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Research Project

Gaëlle Le Dosseur



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Bone Objects in the Southern Levant from the Thirteenth to the Fourth Millennia: Research Project

The organization of prehistoric cultures in the Near East went through considerable changes over the course of time ranging from the thirteenth to the fourth millennia BP. These changes revolved around two main processes: Neolithization and Chalcolithization.

The former marks the gradual transition from the nomadic predatory cultures that dominated in the Paleolithic, to productive often sedentary cultures. The Neolithic heralded the appearance of agriculture and animal rearing, not only for meat but perhaps from the outset for animal byproducts such as hides and milk. Pottery emerged in the second half of this period.

The Chalcolithic is characterized by the emergence of copper metalwork. Major changes in social and socio-economic organization as well as representations inevitably went hand in hand with these phenomena. These were crystallized in the Chalcolithic with the initial signs of social stratification.

Archeologists, by studying the material remains available to them, attempt to characterize the technological, economic and social changes, and adaptations which occurred during this lengthy period.

I hope to contribute to this research, limiting the geographic framework to the Southern Levant, by focusing on one area of the material culture; namely, objects made of bone (also called the "bone industry").

It is always difficult to defend the study of one facet of a culture over others, given that all appear to be connected to form a coherent whole. Nevertheless, I believe that in this specific context, the domain of the bone industry, as part of the wider field of **animal transformation**, is a privileged field of exploration. It is a meeting place where theoretically are intertwined the key vectors of change mentioned above (relationships between man and beast, modes of transformation of raw material...). This may be a useful guide when attempting to disentangle the general system and to better define this prehistory of cultures in the Southern Levant.

My goal is hence to probe the behavior of the bone industries in the light of the major changes that took place during the lengthy period of time under consideration: what were the interactions with their environment, what was the pace of change, their plasticity, their robustness, what kind of markers do they represent in this context?

I. Presentation of the geographic and chrono-cultural framework

The geographical framework (see map, p. 126)

The Near East customarily includes the region situated between the Mediterranean coast to the West, the Zagros range to the East, the Taurus range to the North and the Red

Sea to the South. My research domain is concentrated on one part of this vast area: the Southern Levant. It extends North-South from the Sinai to the Damascus basin, and East-West from the Mediterranean Sea to the fringes of the Arabian Desert. It includes two strips of land that were particularly conducive to human settlement – the coastal area and the Jordan Valley.

The chrono-cultural framework

The presentation of the cultural environment in which the target bone industries developed is concentrated in the Southern Levant. Nevertheless, I will at times allude to phenomena observed in the Northern Levant. Note that my research focuses on events taking place during the Neolithic and the Chalcolithic. However, to correctly assess their impact, we need to integrate into this framework the period which immediately preceded the first major upheaval since it forms the essential basis for comparison. For this reason, the journey in time will begin in the Natufian, a culture on the seam of the Paleolithic and the Neolithic.

The Natufian (12500-10200 BP)

The Natufian inaugurates the lengthy period under consideration.

This culture¹ developed between 12500 and 10200 BP, on the threshold of the Neolithic which amongst other phenomena, marked the transition from predatory cultures to productive often sedentary cultures. It appeared over a vast geographic area extending North-South from the Middle Euphrates to the Sinai and Negev deserts, and West-East from the Mediterranean coast to the Jordanian plateaus.

The Natufians, like their Paleolithic predecessors, hunted, fished and gathered: the species- both animal and plant- that they used were wild² and extremely varied. However a major change took place during this period. In the central zone, which corresponds to the Carmel-Galilee region³, small "villages" emerged which appeared to have been occupied for most of the year. The Natufian thus marks the transition from nomadic life to a lesser degree of mobility, or a form of sedentary living.

Their circular or semi-circular houses were partially dug out and the lower part built up.

The dead were buried in these villages. The graves were mixed in with the houses or grouped in separate areas nearby.

The flint tools were made up of heavy items, such as pickaxes, as well as small ones often shaped like a half-moon, and hence called circle segments. The heavy material in limestone and basalt was made up of grindstones and hand stones, mortar and pestles, and "fishnet sinkers", as well as grooved stones. The Natufians were also artists. They made numerous sculptures, and stone and bone engravings. Animal themes, which predominated over the human form at that time, appear to reflect a special relationship of man to beast.

¹ It was identified by D. Garrod in the Shukba Cave (Wadi el Natouf) (Garrod D., A New Mesolithic Industry : the Natufian of Palestine, *Journal of the Royal Anthropological Institute*, 1932, vol. LXII, p. 257-269). BP = Before Present (term used for radiocarbon dates in particular).

² Only the dog, an animal that was supposedly not eaten, was tamed.

³ This is the region where Natufian culture is defined the best: it is also called the 'nuclear zone.'

Within the Natufian three phases are defined: the Early Natufian, the Late, and the Final. This latter phase is still poorly known. Despite numerous indices of continuity between the three phases, it would appear that overall there was a decline in the Final Natufian, for instance in the Carmel-Galilee region, which had previously been so dynamic. This latter period was also marked by small changes whose impact on the subsequent periods needs to be investigated. For instance, in Mallaha, a well-known site in the Galilee where the Final Natufian has been highly individualized, there is evidence of the beginnings of stratification of inhabited space, as well as the initiation of relationships with the North.

The Neolithic

The Neolithic follows the Natufian. It is traditionally divided into two major periods: the PPN or Pre-Pottery Neolithic⁴ which is broken down into three phases for the Southern Levant (A, B, and C), followed by the PN (Pottery Neolithic) which, as its name suggests, is characterized by the spread of pottery.

The Pre-Pottery Neolithic (10200-7500 BP)

Pre-Pottery Neolithic A (PPNA: 10200-9500BP)

This general label covers the Khiamian, and the Sultanian that followed it. The Mureybetian, contemporary with the Sultanian in the Northern Levant, is also included.

The Khiamian (10200-10000BP)

Most of the features observed in the preceding period continued in the Khiamian. Habitations were comparable to those in the Natufian but were not systematically underground. Predation was the prime means of procuring animal goods, but stone weaponry changed: arrowheads, which perhaps reflect new modes of hunting, appeared. In addition, representations of animals became less common and were supplanted by human figures, in particular female ones. According to J. Cauvin⁵ this transfer is highly significant. It reveals a change in mentalities that initiates the great upheavals of the subsequent periods -- the domestication of plants and then animals.

The Sultanian (10000-9500BP)

In the Southern Levant, the Khiamian was followed by the Sultanian.

