Another facet of man – Red deer relationship in prehistory: Antler exploitation at the Eneolithic settlement at Hârşova-tell (Constanţa County, Romania)

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ABSTRACT – *The significant quantity of antlers identified in the Gumelniţa A2 level in different stages of processing, from finished objects to consumed debitage waste, motivated us to try to reconstruct the management of the modalities of this raw material, of the processing techniques used and activities developed with the help of antler tools. In other words, the series of antler-made tools presents an important evidence of the activity of the Hârşova-tell community. The mentioned series reunites all the conditions for achieving such a study: the numerical importance of the remains, the good conservation stage – which allows for the identification of technological and functional traces – the variety of types of pieces* etc.

IZVLEČEK – *V plasti Gumelniţa A2 prepoznana večja količina rogovja v različnih stopnjah obdelave od končnih izdelkov do odpada nas je usmerila v poskus rekonstrukcije nadzora nad modaliteto te surovine, uporabljenih tehnik obdelave in razvoja dejavnosti, ki ga omogočajo rožena orodja. Povedano drugače, serija orodij, izdelanih iz rogovja, predstavlja pomemben dokaz dejavnosti skupnosti naselbine tipa tell Hârşova. Omenjena serija ima vse pogoje za izvedbo takšne študije: kvantifikacijski pomen ostankov in dobra ohranjenost najdb – kar omogoča prepoznavanje tehnoloških in uporabnih sledi, tipološka raznolikost itn.*

KEY WORDS – *Eneolithic; antler; Cervus elaphus; antler-made tools; processing techniques*

Introduction

The tell at Hârşova (Constanţa County) in southeast Romania is located within the present boundaries of the city; it is *c.* 13m high, with an area of *c.* 200 x 150m, while the thickness of the anthropic sedimentation reaches *c*. 11.20m. Regarding the levels of Prehistoric occupation, the oldest remains are of the Boian and Hamangia cultures (dated to the first half of the 5th millennium BC), continuing with the Gumelniţa (dated to the second half of the 5th millennium BC) and Cernavoda I (dated to the beginning of the 4th millennium BC) cultures.

The first archaeological research was conducted in 1961 (*Galbenu 1962*), but in new excavations from 1993 onwards the excavation strategy changed fundamentally (*Popovici* et al. *1998–2000; Randoin* et al. *1998–2000*). The informational level of the various types of stratigraphic units (SUs) discovered during research was tested in these excavations to allow an elaboration of a sampling strategy appropriate for the purposes of the investigation. Given that the research is being carried out on a tell, thus a multilayered settlement, with an extremely complicated stratigraphy, the principle aim was to evaluate the content of the different SUs, which consisted of either indoor (rarely) or outdoor occupational remains. The screening of sediments from other contexts was performed only in exceptional cases (occupational SUs inside dwellings, remains resulting from combustion structures *etc.*). In this sense,

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the samples were primarily water sieved in screen columns in order to obtain significant data. The research methodology allowed a very fine analysis of the evolution of occupation, unique until now in the history of archaeological research in Romania. There were individualised specific deposits that characterised certain human behaviours, of which some special areas had a housekeeping nature (a type of complex defined for the first time during the archaeological research at this site), that appeared to be very well defined spatial complexes. Moreover, the chronology of the stratigraphic succession of this type of complex has been determined, with significant results for the acquisition of data.

The significant quantity of antlers identified in the level Gumelniţa A2, in different stages of processing, from finished objects, to consumed debitage waste, motivated us to attempt a reconstruction of the ways of managing this raw material, of the processing techniques employed and of activities developed with the aid of antler tools, in other words the productive economy of the Hârşova-tell community. Otherwise, the stratigraphic series reunites all the conditions achieving such a study: the numerical importance of the finds, a good state of conservation – allowing the identification of technological and functional traces – the variety of the type of pieces *etc*. We must add that due to the relatively reduced surface only a very small number out of *c.* 400m^2 of complexes could be studied completely, a fact that obviously limits our interpretation. Also, only *c.* 58% of the pieces of antlers included in the present study come from excavations after 1992, for which the stratigraphic data are much more precise.

Cultural context

The archaeological remains from hard animal materials contain significant potential data, making them essential in interpreting archaeological assemblages and, globally, reflecting on prehistoric life. Thus, starting from the study of these artefacts, on the one hand, we can reconstruct the methods of exploiting the animal environment for non-alimentary purposes, and by identifying the processing techniques of the tools and manner of their use we can reconstruct an image of their users' world. Moreover, in the study of the evolution of human behaviour, tools made from hard animal materials were considered a definitive characteristic of an improvement in modern humans' cognitive capacities (*Henshilwood* et al. *2001*).

