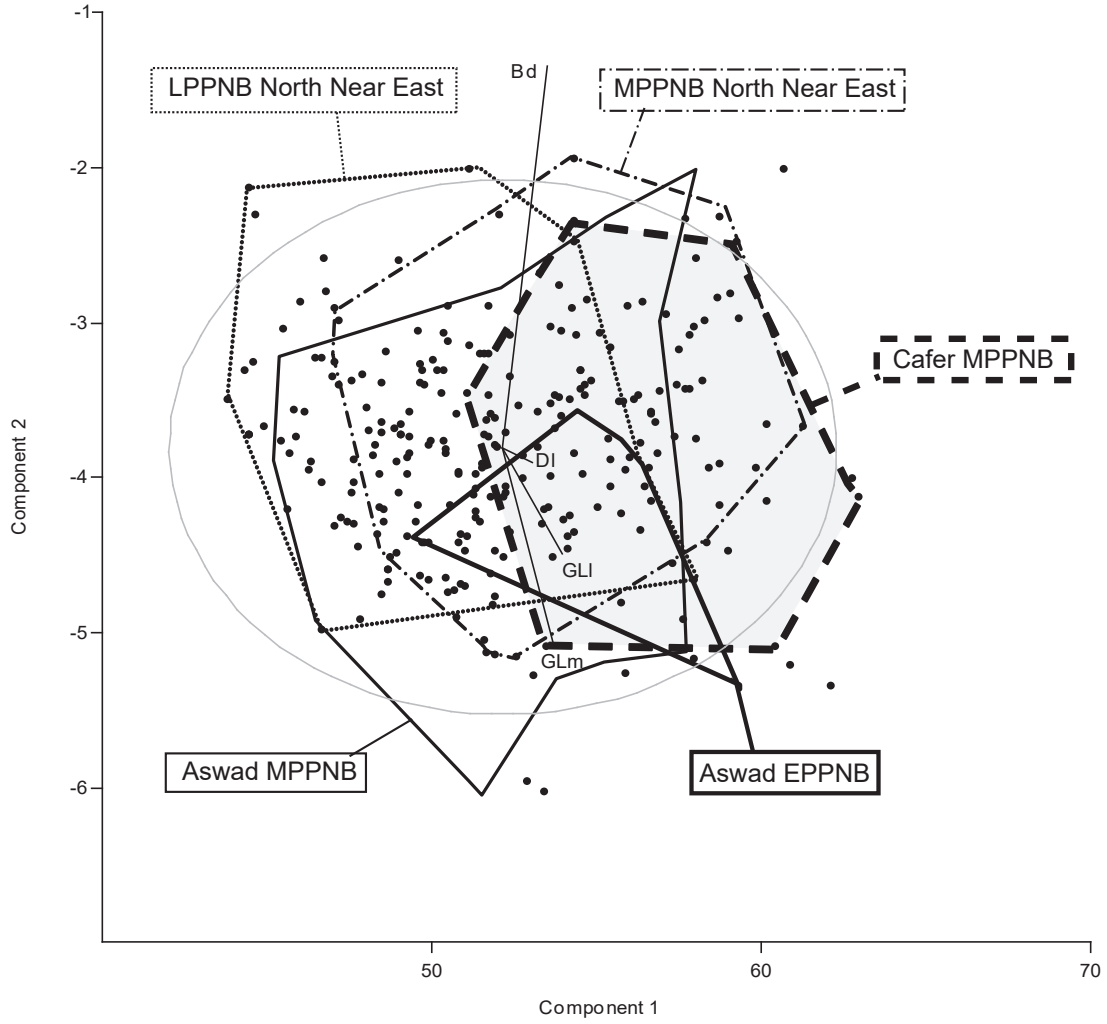


Fig. 3.8. Size comparison of the astragali of Capra from Tell Aswad with the goats from Cafer Höyük (in grey) and other MPPNB and LPPNB sites. Principal component analysis (Past software).

remain smaller (Fig. 3.9). There is a correlation between this size and the first component (ISi/axis 1: r = 0.997; Puncorr = 0.0000), but not with the second component (ISi/axis 2: r = 0.03; Puncorr = 0.629). We can notice that the shape indices for Bd and GLl are negatively correlated (r = –0.67): all the astragali of Tell Aswad have high GL-based indices while the Bd-based indices are relatively smaller. When this observation is relied to the decrease of the global isometric size, it appears that the astragali of the goats became proportionally longer but thinner over time, and then more slender than the mixed populations of Cafer.

Therefore, the biometric analysis of the second phalanges and the astragali strongly suggests that the goats of Tell Aswad are domestic, possibly since the first occupations.

Sheep (*Ovis orientalis/aries*)

The number of biometric data available for the Early phase of Aswad is very low (N=8). However, the mean and the range of variation of the LSI values for this period is quite similar to those for the upper levels (N=24 for the Middle phase, and N=161 for the Late phase). There is apparently no evolution along the sequence (Fig. 3.10). The sheep of Tell Aswad are relatively large in size but the distribution of the values is asymmetric, with an obvious slant towards the smaller specimens. Their means are smaller than that of the mouflons from the Euphrates Valley, which also present the same asymmetry in the distribution. In the latter case, this is due to the sexual dimorphism, with hunting being focused mainly to the females (Gourichon & Helmer 2008).