At that time, sedentism increased. In addition, a few sites show evidence of the first form of predomesticated agriculture: some plants were grown but retained their wild form (which they would lose later on). Animals, by contrast, were still hunted. In the Southern Levant, primarily farming communities occupied the Jordan Valley whereas hunter-gatherers were found in the mountains and deserts.

Habitat appears to be more stratified than previously. Houses were located amidst buildings whose function, although unclear, appears to be more specialized.⁶

⁴ This label was suggested by K. Kenyon after excavations conducted in Jericho.

⁵ Cauvin J., *Naissance des divinités, naissance de l'agriculture*, Paris, Editions CNRS, 1997.

⁶ Note however that there are signs of a complex organization of habitat as early as the final Natufian in Mallaha (Galilee) (Valla F.R. *et al.*, *Le Natoufien final et les nouvelles fouilles à Mallaha (Eynan)*, Israël 1997-2000, *Mitekufat Haeven*, 2001, p. 43-184).

Furthermore, in the Northern Levant (Mureybetian) architecture underwent changes. At the end of the period, quadrangular buildings appeared alongside circular ones.

This Neolithic era is also marked by increased long-distance trade, which timidly began in the Final Natufian. This in particular involved the circulation of obsidian from Anatolia. Lastly, there is direct evidence of basketry, which was particularly advanced in the Southern Levant.

The PPNB (9500-8000/7500 BP)

Pre-pottery Neolithic A was followed by pre-pottery Neolithic B (PPNB). This culture emerged at the crossroads of the Northern Levant, the upper valleys of the Tigris and the Euphrates and the Jezira (see map p. 126).

According to some scholars, the PPNB, which emerged in the North, was introduced later in the Southern Levant⁷, during a middle phase. Other researchers on the other hand argue that there were traces of PPNB as of the oldest phase in a few sites.⁸ Thus the issue is to determine whether the PPNB in the Southern Levant was indigenous or imported. I return to this topic later.

During the PPNB, the most striking changes involved the use of animals and plants. Farming intensified, to such an extent that domesticated plants gradually lost their wild form and took on a domesticated morphology. In addition, people began to raise goats and then sheep. The first attempts took place locally in the North. In the Southern Levant, although goats were eventually domesticated locally, the domesticated sheep was clearly introduced by peoples from the North. The Neolithic peoples also raised cattle and pigs as of the PPNB in the Northern Levant. These animals appeared later in the South. The motivations for animal rearing are still unclear. It is reasonable to assume that the use of byproducts, such as milk or hides, was a motivation as of the first attempts. Indeed whereas meat was provided for so long by "loyal" wild species, investing so much effort in domestication only to use this resource seems fairly illogical. Hunting, despite the emergence of animal husbandry, was still extensively employed.

There are a wide variety of PPNB sites. Sedentary farming villages coexisted with temporary habitats used for hunting, flint quarrying... Base camps for nomadic shepherds appeared at the end of the PPNB. These increased in the next phase.

In the sedentary villages, quadrangular constructions became more common. Plaster, which reveals good mastery of the use of fire, was frequently used in building. The

⁷ Edwards P., personal comm. Kuijt I., Trying to fit round houses into square holes : reexamining the timing of the south-central levantine pre pottery neolithic A and Pre pottery neolithic B cultural transition, In : Gebel H.G.K. et al. eds., *The prehistory of Jordan II. Perspectives from 1997*, Studies in Early Near Eastern Production, Subsistence and Environment 4, Berlin ex oriente, 1997, p. 193-202.

⁸ Gopher A., *Flint tool industries of the Neolithic period in Israel*, Ph.D. Thesis, Jerusalem, Hebrew University, 1985 ; Gopher A., Mujahiyah - An early pre pottery Neolithic site in the Golan Heights, *Tel Aviv*, 1990, 17, p. 115-143 ; Gopher A., Horvat Galil - An early PPNB site in the Upper Galilee, Israel, *Tel Aviv*, 1997, 24/2, p. 183-222.

domestic areas were well maintained: this was already observed in the PPNA and apparently, in the Final Natufian.⁹

The graves were located outside the houses, or in abandoned buildings. The skulls of the deceased were often removed, a habit going back to Natufian times. What is new in the Southern Levant during the PPNB is the custom of remodeling them.

It is reasonable to presume that village society became more complex in the PPNB. It was needed for the cohesion of the groups, larger than previously. In addition, there is evidence for a denser network of relationships between different sites. All these ties formed a large *koinè* in the PPNB.

With respect to production of material goods, the PPNB people made large arrows out of flint, engaged in weaving and basketry and created a variety of objects in plaster. They also made vessels and ornaments from non-flint stones. It is noteworthy that at the end of the period, people contemporary to PPNB shaped the first pieces of pottery.

Let us return briefly to the origins of the PPNB in the Southern Levant. Did this culture develop locally or was it introduced by peoples from the North? Arguments in favor of both interpretations exist. Intrusive elements are found side by side with features inherited from the local PPNA. We should doubtless presume that there was an outside component that mixed in with the local substrate to constitute an original Palestinian PPNB.

The study of the PPNB in the Southern Levant thus is enhanced by a specific dimension: it is worth studying in this region how new ideas, introduced directly by newcomers and/or indirectly by contacts with the North, blended into the local traditions.

The PPNC (8500-7500BP: contemporary with the final PPNB in the Northern Levant)

This phase was characterized in the southern Levant as in the northern Levant by the "conquest" of arid lands.

Pastoral nomadism expanded considerably during this period (this economic system began in the late PPNB). In the Southern Levant, livestock was enriched by two species: cattle and pigs. Animal husbandry thus took on greater importance whereas hunting was less frequent, although still practiced.

The pottery Neolithic (6th-5th mill. BC)

The areas occupied by the people of the pottery Neolithic were smaller than those frequented by their predecessors. Long distance trade, so intense in the PPNB, rarified. In addition, the size of the sites decreased and no stratification can be determined between them. Furthermore, no specific social contrasts are observed in the habitats.

The subsistence economy was partly based on farming. At that time, recourse to new implements suggests that changes took place in the management of cultivated fields.

Stone projectiles, smaller than previously, are doubtless indicative of new methods of hunting. However this activity was in sharp decline, and replaced by animal husbandry.

The emergence of pottery signals a technological innovation, which however needs to be put into perspective. In fact, some techniques were directly drawn from those used for

⁹ Valla F.R. *et al.*, Le Natoufien final et les nouvelles fouilles à Mallaha (Eynan), Israël 1997-2000, *Mitekufat Haeven*, 2001, p. 43-184.

work on plaster that had existed since the PPNB¹⁰. The first potteries were not very functional: they seem to have been primarily used to reflect new social and ideological values. They were, in this respect, a new cultural marker.