A review of the local bibliography reveals a certain lack of technological and functional analysis of hard animal material industry for Gumelniţean assemblage. Generally, the excavation reports, even recent ones, offer as unique information an almost standard phrase: *the inventory is completed by tools made of silex, bone and antler* or, in the best of cases, an enumeration of the main typological categories, with no consideration of a functional or technological nature. In this context, some older excavation reports become significant, such as those of Vladimir Dumitrescu on the settlements at Gumelniţa and Căscioarele (*Dumitrescu 1924; 1965; 1966*), in which the hard animal material industry is given special status, the illustrations also being eloquent. In special studies, we will mention those of Eugen Comşa (*1985; 1986*) concerning harpoons; those of Radian Andreescu (*1995; 1997; 2002*) on bone statuettes; Valentina Voinea's study (*1997*) of hard animal material from the settlement at Borduşani-Popina, or that of Valentin Parnic and Andreea Paun (*2004*) on the industry at Măriuţa settlement (Călăraşi County). If the analysis of other types of artefact have a precedent, and we refer mostly to the ceramics, the working hypothesis established for the study on hard animal material from the Eneolithic in the Romania is in its beginnings and must be correlated with complementary analyses on other archaeological material and archaeo-zoological studies.

Raw material

Antler, already exploited by Neanderthals in the Middle Paleolithic (*d'Errico, Laroulandie 2000; Villa, d'Errico 2001*), gradually becomes important in prehistoric communities due to its technical and cognitive qualities, being used for the production of a wide range of objects: weapons (projectile points, harpoons); tools necessary for the processing of wood, ceramics, and stone tools (chisels, mattocks, hammers *etc.*), and even for ritual objects with no apparent utilitarian function, which accounts for its presence in most activities in these communities.

Antler is an excrescence of the frontal bone specific to all species of *Cervidae* (*Christensen 2004*), being the exclusive privilege of the male in the *Cervus elaphus* species. It is composed of compact and cancellous tissue, the proportion between the two varying according to the species and irrigation during growing (*MacGrégo 1985*). The proportion and texture of the cancellous tissue depend on position in the antler branch (*Averbouh 2000*). According to specialists, of all the osseous matter, the antlers are the hardest and most elastic bones, and according to this they are best adapted for the manufacture of various tools specific to prehistoric periods (*Billamboz 1977; Michels, Zurbruchen 1991; Averbouh 2000; Riedel* et al. *2004; Vercoutère* et al. *2007*). It absorbs shock and impact, due to the important proportion of organic matter in its structure (*MacGrégor 1985*). Russell Dale Guthrie (*1983.279*), who made reinforcements from three types of raw material (bone, antler, lithic), concluded that the antler was the best material because it is easily worked, shaped or straightened when wet, resistant to breakage, easily sharpened, and in most cases readily available.

Artefact composition: products and sub-products

Finished objects – made on whole blanks

Hammers. We attribute to this category a single piece, fractured both proximally and longitudinally (Figs. 1.1, 1.2). It might have had two active areas, but only one, positioned laterally, can be identified with certainty, its outline being oval and in profile convex-concave. The piece was obtained from the basal part of a shed antler, the active part being actually the burr, the edges of which were removed; the technique employed cannot be identified due to subsequent alterations. The utilisation of the basal part was not random: it provides a blank with a form and dimensions already similar to the tool. It was produced by the removal of the antler's external structure; the surface was strongly shaped to obtain a regular shape. The shaping followed the creation of the active part, the convexity, but we cannot identify the technique, as the traces were removed by deterioration of the active part. At the proximal level, a rectangular perforation can be seen, which was made by progressively deeper cuts (Fig. 1.4, 20x magnification). The inside of the perforation is lisse, and well-polished, resulting from wear by the handler.

The active part has numerous depressions oriented approximately transversally to the antler's vertical axis. At the same time, we identified a series of cuts (Fig. 1.3, 75x magnification) with a microscope that are possibly the result of the contact with hard lithic material, which is probable due to the periodic change of the form by shaping, in order to retain the convexity. Specialists have shown that the use-life of this kind of hammer was quite long, a fact that can justify its rarity among archaeological remains (*Averbouh, Bodu 2002*).