For the Early PPNB, the mean values seem to be consistent between Cafer, Dja'de or Nevalı Çori (Fig. 3.11) and are smaller than the PPNA wild sheep. On the basis of this observation, and given the fact that no major climatic change occurred between the PPNA and the Early PPNB, A. von den Driesch and J. Peters asserted that sheep was domesticated at that time (Driesch & Peters 2001). Can the reduction in size of the sheep be also related to its domestic status at Tell Aswad?

According to the PCA made for the first phalanges

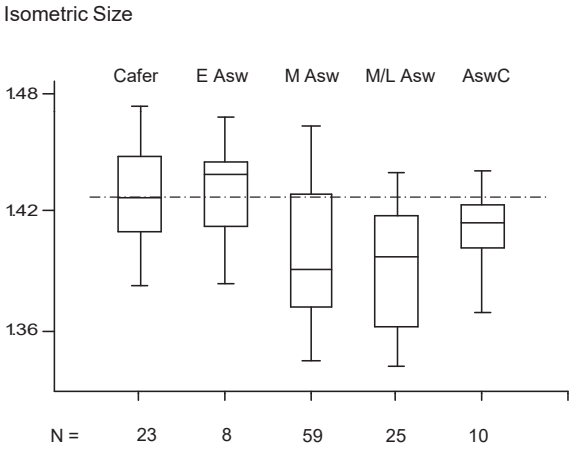
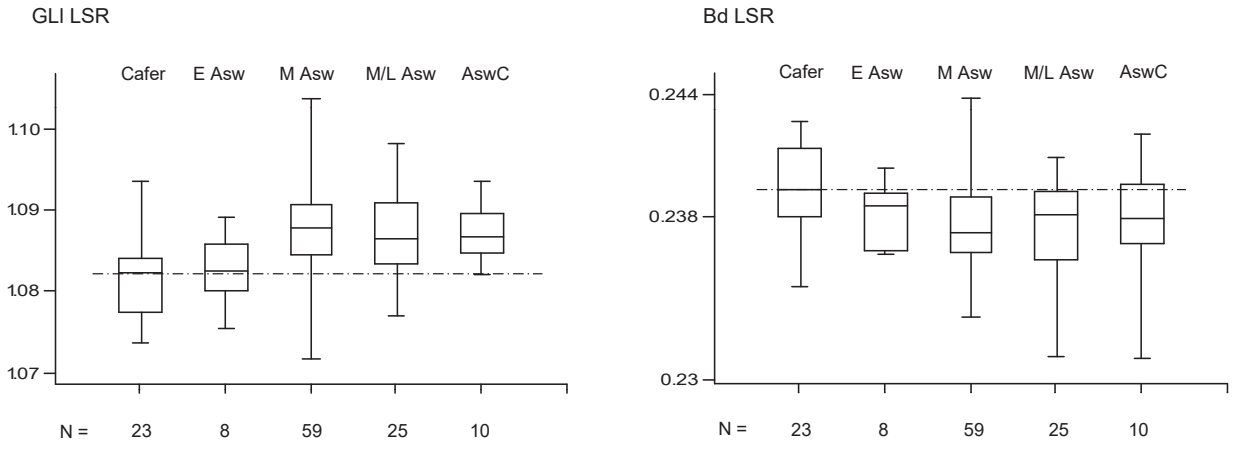


Fig. 3.9. Shape comparison of the astragali of Capra from Tell Aswad with the goats from Cafer Höyük and other MPPNB and LPPNB sites (Mosimann's method). Box plots showing the indices of isometric size and the shape indices (Log Shape Ratios) for GLl, Bp and Bd (Past software). The dashed line indicates the median for the Cafer goats. E Asw = Early phase; M Asw = Middle phase; L/M Asw = transition Middle/Late PPNB; AswC = Middle PPNB layers from the Area C of Aswad.