Thus throughout the pottery Neolithic, people made small adjustments, accumulated small changes which little by little restructured society and its economy at the same time as these changes made them more flexible and able to innovate or absorb new trends. The modifications arise from internal flux, perhaps influenced by outside trends. However the material culture testifies to intrinsic creativity and a high degree of freedom.

The Chalcolithic (4200-3500BC)

During this era, the large sites orchestrating social, religious and economic activities emerged. They were surrounded by smaller satellite settlements. Each center-periphery unit thus formed a regional center united by shared ties: there were doubtless closely knit relationships between the different units. In addition, long distance trade intensified, reaching Egypt at the end of the period.

The Chalcolithic is hence marked by a much more stratified social and economic organization. The contrasts are found between both the center and its periphery as well as within sites. Certain activities were reserved for specialists. This was the case for work on ivory, pottery and copper metal work (the technological innovation which marked this period). The degree of social integration is thought to have reached the level of the chiefdom. Subsistence depended on farming and animal rearing. There was an increase in irrigated crops, while animals were raised for their meat as well as for byproducts such as skins, milk, and power (horses and donkeys were used for transportation). Hunting was rare. Several systems of occupation and use of land are found. Sedentary farming villages coexisted with base and seasonal camps for semi-nomadic shepherds.

Thus throughout this period there were considerable changes which affected the use of the environment, both animals and plants, as well as social relations and representations of the world. All this doubtless impacted in one way or another on the bone industry, which was part of the daily life of these cultures. The changing relationships between people and animals doubtless played a particularly influential role.

A few reactions can be anticipated here. But before presenting in detail the questions I intend to raise, in this context as regards the bone industry, it is worthwhile summarizing what is already known about this activity for the period under consideration.

II. The bone industry in the Southern Levant: state of the art

As in Europe, the bone industry experienced its first period of growth in the Aurignacian (32000-20000BP – the Upper Paleolithic). It then waned until it recovered its dynamism in the Natufian.

The Natufian

The range of objects created at that time was extremely varied. The local and trans-cultural toolbox was composed of awls, spatulas (flat tools at times suggestive of European smoothing tools), and tools with a beveled edge (see pl. I, 1-3, p. 127). This

¹⁰ In the Northern Levant, the first pottery pieces have been found contemporary to the end of the PPNB, next to plaster vessels.

industry existed alongside more original, complex and doubtless more specialized objects, such as handles with lateral blade slots, retouchers (probably flint pressure flaking tools), large bi-points, small bi-points or “straight hooks,” “curved hooks” as well as barbed points (see pl. II, 4-9, p. 128). The four latter tools are customarily believed to have been hunting and fishing weapons although firm evidence is still lacking.

The Natufians also made beads and pendants (see pl. III, p. 129).

Finally, some sculpture has been found, often decorating the tools (see pl. II, 4, p. 128).

The material most often used was bone. Use of antlers was less common. The animals used for their bones coincided with those that were eaten: large bovines, deer, roebuck, gazelle (found extensively), hares and birds. The long bones, the ribs and the phalanx were all used.

The bone modification techniques were very varied. The Natufians mastered almost all of them: percussion, sawing, grooving, scraping and abrasion.

These people customarily heated their work, often in the finishing phase. We do not know how or why this was done: did it make the work easier on bone, did it strengthen the tools or did it enhance them esthetically (heating makes rich, warm, sparkling colors that are pleasing to the eye)?

The technological sequences were more or less standardized depending on the type of product. Common tools are evidence of more flexible production whereas the original and complex objects were more codified.

Initial conclusions regarding these Natufian industries have been put forward by D. Stordeur, a specialist in this field in the Near East.¹¹ The distribution of typically Natufian attributes enabled Stordeur to define a vast cultural zone. However, a closer examination led to the differentiation of four geographic areas¹² differing as to the presence of the typical attributes. The Carmel-Galilee is the richest, in that the farther from this area, the greater the loss of attributes. The decline is found in both space and time: it translates by a gradual reduction of the spectrum of objects manufactured, with lesser specialized and complex tools as common domestic tools increased, as well as by a simplification of techniques. The waning with time appears however less marked in the central Carmel-Galilee area, which was more conservative than the periphery.

The reasons for this loss are still not well understood. They need to be explored in detail. In addition, today we are able to specify the behavior of the bone industry at the very end of the period through excavations conducted on a site in the Galilee, Mallaha, where the final Natufian has been highly individualized.

The PPNA

¹¹ Stordeur D., *Outils et armes en os du gisement natoufien de Mallaha (Eynan), Israël*, Mémoires et Travaux du Centre de Recherche Français de Jérusalem, 1988, 6, Paris, Association Paléorient, 135 ; Stordeur D., Le Natoufien et son évolution à travers les artefacts en os, *In* : Bar Yosef, O. et Valla F.R. eds., *The Natufian culture in the Levant*, 1991, International Monographs in Prehistory, Archaeological Series 1., 1991, Ann Arbor, p. 457-482 ; Stordeur D., Change and Cultural Inertia : From the Analysis of Sata to the Creation of a Model, *In* : Gardin J.C. et Peebles C.S. eds., *Representations in archaeology*, Indiana University Press, Bloomington, 1992, p. 205-222.

¹² Carmel-Galilee, Judea-Samarie, Negev-Sinai, Northern Levant.

The bone industries in the Southern Levant, less well known than those in the North, include the same common objects as in the previous phase. In contrast, typically Natufian objects, such as projectiles, hooks, and lateral hafted handles disappear. At the same time, new heavy tools on long bones, mandibles and shoulder blades appeared (see pl.IV, p. 129). Some are similar to tools used in the PPNB and are thought to be possible farming instruments. Did the first bone farming tools appear as of the PPNA? Note that at that time a form of pre-domesticated agriculture was present. To answer this question, we need to conduct functional studies on the target tools.

There was little change in technological register and the absence in the Southern Levant of new techniques which had appeared in the North is intriguing. There is evidence for high investment in manufacturing although the use of natural shapes, which restricted modification, was more frequent than previously.

The PPNB

Ordinary transcultural tools dominated at this time. Complex and specialized output were much more rare and their geographical scope was shrinking.¹³ A few tools suggestive of shovels or axes were perhaps used for farming which developed in the PPNB.¹⁴ (see pl. V, p. 130). Functional analyses also need to be conducted here. Initially, despite the introduction of new domesticated resources, wild animals were still frequently used. This trend reverses as hunting became less frequent.