Wedges. In this category we include four items, made from a tine and exploiting the natural form of the antler. The items have different fractures at the proximal level (Figs. 2.1, 2.2), so we can identify the removal technique from the shed antler in only one sample, which was sawn around the entire circumference by rotating the piece. At the cancellous tissue level, in order to detach it from the shed antler, percussion seems to have been used, due to the regular plan of the removal surface. The arrangement of the active part in bevelled technique was made by two methods: removal by direct percussion, in oblique plan, superposed by scraping (Fig. 2.3, Fig. 2.4, 30x magnification) or directly by deep longitudinal scraping. In all the samples, the distal end is very blunt, with various ramming and fractures. The proximal end, so much as survived, appears to have been rammed and chipped, and on the rest of the surface at the medial level there are peripheral removals, longitudinally developed, evidence of a powerful shock. We consider these artefacts as intermediate tools due to fractures that are present at both ends.

Projectile points. We refer to two items processed from a secondary tine (Fig. 3.1). Both are fractured at the proximal level, one by saw teeth fracture (Fig. 3.2, 20x magnification), and the other *en languette*. The entire surface of the items show hand deep, lon-

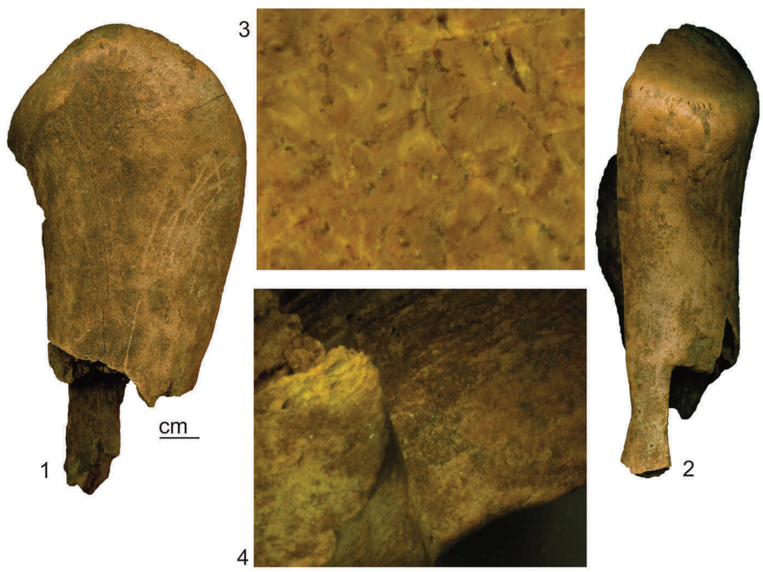

Fig. 1. Hammer made from the basal part of a shed antler.

gitudinal grooves (Fig. 3.3, 100x magnification). Macroscopically, the distal end is strongly *emoussé* with usage polishing, with the entire removal of scraping traces, while the microscope reveals a series of longitudinal, possibly functional, scratches (Fig. 3.4., 100x magnification). The original length of the pieces cannot be established, but both items have an average diameter of 1.6cm. We do not assert that they were used for working the land (as a planter), which is the usual interpretation in the specialised literature, because the usage area is not extended in surface. It seems more probable that they were used as projectile points, but we cannot identify the hafting system, because of a proximal fracture.

Mattocks. We attribute two pieces to this category. The artefacts are made from a beam, and have both longitudinal and transversal fractures, preventing full reconstruction of their morphology. In the first sample, the active part has convergent convex edges, a convex-concave section, and sharp bifacial end (Fig. 4.1). The technique of removal from the antler cannot be determined due to the fracture. There is a perforation at the medial point with rectangular morphology, made with successive cuts (Fig. 4.3, 20x magnification). The inside of the perforation is perfectly *lisse*, a fact that proves a long period of usage. The active part was formed by longitudinal cutting, in order to create a bevelled end, seemingly by percussion (as seen in one side that was not entirely shaped), then the two percussion sides were shaped, the active part emerging from their intersection. They present an *emoussé*, rounded aspect (Fig. 4.2, 50x magnification), with visible functional scratches on both sides developed parallel to the axis (Fig. 4.4, 150x magnification). The second item (Fig. 4.5), although fractured, was included in the same category as its active part has a slightly sharpened morphology and the manner of use is quite similar to that of the previous item (Fig. 4.6, 100x magnification; Fig. 4.7, 150x magnification). The distal end is a sub-rectangular intersection, with convex-concave edges, and a biconvex end in profile. The fracture prevents the identification of the processing techniques, but we can still assume that the arrangement of the active part resembles the first sample. The shaping covered only the distal end, extending only toward one of the fracture edges. It actually constituted the active part, which was developed laterally, towards the inner side.