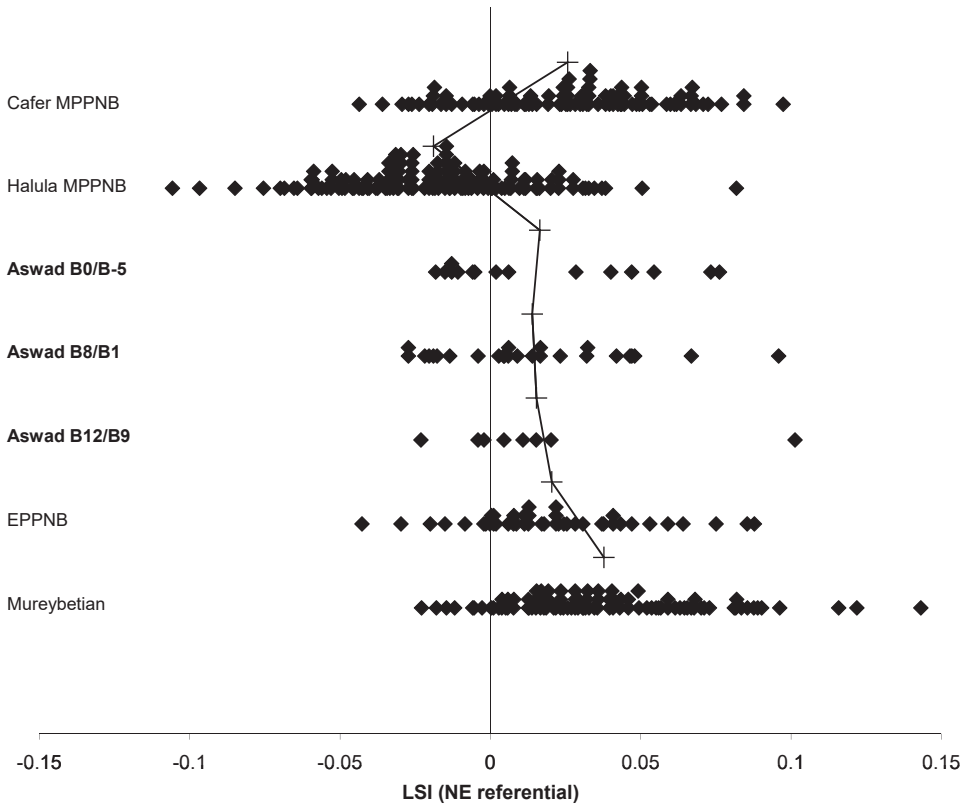


Fig. 3.10. Comparison of the biometric data (LSI) of Ovis from Tell Aswad with the PPNA (Mureybetian) mouflons and the sheep from Cafer Höyük (Early and Middle PPNB) and Halula (Middle and Late PPNB).

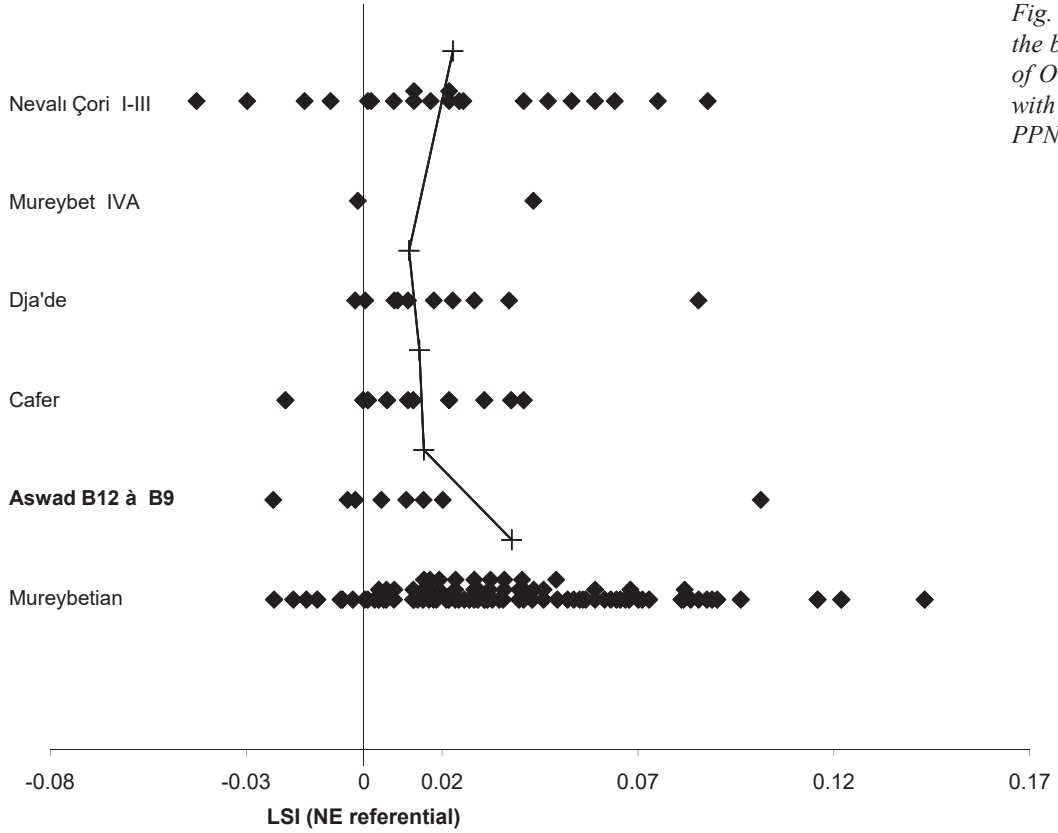


Fig. 3.11. Comparison of the biometric data (LSI) of Ovis from Tell Aswad with sheep from Early PPNB sites.