In the Northern Levant, D. Stordeur and D. Helmer studied resistance to using domesticated animals¹⁵. In their view, the persistence in selecting wild animals was not motivated by material, technological or functional imperatives that the quality of the bones of this type of animal would satisfy. Rather the explanation lies in a strong cultural attachment to these animals. Evidence is precious, but to understand these choices it would have been valuable to take into account other variables such as slaughtering timetables or the management of wild animal carcasses as compared to domesticated ones. Note that this topic has not been dealt with as concerns the Southern Levant. The question of how these two forms – wild and domesticated – were used when both were available has not been raised and should be studied.

Thus the initial studies on the PPNB bone industry show that it was resistant to certain changes. It appears overall to be more inert than many other domains at this time. This is confirmed by the continuity in the Southern Levant of typically PPNA objects whereas Northern PPNB attributes were massively penetrating other spheres of the culture. This resistance has been studied in terms of the shapes of manufactured objects. It would be interesting, for this region, to conduct a more in-depth study of this facet in terms of technological traditions: What were the customs? Were they associated with the

¹³ Stordeur D., Néolithisation et outillage osseux. La révolution a-t-elle eu lieu ? In : Collectif, *Préhistoire d'os*, Aix en Provence, Publications de l'université de Provence, 1999, p. 261-272.

¹⁴ Stordeur D., *ibid.*

¹⁵ Stordeur D. et Helmer D., Les outils en os d'El Kowm 2 caracol : matière sauvage ou domestique?, In : Stordeur D. dir., *Une île dans le désert : El Kowm 2 (Néolithique précéramique, 8000-7500BP, Syrie)*, Paris, Editions CNRS, 2000.

North at that time, or were they the prolongation of older local traditions? This type of study is highly refined, and doubtless the information is very abundant.

Even in the absence of more fine-grained data, several general technological trends have nevertheless been identified. For instance, there was apparently much less modification than previously. The natural shapes of the bones are more often visible. In addition, the manufacturing sequence is more flexible. This is thought to be an indication of an ordinary and domestic form of manufacture rather than specialist output.¹⁶

Few studies have been devoted to the Neolithic Pre Pottery C, the Neolithic Pottery, or the Chalcolithic. The first very preliminary studies suggest that production became standardized in the Chalcolithic.

III. The Research project

There is already considerable evidence on the Natufian-PPNB period. However the research corpus has been enriched by new collections which need to be compared to earlier findings: Do they confirm the conclusions built on the basis of the former, disconfirm them or help pinpoint the original trends?

In addition, hardly any studies have been conducted on the PPNC-Chalcolithic. All the descriptive work needs to be done. My prime goal is to shed light on these periods, but I would like to do so in a broad perspective that covers both major Neolithization and Chalcolithization processes.

I would like to paint a fresco of the bone industry, integrating the findings we already possess on the Natufian-PPNB period, plus the new collections, with new evidence from PPNC Chalcolithic assemblages. In the long term, this requires reformulating questions about the bone industry and devising a homogeneous research framework that will guide analysis of the new collections, integrate earlier data and incorporate the unsolved questions raised about them.

To facilitate this task, I have formulated a theoretical, simplified schema of the role played by the bone industry in the overall system as well as the relationships it logically maintained with the other domains.

In the chart (see chart p. 131-132) the "bone industry" is part of "use of animals." Bone use is traditionally divided into four stages:

- Gathering raw material, which includes slaughter and butchering the animal. This can be autonomous or secondary- in other words part of other higher priority activities such food consumption.
- Its transformation into an object
- Use of the object
- Its disposal.

The arrows indicate the theoretical relationships between the bone industry and the environment during these four stages.

The ecosystem provides the animals at the procurement stage whereas slaughter (and animal husbandry if they were domesticated) affects its balance by preserving the system or depleting it.

¹⁶ Stordeur D., Néolithisation et outillage osseux. La révolution a-t-elle eu lieu ? In : Collectif, *Préhistoire d'os*, Aix en Provence, Publications de l'université de Provence, 1999.

After slaughter and butchering of the carcasses, the raw bones are handed over to the bone object artisans. Reciprocally, some products made of bone (projectiles) can be used in the first operation.

Then, modifying the bone into objects calls for tools made of bone and mainly of other materials. The latter, which may also be used earlier for slaughter and butchering, come from other technological domains in which certain bone tools reciprocally may be used.

Finally, the social and symbolic systems define the rules of animal procurement, bone modification, use and finally the disposal of the manufactured objects. Reciprocally, these four stages maintain these systems by activating their values and providing the mediators for them.

Thus theoretically, multiple relationships can be envisaged. Doubtless the “shifts” observed over time in the environment of the bone industry affected this field. Using the chart, my general question is whether certain changes led to limitations, constraints or stimulations for the bone industry. On this basis I have formulated three major questions to be raised as regards this industry in each chronological-cultural context. I will then compare the findings sequentially to retrace changes over time.

In this article, I first looked at changes in the procurement of animal resources. All during the target period, hunting strategies changed, while animal husbandry, a new form of animal use, competed with hunting. Recall that the first attempts at domestication were perhaps motivated by the use of byproducts or by specific social usages. From this changes, which affected the initial stages of the bone manufacturing process, we can make several assumptions:

- The new domestic status may have attracted bone industry artisans to these animals. Alternatively, the rarity of wild prey could have engendered a new fascination with them by attributing special prestige to wild animals. Perhaps the values attributed to domesticate/wild status translated into new taboos or new rules of behavior as regards their skeletons: for example, a particular status would be assigned to the manufacture of certain type of object, made in a certain way depending on the value attributed to the animal.
- Changes in procurement of animals may have affected the slaughtering calendar and hence the seasonal availability of skeletons, a variable which probably influenced the choice of animal whose bones were used and the way these were treated.¹⁷

Thus, on one hand, the emergence of animal husbandry perhaps led to a restructuring of the hunting calendar and hence modified the habits of bone artisans who relied on this resource.