Bevelled objects – chisels. Chisels are represented by six finds, all ending with a bevelled morphology. They were made from a main beam (4), tine (1) and basal area of antlers of game animal, using both the pedicle and the burr. The last item has traces of burning that contributed to surface exfoliation, destroying the fine marks. The basal area was removed from the antler by percussion. At this level, the detachment surface remained in a raw state, but has small detachments and ramming. We do not know how the find was detached from the skull, but percussion was used to form the active front. It is the only item with an intact proximal end. In the other three samples, only fragments of perforation remain; two were made by percussion (Fig. 5.1) and one by sawing, which ensured transversal hafting, while the last two samples are distal fragments.

Technological and functional traces on the active parts vary, probably in accordance with use. For instance, in one of the samples, the end is extremely blunt, becoming concave, with an extended polish on the superior side (unmodified) and quite limited on the surface. The conclusion is that it was worked in a longitudinal movement in an opened angle. On another piece (Fig. 5.1), the regularisation of the fracture edges was made only towards the distal part through abrasion to create the bevelled shape (Fig. 5.2, 30x magnification), which is still present in the peripheral area, but the abrasion was removed by a long period of use. The technological marks are superposed by strong polish, which is visible macroscopically and characterised by few functional traces (Fig. 5.3, 200x magnification). In another case (Fig. 5.4), the arrangement of the active side was accomplished only from the inferior side and the po-

Fig. 2. Intermediate tools.

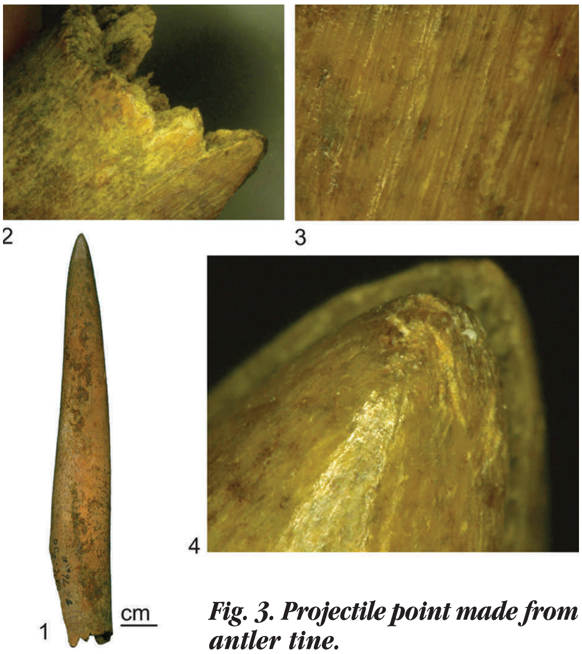

Fig. 3. Projectile point made from antler tine.

lish from the superior side was exclusively functional. A couple of cuts remain in the peripheral area of the bevelled edge (Fig. 5.5, 30x magnification). The inferior side was subsequently shaped by abrasion. The active part is blunt, with a high polish, and very extensive on the surface, especially on the inferior side, which covered the traces of previous work. Functional traces can be observed at an angle to the axis of the item on the superior side (Fig. 5.6, 150x magnification).

Handles. The first item in this category was made from a main beam, retaining the eye tine (the length is 36cm) (Fig. 6.1). The cutting was accomplished by direct percussion at the extremities and without regularisation of the cutting area. The shape of the item allowed for an easy grip by means of the tine. The cancellous tissue was entirely excavated, ensuring the hafting. The second artefact also includes a fragment from a main beam and a tine (Fig. 6.3). Unlike the previous find, a longer fragment from a beam was sectioned, which allowed the creation of two extremities for hafting (double handle). The segmentation was made by direct percussion around the circumference at both extremities.

Next we have three handles made on an eye tine, with lengths between 20 and 33.5cm. The removal from the antler was made by direct percussion around the entire circumference in two of the find; in the third artefact modern fractures made the diagnosis impossible. Inside, the cancellous tissue was completely hollowed out in order to create a gloving opening. One of the samples has a longitudinal fracture that may have been caused by utilisation after a shock (Fig. 6.2).