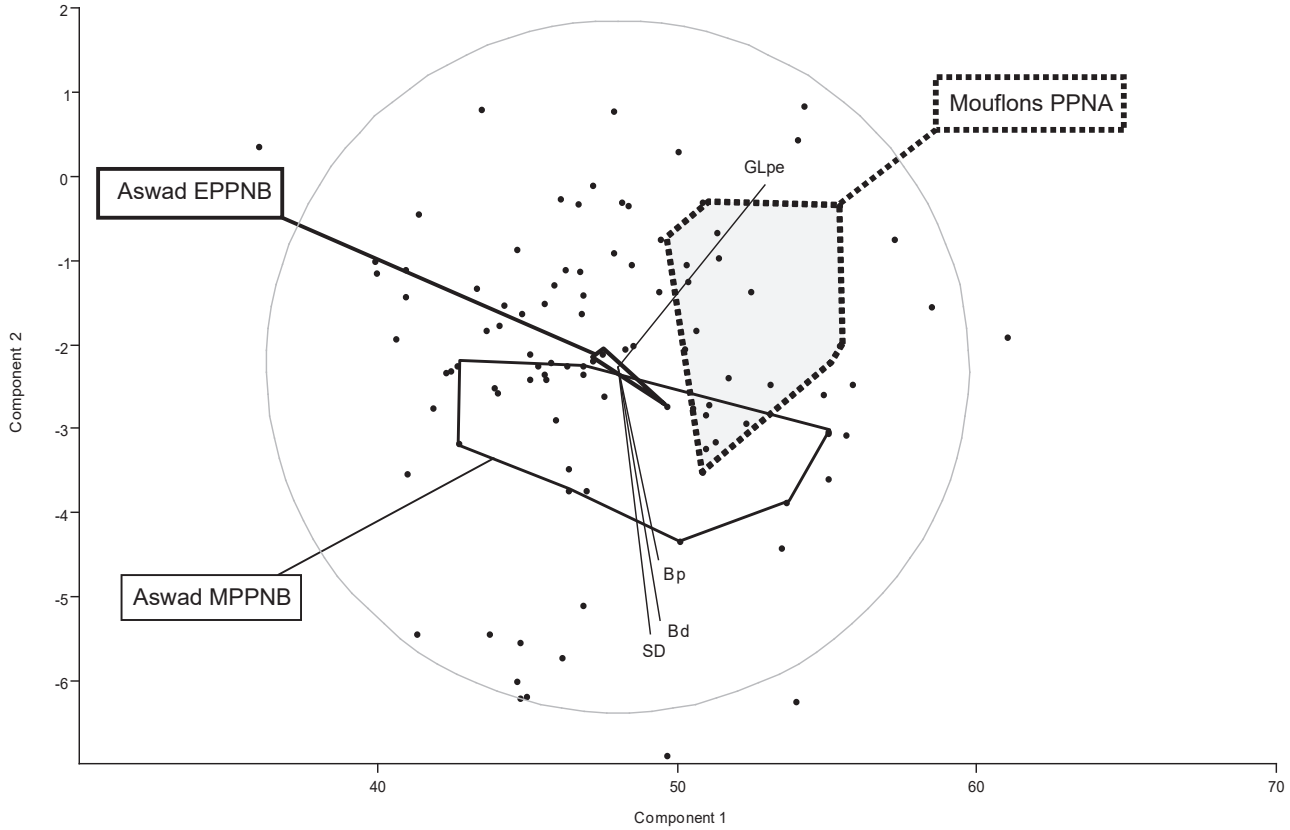


Fig. 3.12. Size comparison of the first phalanges of Ovis from Tell Aswad with the PPNA mouflons (in grey). Principal component analysis (Past software).