On another hand, the modes and goals of animal rearing (perhaps different from the outset from those of hunting) probably led to new slaughtering calendars that were either

¹⁷ For instance, a species which is not available when there is a need for bone objects will either be left out of the selection, or stockpiled beforehand (the unprocessed or transformed bones are stored to handle future needs, for example).

more beneficial or more detrimental to the bone artisan. These modalities perhaps dictated certain choices. For instance:

- Imagine that an economic imperative dictates the slaughter of domesticated goats in the winter because in this season fodder is in short supply and hence the cost of feeding is too high. If bone objects are needed in the spring, the demand must be anticipated by storing raw material starting in the winter, or setting aside finished objects in goat bone. Alternatively the artisan could use other animals, possibly wild ones, available in the spring.¹⁸ In this case, goat bones would not be used since the slaughtering season does not coincide with the demand for bone objects.
- Imagine that specific societal events call for the slaughter of certain domesticated animals at a given season.¹⁹ If the time when the bone objects are needed does not coincide with the slaughtering calendar, adaptations must be made.

New modes and reasons for using animal resources could play a role in the number and quality of available bones.

- For instance, the raising of animals for their milk implies the slaughtering of mainly young animals with weak and porous skeletons. Hence the bone artisan will be supplied with mediocre quality bones.
- Biological changes in domesticated animals could manifest, after a certain time, as weaker bones, which then did not fit criteria for use in the bone industry.
- Finally, the carcasses of wild and domesticated animals, perhaps treated differently, might not be equally available. These factors could dictate the choice of one species, domesticated or wild, for industry.

All these features, as well as the specific goals of bone manufacture probably played a role in the management of raw material including the choice of animal, the part of the anatomy and the modes of modification, as well as the economy of the selected portions.

The first question I will raise concerning the bone industry is hence the following:

1) In what ways and how did the mode and context (economic, social, symbolic) of animal procurement govern the choice of species and the processing of their skeletons?

In each chronological-cultural context, I will try to define the choices of species and anatomical parts as well as the techno-economical options applied to each. I will examine the amount of both domesticated and wild animals and how each was treated. I will attempt to interpret the different cases by examining, taking into account manufacturing needs (amount of objects required, desired type...), the variables connected to the context of animal procurement, their intrinsic qualities, the values associated with them. To do so, I will compare data:

¹⁸ Other materials than bone could also be used.

¹⁹ Note however that this situation was not reserved for domesticated animals alone: wild animals could be involved in societal events that would also call for rigid slaughtering calendars.

- on the number of animals present, with a breakdown into an inventory of available anatomical parts and their condition (using tables drawn up by archeozoologists).
- The seasonal availability of different species (using slaughtering curves drawn up by these same specialists);
- Skeleton quality (shape, size, resistance).

I hope to show how the bone industry adapted to each new animal resource procurement situation, which adaptations took place, and changes motivated by them. This will serve to evaluate the flexibility and robustness of this activity.

Secondly in this paper, I turned to changes observed in technological fields not directly related to animal procurement **and/or involving the transformation of other raw material than bone**. We have seen that throughout this period, new activities emerged: farming, weaving, pottery, copper metal work. The emergence of these technologies may have affected the bone industry in the following ways:

- Some activities may have called for earlier bone tools, or required the production of new types.²⁰ In this case, new constraints concerning the amount and qualities of the required products as well as their manufacturing time doubtless imposed technological and economic adaptations that must be assessed.
- Reciprocally, some domains may have provided new tools and weapons that could be used in bone procurement and transformation. They may have helped improve manufacture and/or imposed new constraints (availability and quality of new tools, difficulty in manufacturing or time needed).
- Finally, new cultural-identificatory products such as flint arrowheads, which became more prevalent as of the PPNA, pottery, and metal objects may have led to lesser interest in bone items to play this role. In the case of stone projectiles, the eventual transfer is dual, in both function and in ideas: they replaced bone weapons at the same time as they dispossessed the bone industry of a cultural- identificatory status.

The second question raised as regards the bone industry is hence the following:

2) What relationships did it have to technological activities unrelated to animal procurement and/or involving the transformation of other raw materials than bone? In what ways and how were they mutually tapped?

On one hand, I will assess, in each chronological and cultural context, the spread of bone products to these other technological domains. Did the new activities prompt the call for new bone tools? If yes, to what extent did this new output affect the traditional use of the animal carcass and the technological habits? On the another hand, I will attempt in particular to determine whether the new copper tools of the Chalcolithic were involved in bone industry. Were these products immediately used in practical ways?

²⁰ D. Stordeur raised this question in a recent overview of the Neolithic periods (Stordeur D., *ibid.*). Current information can be supplemented by more in-depth functional analyses.

Were they used for slaughter, butchering of the animals, transformation of bones into objects? What types of shapes and which technological sequences, advantageous or disadvantageous, did they lead to?

The next issue is that of transfer. I will assess the decline of bone objects chronologically, and whether objects made of other raw materials replaced them. In the case of transfer, I will attempt to determine the causes. Was the use of new raw materials due to a dearth of bones? Was the quality of the former better adapted to new needs? Did this decline simply express waning interest in hard animal matter?

In the latter part of this article, I referred to social and socio-economic relationships within sites and between regions. Throughout the target period, relationships within sites as well as between regions changed. Phenomena such as the permeability of the South to the North as of the Final Natufian, the possible arrival in the PPNB of Northern newcomers in the South with whom they doubtless had to deal, the inward-turning of the sites in the Pottery Neolithic (perhaps as of the PPNB), the high stratification of individuals and sites in the Chalcolithic.

There are many implications for the bone industry:

- the opening of the Southern Levant to the North possibly influenced bone manufacture by inspiring new shapes and new techniques
- stratification of individuals and groups may have prompted new identificatory tokens and bone may have been used to produce these objects
- the differentiation between individuals and sites may have led to a new distribution of labor in the bone industry, with access reserved for certain products, modes of production and/or resources.²¹ With this third question, the first two regain their societal dimension.

I hence turn to a third question concerning the bone industry:

Did changes in relationships between people, within sites and on the regional level, affect this activity? If yes, in what ways?

I will attempt to determine, by reexamining all the observations on the use of bones, combined as far as possible with the distribution of evidence in space, which social, socio-economic and cultural landscape defines the bone industry on the site and then on the regional level. Does this picture fit what was observed elsewhere?

- I will start with examining the range of objects produced and attempt to determine the **consumers**.

On the site level, I will look at the spatial distribution of different objects: everyday tools for domestic use, more specialized tools, parts of ornaments. Is there a significant distribution likely to correspond to a functional and/ or social stratification of spaces and perhaps individuals? Similarly I will look at the distribution of products on the regional level: do they show specific contrasts connected to site functions (possibly

²¹ Access to certain species or certain anatomical parts, possibly conditioned by social and economic ties between individuals, could be restricted and reserved for members of certain categories of society.

complementary) or group cultural identities? Alternatively, do they reveal particular affinities between specific regions?