Four other artefacts made from a tine that had fractures, sometimes at both extremities, were attributed to this category. Only two samples preserve marks made by direct percussion, when they were removed from the antler. It is certain that they have hollows that seem intentional, ensuring hafting by longitudinal insertion.

Indeterminate function. In this category we include a series of 14 finds, unfortunately heavily fractured, in order to establish a diagnosis of their function; each has the whole blank and the presence of a perforation. In only three of the pieces we were able to identify a circular perforation. The first (Fig. 7.1) is a tine detached from an antler by direct percussion with still visible cuts (Fig. 7.3, 20x magnifi-

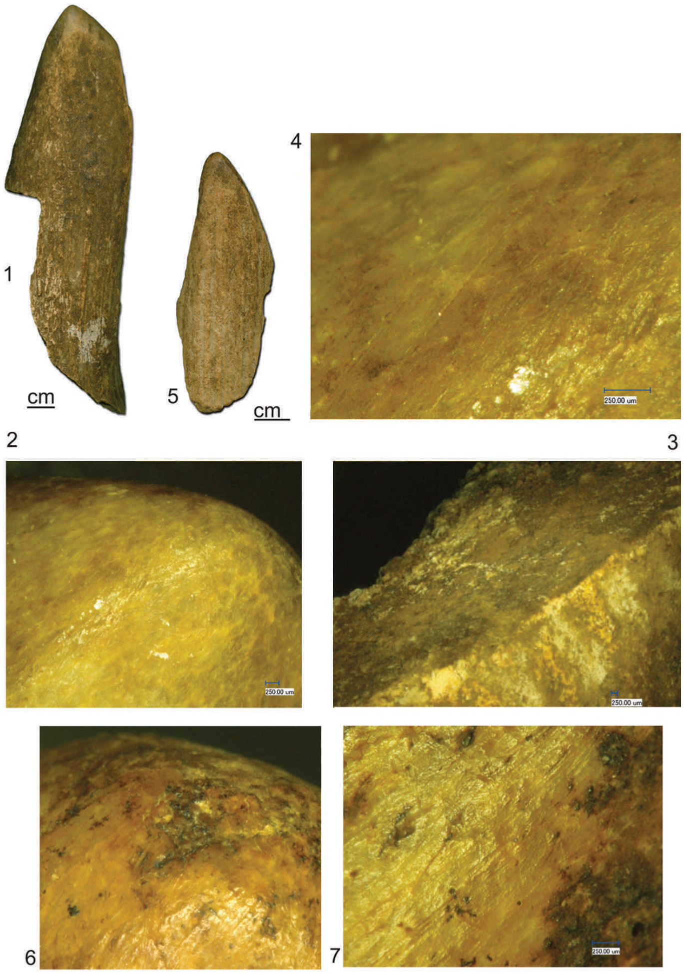

Fig. 4. Mattocks made from antler.

cation), with a circular perforation with similar diameters at each end (Fig. 7.2, 20x magnification), after which the entire surface of the piece was thoroughly shaped, including the area of the removal from the branch, probably by cutting and followed by very fine polishing. The piece has a saw tooth fracture at the perforation that is possibly functional and caused by shock. Unfortunately the morphology of the functional end remains unknown due to the fracture.

The second fragment has interesting traces as well (Fig. 7.4). First of all, there is an obvious perforation made by cutting from both sides. But the item is fractured around the perforation (which prevents us from identifying the method of removal from the branch); the piece was hafted longitudinally and the cancellous tissue was entirely removed. The end was used in an abrasive action, for smoothing, since the area is highly polished and the end blunted to the cancellous tissue, which makes it non-functional.

The last piece seems to have been made from an antler base (probably at burr level); it is fractured both longitudinally and transversally (Fig. 7.5). The perforation is circular, made with an unidentifiable technique; the inside is highly polished, which is an evidence of its use. One of the extremities is bevelled, with numerous deep removals, superposed by very high polishing that blunted the surface. Still, we cannot say for sure if it was an active part.

An additional set of eleven pieces which are heavily fractured, that contain no fragments of active parts, but only indications of perforation was included in this category. In all these examples, the method was the same – sawing, which resulted in a rectangular perforation.