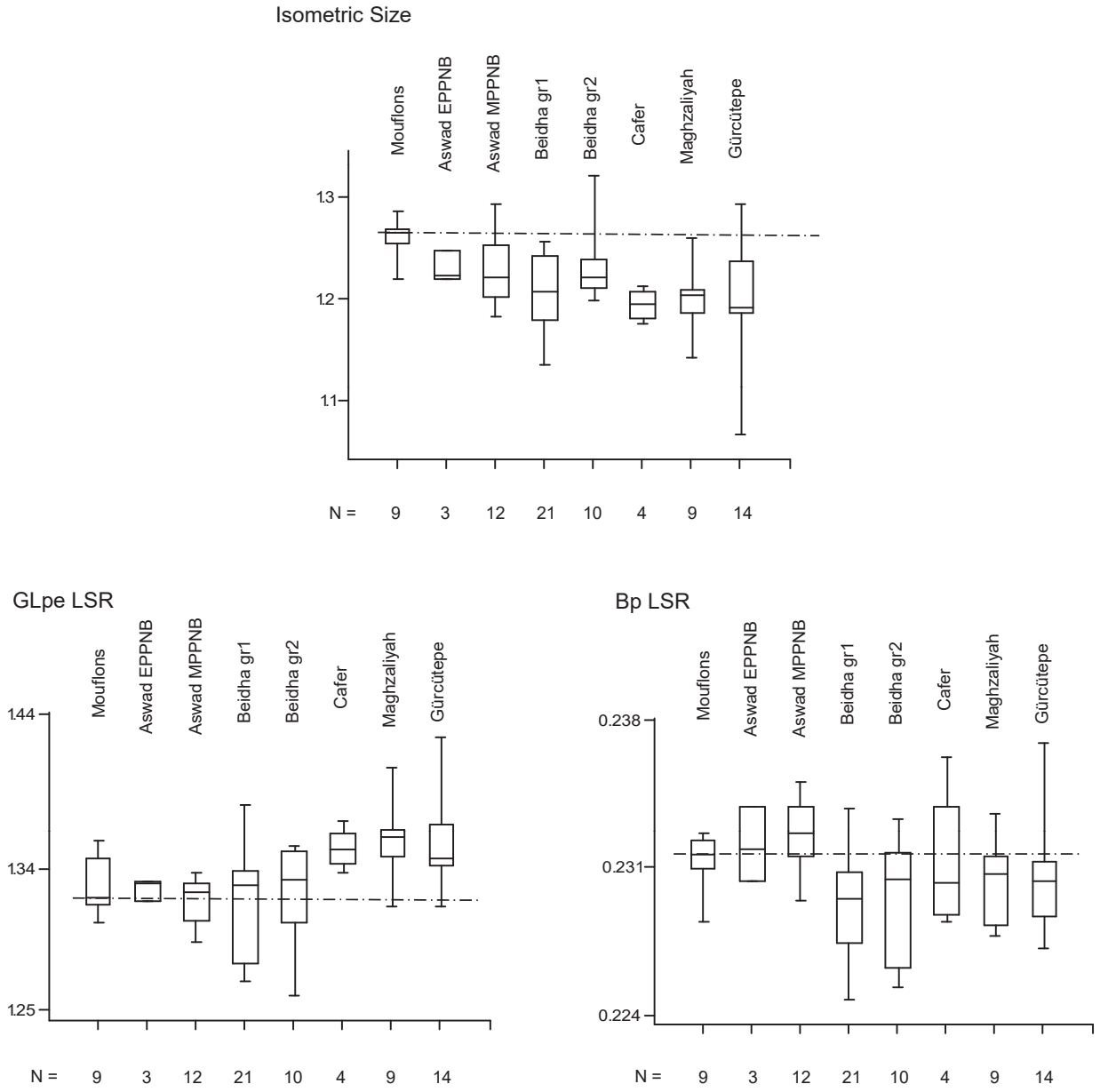


Fig. 3.13. Shape comparison of the first phalanges of Ovis from Tell Aswad and other PPN sites with the PPNA mouflons (Mosimann's method). Box plots showing the indices of isometric size and the shape indices (Log Shape Ratios) for GLpe and Bp (Past software). The dashed line indicates the median for the PPNA wild sheep.

(GLpe, Bp, SD and Bd), the 3 phalanges from Early Aswad are outside the range of variation of the mouflons but are very close to that of the specimens found in the Middle phase (Fig. 3.12). The isometric size is correlated with the two main components, but in a negative way (ISi/axis 1: r = 0.878, Puncorr = 9.9E-34; ISi/axis 2: r = –0.472, Puncorr = 5.3E-07).

Regarding the shape analysis, we can see that, despite a clear reduction in the isometric size compared to the PPNA mouflons, the Bp indices increase and the GLpe indices do not change at the same time for the Aswad populations (Fig. 3.13): the phalanges from Tell Aswad are stockier than the phalanges of wild sheep. On the other hand, at Cafer and Maghzaliyah (domestic), Bp is smaller and GLpe larger: the breeds have more slender phalanges. At Beidha, whatever the group considered, Bp is smaller and GLpe slightly larger than those of the mouflons, like in the Northern Levant. Consequently, the general decrease in size and the presence of important allometries argue for the domestication of sheep in the Early PPNB at Tell Aswad. The study of the humerus, still in progress, seems to go along the same lines.

Pigs (*Sus scrofa/domesticus*)

For the pig bones, the number of variables for applying the

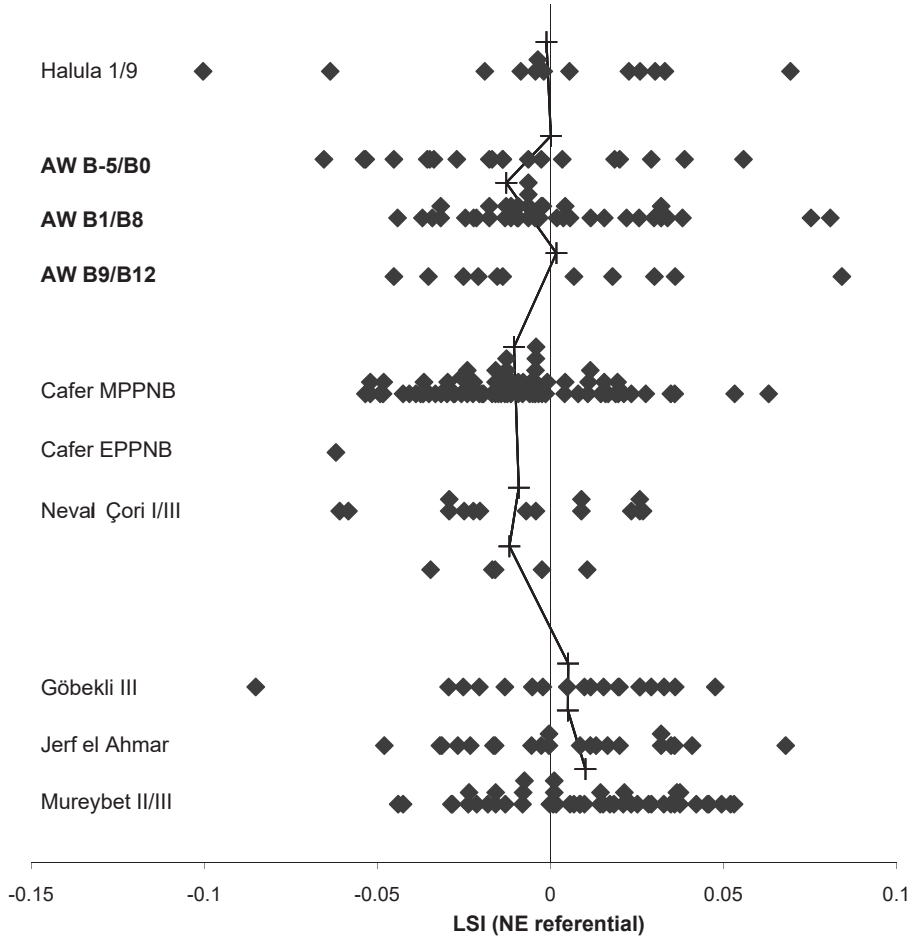


Fig. 3.14. Comparison of the biometric data (LSI) of Sus from Tell Aswad with the PPNA wild boars (Mureybet, Jerf el Ahmar and Göbekli III) and pigs from the Early (Dja'de, Nevalı Çori I/III, Cafer) and Middle PPNB (Cafer, Halula 1/9).