- As regards the transformation of raw material into objects I will attempt to identify the **producers** on the site level.

I will base myself on the distribution of evidence of the bone industry in order to determine the manufacturing areas: were they scattered throughout houses or restricted to more specialized contexts? At the same time, I will examine the social implications of the different types of technological sequences: are they flexible, rigid, or standardized? These questions are aimed at specifying the manufacturing context: is it domestic or the work of specialists²²?

Then I will look whether producers and consumers were the same, different, or the same and different. I will base myself on the distribution in the habitat of objects used (excluding rubbish areas) and then of production wastes connected to them (excluding rubbish areas). Are these locations the same or different?

On a broader scale I will examine the geographic distribution of different known technological sequences. Does it reveal large areas made up of different sites with strong ties among them, or on the contrary, smaller groups turned inward? In the first case, one would have to consider different explanations for a community of features between sites: it could testify to widespread and shared technical concepts going back to a common cultural past, to the spread of products from supply centers to consumers, to the physical introduction into a new region of a group with its own technical traditions and objects (this question is particularly relevant for the PPNB: recall that the Southern Levant was visited at that time by newcomers from the North).

- I have mentioned the use of bone objects and their manufacture. Let us complete the picture by asking who had the right to which types of bone material. Was access restricted to certain species, certain anatomical parts? I will be attentive to the distribution of different species and parts of their skeletons on the manufacturing areas. Can a connection be made between a given situation and the overall context of the procurement of

²² Before drawing hasty conclusions, it is worth examining the meaning of flexible production. This feature is equivocal. It may simply reveal independent domestic production, where each household had its own workmanship. In this case, the range of target products is domestic and the production areas are widespread. However it could also testify to the skill of **one** artisan able to adapt to various technical constraints imposed for example by the variety of shapes of bones collected beforehand. One must be attentive to these possible constraints.

Similar questions can be raised regarding rigid and standardized production. The first step is to ask whether the repeated schema is one option out of other possible ones, or whether inevitably it simply corresponds to severe technical and/or functional restrictions. Once this variable has been excluded, a codified, repetitive production may then be the work of an artisan with individual habits or the work of all if a strong tradition has spread throughout the group. The range of productions concerned will be examined, common or specialized objects, and the spatial distribution of their production areas, whether widespread or circumscribed.

animal resources? (This completes and enhances the first theme mentioned which is directly concerned with this activity.)

These three questions, still at the theoretical stage, and doubtless utopian, will dictate analyses of bone object collections. They will guide the study, but I will attempt to let the archeological evidence speak for itself, and be open to the findings. Disappointments but also pleasant surprises are expected. This is the happy fate of the archeologist.

I hope to be able to present the preliminary findings in the near future.

Gaëlle Le Dosseur

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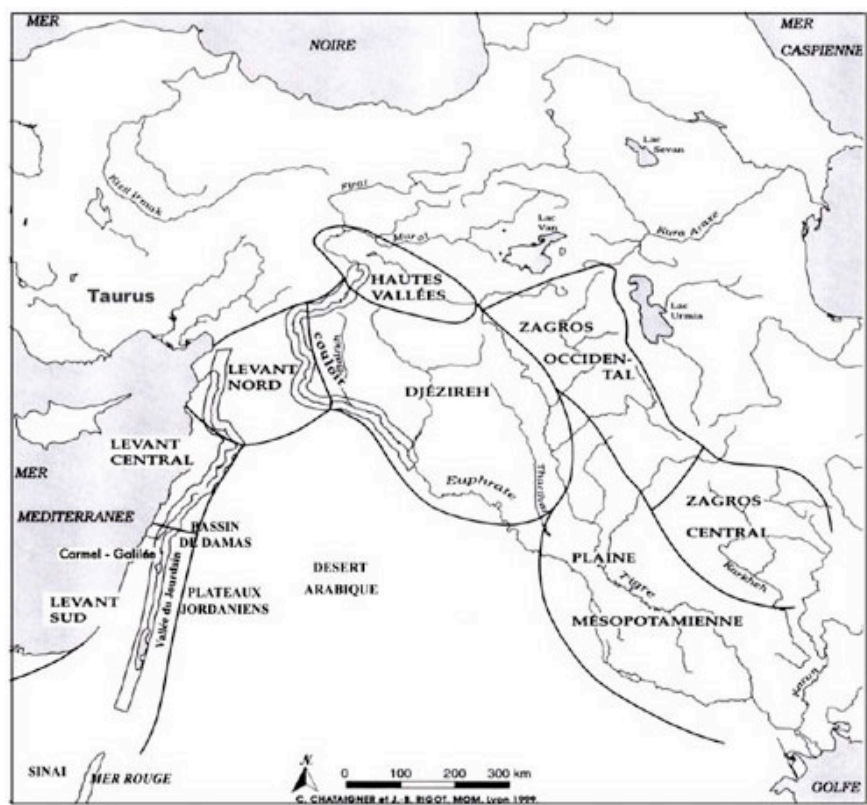
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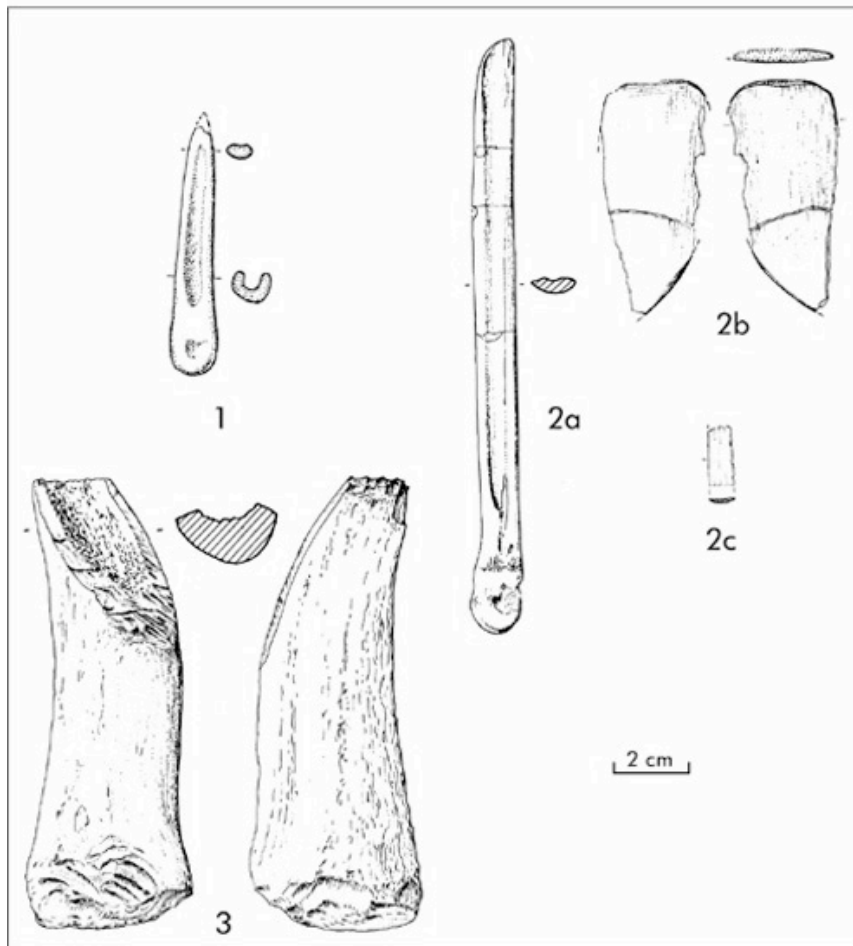