Finished objects – made on flattened blanks

Chisels. The first artefact (Fig. 8.1), made on main beam, is actually a distal fragment. The antler was cut longitudinally, but the technique is unknown, because the inferior side was submitted to an extremely thorough abrasion (Fig. 8.2, 20x magnification), until the surface became flat. The active part was developed also on the superior side of the tool, but it the result of utilization. It is very blunt with loss of matter and macroscopic polish. At the microscopic level deep multidirectional traces appear on both sides (Fig. 8.3, 150x magnification).

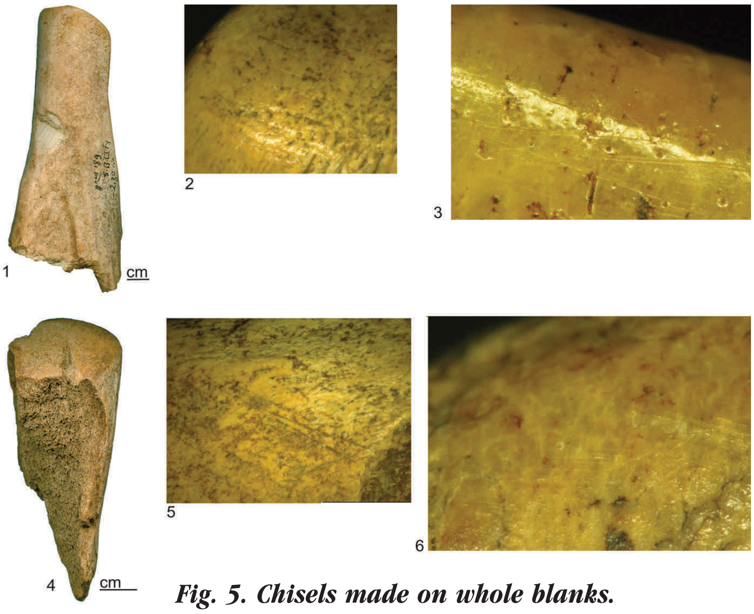

Fig. 5. Chisels made on whole blanks.

The second chisel (Fig. 8.4) has multiple fractures with a convex-concave section, a concave end and an unifacial arrangement. The artefact was worked in the main beam by longitudinal cutting. We were not able to identify the technique, because the entire inferior face was regularized by abrasion and the oblique scratches are still visible at peripheral level (Fig. 8.5, 20x magnification). The distal end is very blunt, giving it a concave morphology, with a strong polish that also extended on the superior side of the tool (Fig. 8.6, 150x magnification). The active part on the surface is not extended, which probably means that it was worked under opened angle. The functional traces are parallel with the tool's axis that was developed on both sides.

Projectile points. This typological category includes a distal fragment (Fig. 9.1), that was possibly used as an arrowhead, but was unfortunately burned and fractured. The distal part of the tool presents convergent rectilinear edges, a triangular section and a sharp end. We don't exactly know The technique of the detachment from the antler is unknown, because of the subsequent marks made on the tool, but we can assume that a splint was extracted from the block of raw material both by longitudinal and transversal debitage. It has an active, sharp part, made by longitudinal scraping (Fig. 9.2, 50x magnification), that was applied on three sides, creating the triangular section and the very regular aspect of the surface. The projectile point is blunted

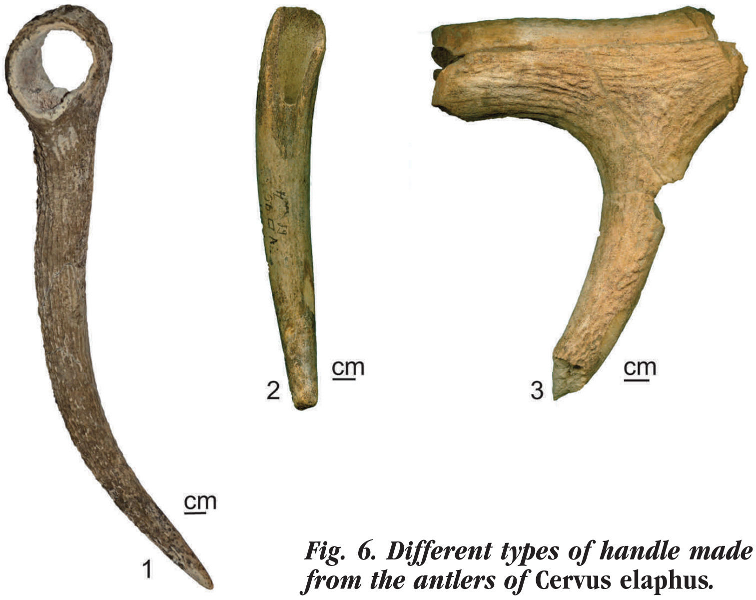

***Fig. 6. Different types of handle made from the antlers of* Cervus elaphus.**

with loss of matter that transposes in depressions and is microscopically visible (Fig. 9.3, 150x magnification).