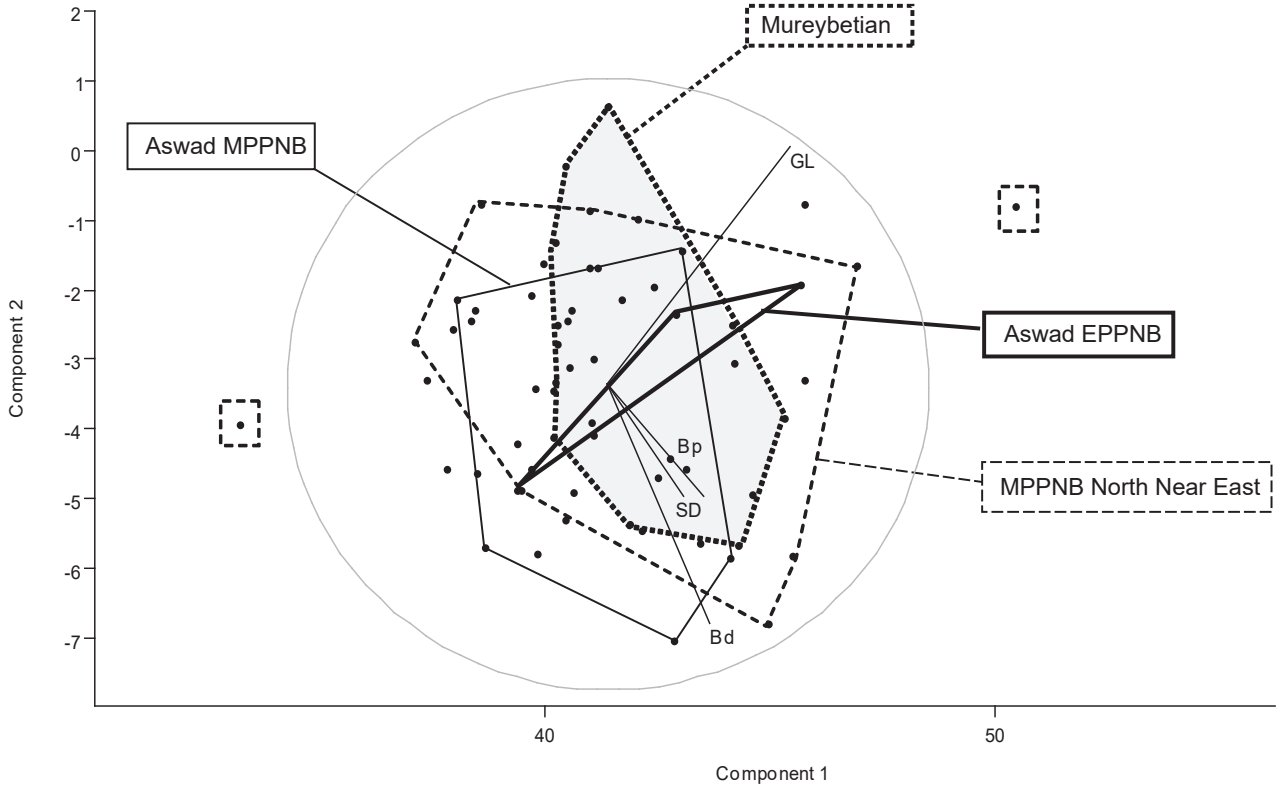


Fig. 3.15. Size comparison of the second phalanges of Sus from Tell Aswad with the PPNA wild boars (in grey) and pigs from other Middle and Late PPNB sites. Principal component analysis (Past software).