Plate I: Common Natufian tools. 1: Awl (Mallaha, drawing D.Ladiray); 2: Spatulas (Mallaha) : a: drawing G. Deraprahamian, in : Stordeur; 1988; b et c: drawings D. Ladiray; 3: Beveled tool (Mallaha, drawing G. Deraprahamian, in : Stordeur; 1988)

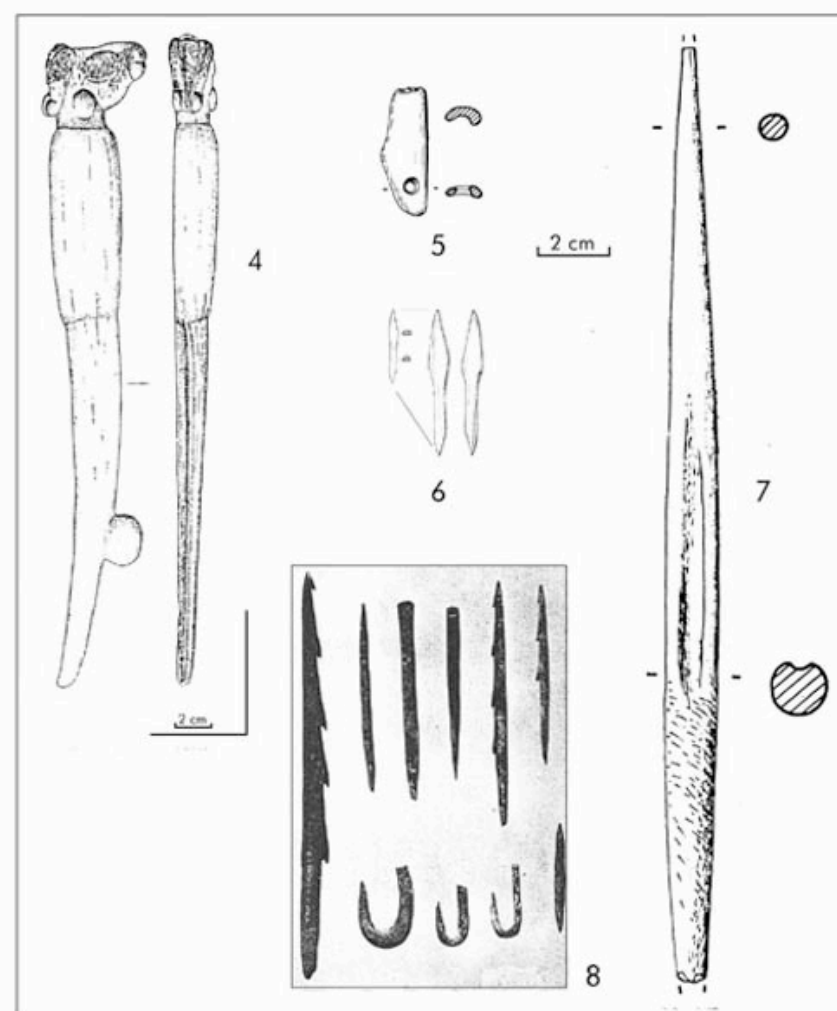


Plate II : Natufian Tools and Specialized Weapons. 4: Handle with lateral blade slot (Kebara, in Unger Hamilton, 1991); 5: Retoucher (Mallaha, drawing G. Deraprahamian, in : Stordeur; 1988); 6: Large bipoint (tip of a lance) (Mallaha, drawing G. Deraprahamian, in : Stordeur; 1988); 7: Small bipoint (Mallaha, drawing D.Ladiray); 8: "Harpoons", small bipoints and "curved hooks" (Kebara, after Turville Petre, 1932)



Plate III: Natufian beads on the ends of gazelle phalanx (Wadi Hammeh, in : Edwards, 1991)

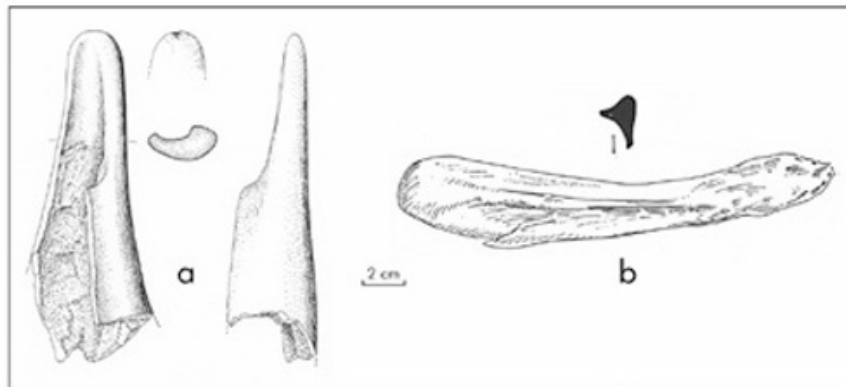


Plate IV : Heavy tools from Neolithic Pre Pottery A. a: Hatula (in : Stordeur, 1994); b: Jericho (in : Marshall, 1982)