Harpoons. In the settlement from Hârşova we identified 19 harpoons made from *Cervus elaphus* antlers, out of which 6 complete samples, 9 proximal fragments, 2 distal fragments, 1 medial fragment, a harpoon that misses a fragment at medial level were discovered, and an additional artefact that is still being analysed. The pieces were divided into two categories, in accordance with the barbs' unilateral and bilateral character, and the subcategories are divided according to the barb's morphology: unilateral harpoons, with convex barbs (3 artefacts); bilateral harpoons with convex barbs (8 artefacts); bilateral harpoons with sharp barbs (4 artefacts); and the morphology of the remaining 4 artefacts could not be identified, because the barb was entirely fractured (*Mărgărit, Popovici 2011*).

For the manufacturing of the antler a blank was extracted out of the branch by transversal and longitudinal debitage, but the techniques could not be identified due to the subsequent technological interventions. The manufacturing of the base implies three stages: the regularization of the surface after the extraction of the blank, the pre-forming of the tool and the forming of the specific elements (barbs). The tools are not always made in this process because sometimes the barb was cut first and was only later formed and shaped. In the same time, some artefacts still retain the external structure that is specific for the antler, while in other examples the first operation may represent regularization and a sharpening of the superior and the inferior side of the future harpoon. In the clearing of barbs, an operation which consists of progressively deepened incisions, alternatively, on both sides (Fig. 10.4, 50x magnification), the direction of the incisions determines the morphology of the future barbs. For the barbs that are positioned far from the shaft, the purpose was to create a space between barbs, by removing an approximately rectangular shape remnant. Thus sawing is applied starting from three levels: the proximal edge of the first barb, the space between barbs and the distal edge of the next barb. The second procedure, which seems more adequate for convex-concave barbs, is to create two incisions by sawing, representing the distal edge of a barb and the proximal of the other one, both gradually deepened so that they reunite. In the end, the projectile point is thinned by scraping (Fig. 10.2, 100x

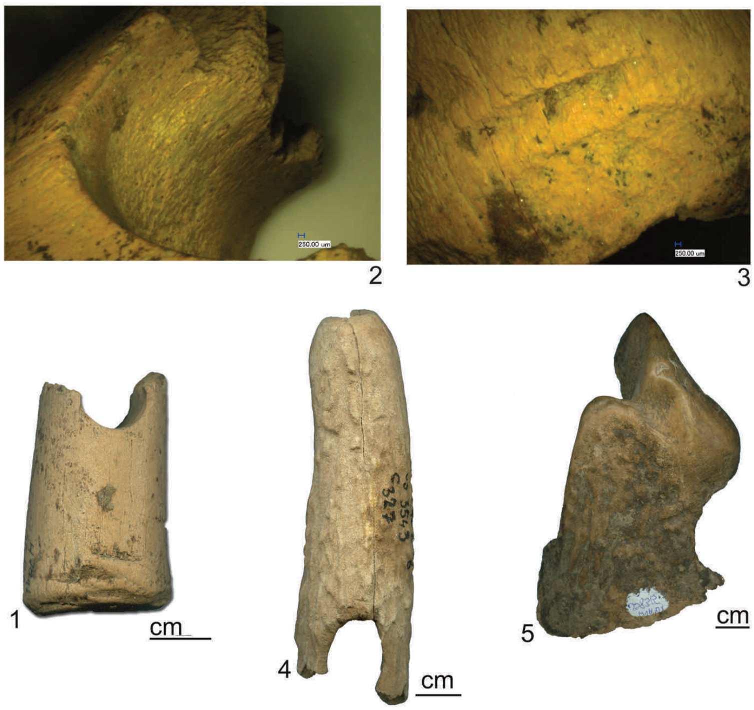

Fig. 7. Pieces of indeterminate function, endowed with a perforation.

magnification; Fig. 10.3, 30x magnification), that may be peripheral, thus obtaining a conical or bifacial end, in order to get a circular shape; points are cleared after barbs, especially those which are set in continuation of the distal edge of the last barb.