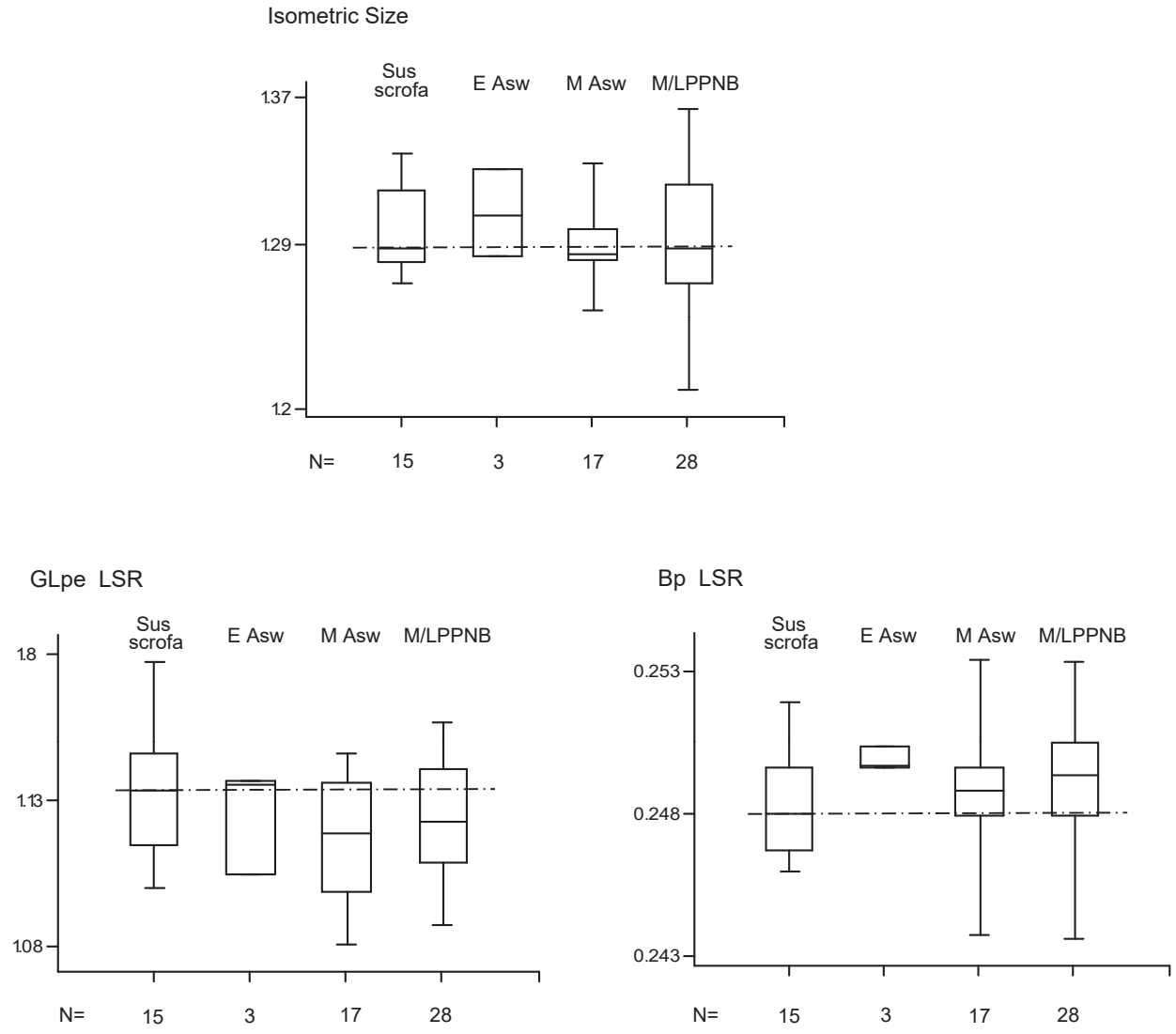


Fig. 3.16. Shape comparison of the second phalanges of Sus from Tell Aswad with the PPNA wild boars and pigs from other Middle and Late PPNB sites (Mosimann's method). Box plots showing the indices of isometric size and the shape indices (Log Shape Ratios) for GLpe and Bp (Past software). The dashed line indicates the median for the PPNA wild boars.

LSI method is low (N=8), due to the usual predominance of young or subadult animals (scarcity of completely fused long bones) in Neolithic sites. Therefore, the results obtained from the size analysis have to be considered with caution. As a whole (Fig. 3.14), the mean values of Tell Aswad appear smaller than the data from the PPNA period (Mureybet II/III, Jerf el Ahmar, Göbekli III). Consequently, these pigs could be domestic.

Only one set of data is useful for the analysis of the variations in size and shape: the second phalanges. Regarding the size, the results of the PCA (ISi/axis 1: r = 0.29, Puncorr = 0.0223, significant; ISi/axis 2: r = –0.054, Puncorr = 0.673, non significant) show that the specimens from Early Aswad (N=3) match well with the wild population (PPNA) and those from the Middle phase (N=17) are located in the bottom-left part of the graph (Fig. 3.15). For the other samples from MPPNB and LPPNB sites, the range of variation is so large than it incorporates all the assemblages.

The indices of isometric size do not present any clear variation over time (Fig. 3.16). However, looking at the shape indices, it appears that the Bp values are much higher and the GLpe values smaller than the wild standard (correlation Bp LSR/GL LSR, r = –0.23, Puncorr = 0.069, non significant but just under the 0.05 threshold): the phalanges of domestic pigs are in general stockier. The same trend is observed for every phase at Tell Aswad. Then, domestic pigs are probably present at the site since the earliest occupations.

Conclusions

The combination of different methods for analysing both the size and the shape (proportions) of the bones can be

useful when dealing with small assemblages. The LSI method has been used here to detect the presence of variations in the general size. If this all-embracing method is not always meaningful (especially when samples are too small), it can be applied in addition to other statistical tools and can give relevant results when the variation in size over time is the main studied parameter. Bearing in mind that this variation remains one of the criteria which can be used for identifying the domestication: reliable for sheep and pig, fairly secure for goat but weaker for cattle (Helmer *et al.* 2005; Helmer & Gourichon 2008). For instance, the fact that the mean values of the goats from Tell Aswad are lower than those of the EPPNB and MPPNB populations from Cafer Höyük reinforces the hypothesis about their domestication in the earliest levels of the site. The same argument can be proposed for the pigs.

The application of a principal component analysis to the raw biometric data allows us to assess the variability in size and shape of a given skeletal part. On the one hand, the global size variation (isometric size) is mainly expressed by the first principal component (axis 1). Indeed, differences between males and females and of between domestic and wild can be observed on this axis. On the other, the second component (axis 2) displays especially the variations in proportions, namely the allometries, which can be negatively correlated with or independent from the isometric size. Then, the calculation of size and shape indices, following the Mosimann's method, gives the possibility to study more precisely – and separately – the variation of each parameter (i.e. bone measures).

The analysis of the potential domestic ungulates found in the deepest levels of Tell Aswad (Early PPNB) provides various results. First, determining the status of the sheep at Tell Aswad is rather easy: the bones which were taken into account for the study are obviously different in size as well as in shape from the wild standards (PPNA populations of the Northern Near East). These sheep can be then considered as domestic. Secondly, for the goats, the absence of data which could be representative of the local wild populations and the occurrence of distinct allometries complicate the study. However, based on the most relevant dataset (from the astragalus), a general smaller size and a probable genetic drift suggest that the goats are domestic. Thirdly, the second phalanges of pigs from Early Aswad do not seem to vary in size but are similar in shape to the domestic pigs, like those from the Middle PPNB which are clearly distinct from the wild boar. This observation suggests that pigs are domestic in the oldest levels, but the low number of specimens and the particular nature of the bone (phalange) do not allow us to conclude with certainty. Lastly, it remains difficult to assert whether the bovines from Early Aswad are domestic or not, although their domestic status is clearly defined as least from the earliest level (B8) of the Middle phase (Helmer & Gourichon 2008). Since the first evidence for the domestication of cattle were found in the Early PPNB of Dja'de el Mughara (Helmer *et al.* 2005), it implies that either the presence of domestic bovines (and pigs) is later at Tell Aswad, or that these animals arrived altogether with the other domestic taxa.