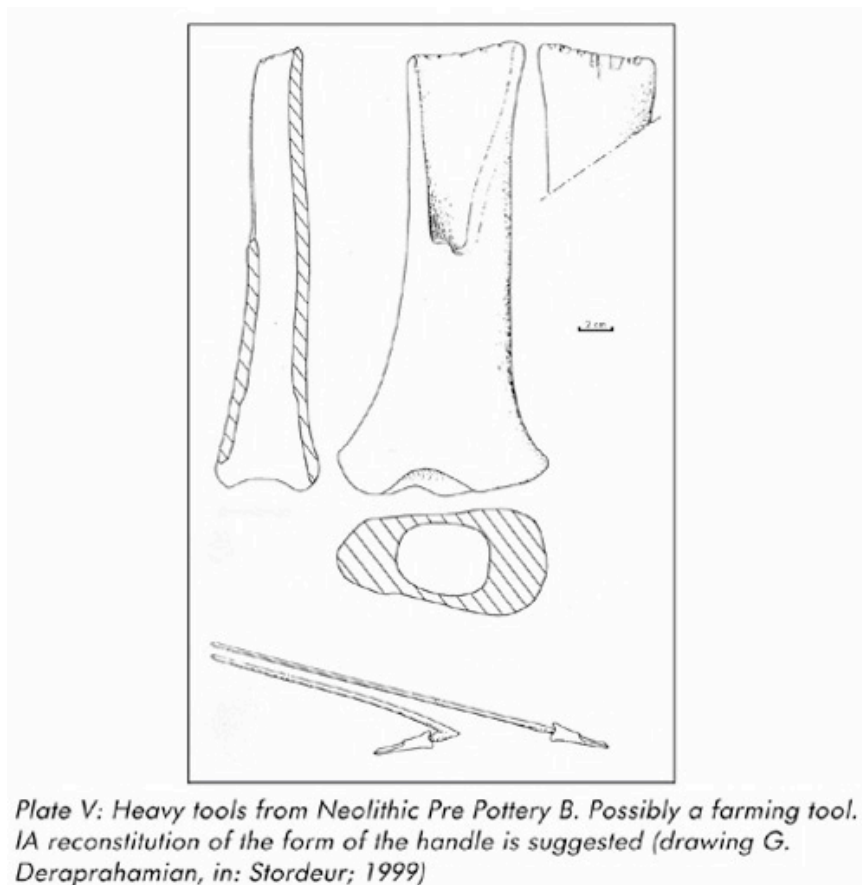


Plate V: Heavy tools from Neolithic Pre Pottery B. Possibly a farming tool. A reconstitution of the form of the handle is suggested (drawing G. Deraprahamian, in: Stordeur; 1999)

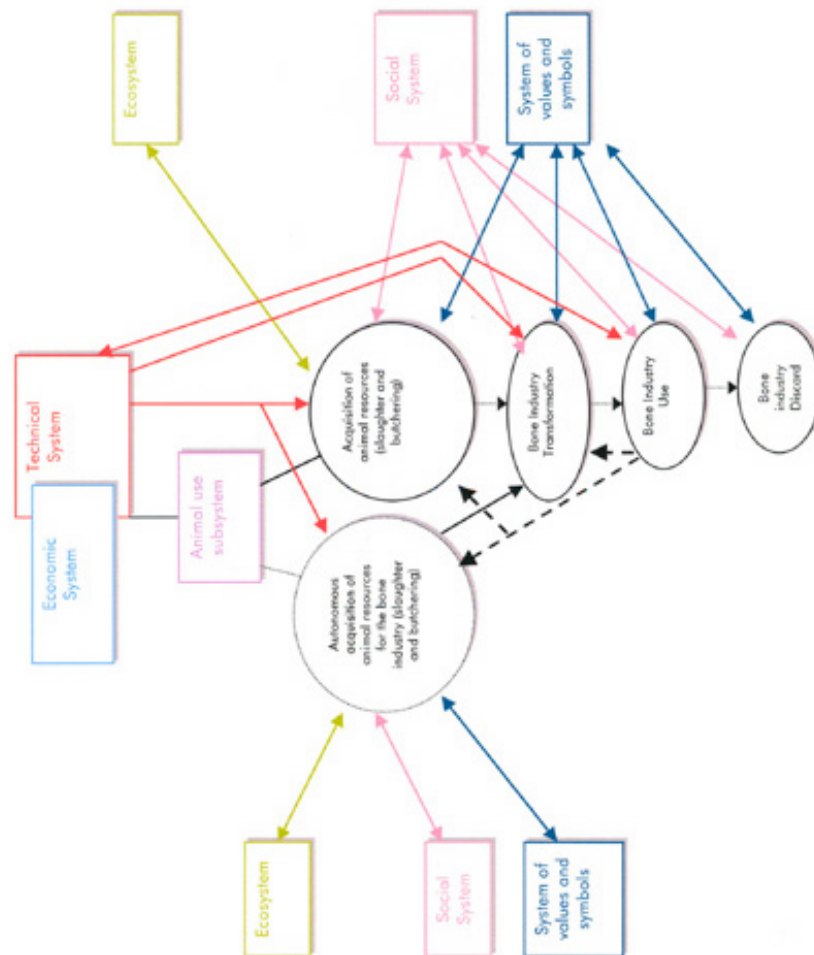


Chart: Theoretical relationships between the bone industry and its environment

The bone industry is part of the field "use of animals". The bone use chain has four links:

- procurement of raw material, which includes slaughter as well as butchering the animal. It can be autonomous or secondary
- its transformation into an object
- the use of this object
- discarding of the object

The black and colored arrows indicate the theoretical relationships between the bone industry and its environment over the course of these four stages.

Bone Objects in the Southern Levant...

The ecosystem (green box) provides the animals at the procurement stage while slaughter (and husbandry preceding it in the case of domestic animals) affects its equilibrium by preserving or depleting it (the double arrow symbolizes these relationships).

After slaughter and butchering, the raw bone material is delivered to the bone artisans (dashed black line). Reciprocally, some bone products (projectiles...) can be used in the first operation (dashed black lines).

Then, the transformation of the bones into objects requires tools made of bones (dashed black line) as well as tools made of other materials. The latter, which can also intervene earlier during slaughter and butchering, come from separate technical fields (red box) in which some transformation tools made of bone have also been integrated (the reciprocal relationships between these technical fields and the bone industry are symbolized by double red arrows).

Finally, the social system (pink box) and the symbolic system (turquoise box) define the rules of animal procurement, the transformation of bones, their use and then the discarding of the manufactured objects. Reciprocally, the four links in the chain preserve these systems by activating their values and by acting as mediators (these relationships are indicated by double turquoise arrows).