As a major result, it seems evident that at least one species, sheep, is domestic at Tell Aswad in the earliest occupations. This animal is present in the oldest layer excavated at the site. So, if this level corresponds to the first occupation, this implies that the village was settled at the end of the Early PPNB period by a community of herders. The site location, on the bank of a permanent lake, nearby hilly landscape where flint sources are abundant, was very well suited for agriculture (rich soils) and herding (grasslands and reed beds). Moreover, the Damascus Oasis, at the foot of wooded mountains and on the edges of dry steppe areas, is at crossroads between Northern and Southern Levant and between the inland and the coastline. With herding based on caprines and hunting focused on small game, Tell Aswad is economically more related to the Southern than to the Northern Levant (Helmer & Gourichon 2008). The lithic industry comprises also typologically 'southern' tools but made with technologically 'northern' supports, i.e. with blades produced from bipolar naviform cores (F. Abbès, personal communication).

The hypothesis we can make about the first settlement of Tell Aswad is as follows: if there was acculturation from the North (introduction of some techniques), as is likely the case, the integration of these techniques was made in accordance with cultural modalities particular to the Southern Levant. In other words, if the human group was originated from the South or the nearby territories and accultured by contact with the North, they certainly acquired new techniques (husbandry, flint knapping) but managed them in their own way. Most of the questions about the beginnings of the animal domestication and the diffusion/adoption of new technological knowledge rely on the archaeological data available for this critical period (9th millennium BC). In this sense, the large region extended from the Euphrates Valley to the Damascus Oasis remains little known until now. Recent excavations and material studies carried out in Lebanon and Southern and Western Syria will hopefully provide new information about the local wild populations of ungulates and, consequently, about the emergence of husbandry in this area.

Note

1 The annual rainfall is 150–200mm today.

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Appendix. Measurements and mean values used for the calculation of the Log Size Index (LSI), Near Eastern (NE) referential.

***Bos* sp.**

Humerus	Bd	Bt	Htr
M	101.95	90.98	56.9
N	14	24	26

Scapula	GLP	LG	BG
M	82.26	65.58	55.16
N	21	22	25

Radius	Bp	Bfp	Dp	Bd
M	98.68	88.04	50.57	89.22
N	15	11	15	15

Carpi II-III	GB
M	42.62
N	72

Metacarpus	Bp	Dp	Bd	BFd
M	72.82	42.32	67.4	73.91
N	23	29	21	30

Astragalus	GLl	Bd
M	80.48	52.19
N	86	94

Metatarsus	Bp	Dp	Bd	BFd
M	58.42	58.38	66.2	71.36
N	25	10	23	25

Tibia	Bd
M	75.24
N	20

Phalanx 1	Bp	SD	Bd
M	36.27	34.94	33.55
N	204	122	96

Centrotarsale	GB
M	66.38
N	59

Phalanx 2	Bp	SD	Bd
M	35.76	29.64	30.98
N	409	317	291

***Capra* sp.**

Scapula	GLP	LG	BG
M	36.32	29.17	24.44
N	115	128	141

Astragalus	GLl	Bd	Dl
M	33.22	21.37	18
N	259	204	208

Humerus	Bd	Bt	Htr
M	36.19	33.98	21.58
N	242	226	264

Tibia	Bd	Dd
M	30.07	22.89
N	108	104

Phalanx 1	Bp	SD	Bd
M	15.02	12.39	14.33
N	193	176	176

Phalanx 2	Bp	SD	Bd
M	14.62	10.86	11.58
N	123	123	107

***Ovis* sp.**

Humerus	Bd	Bt	Htr
M	32.96	31.49	20.49
N	222	201	229

Scapula	GLP	LG	BG
M	36.06	28	22.88
N	102	108	113

Metacarpus	Bp	Dp	Bd	BFd
M	24.44	17.76	27.30	27.95
N	46	39	30	46

Astragalus	GLl	Bd	Dl
M	31.58	19.71	19.01
N	239	218	197

Metatarsus	Bp	Dp	Bd	BFd
M	22.87	23.69	26.22	26.85
N	44	19	42	53

Tibia	Bd	Dd
M	28.61	22.46
N	95	66

Phalanx 1	Bp	SD	Bd
M	13.36	10.47	12.77
N	117	108	103

Phalanx 2	Bp	SD	Bd
M	12.86	9.02	10.14
N	67	69	60

***Sus* sp.**

Humerus	Bd	Bt
M	49.28	37.92
N	24	21

Scapula	GLP	BG
M	43.02	30.46
N	23	24

Astragalus	GLl	Bd
M	50.41	29.31
N	33	34

Radius	Bp
M	35.05
N	11

Phalanx 1	Bp
M	21.42
N	30

Metap. 3/4	Bd
M	20.44
N	23

Phalanx 2	Bp
M	19.79
N	33

Tibia	Bd
M	35.76
N	17