The proximal part has two types of hafting. The first and the most representative refers to the extremities provided with protrusions, which are made using the same technique as that of barbs (Fig. 10.5, 50x magnification); and the second has a proximal part in the continuation of the shaft that was shaped through scraping. Ethnographical examples show that these different morphologies of the proximal part do not necessarily depend on a fix or mobile hafting (*McClellan 1975*).

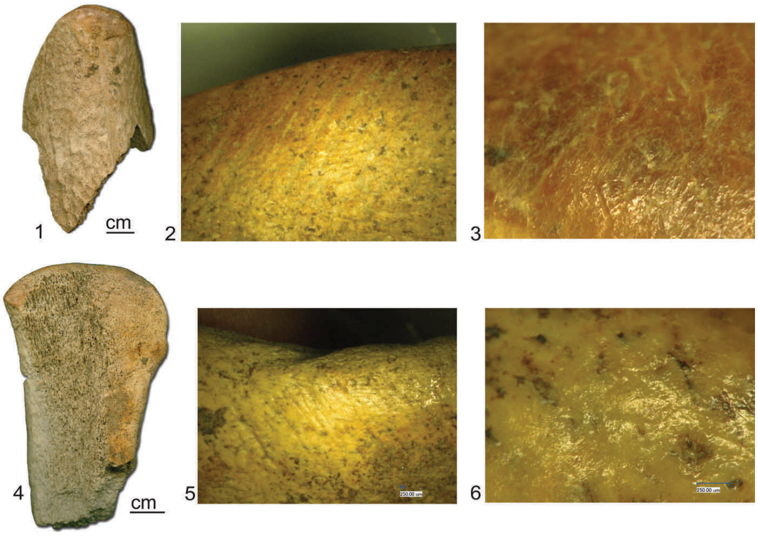

Fig. 8. Chisels made on longitudinally cut antler.

Indeterminate. In this category we included 6 artefacts, all of them made on flattened blanks, which could not be included in a typological category, either because their function is unknown, or because they are too fragmented; but they represent finished tools since they had typical marks.

The first artefact is proximally fractured in saw teeth style, being formed from a rod and a branched distal part (Fig. 11.1). The rod has a circular section with approximately rectilinear parallel edges. The distal part presents a triangular end, a biconvex section and two teeth oriented toward the middle part, with biconvex section, convex-concave edges and a slightly rounded end. A fragment from the main beam was used for shaping this tool, because only this area of the branch offers wide blanks, in this case the width of the preform is over 4cm. The entire surface of the tool was thoroughly polished on both sides and that created a circular and biconvex section, and this destroyed all traces of previous actions. The marks of the cutting therefore are no longer preserved. The antler was cut longitudinally and transversally, obtaining a rectangular chip. The composing elements were chipped out by sawing, and only a few traces remains of this technique (Fig. 11.2, 50x magnification), that were not entirely removed by polishing (Fig. 11.3, 30x magnification). We assume that this was a prestige object, since the tools was thoroughly and finely made. In addition, the object was excavated in an occupational level.

The second artefact (Fig. 11.4) presents a normal side with convex-concave morphology, while the opposite side is endowed with three characteristics with different morphologies, but detached with the same technique as that of the barbs. The normal side was shaped by scraping and later finished by polishing.

The next two examples have an approximately rectangular form (Fig. 11.6). The characteristic element is a perforation (fractured in both cases), that was made by rotation from both sides. One of the artefacts has two unfractured sides, which illustrates that a regulated shaping was used.

The fifth artefact (Fig. 11.5) is an antler rod, fractured at distal level and with a subrectangular morphology. The antler was fractured transversally and longitudinally, seemingly by percussion, proved by small removals that remained on one of the detaching sides. At distal level a perforation was made by rotating the tool from both sides, but it is unfortunately fractured. The entire surface of the artefact, including

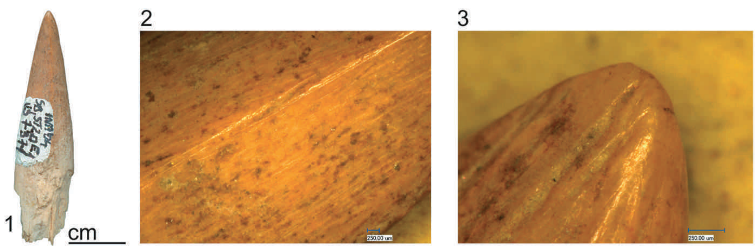

Fig. 9. Projectile point made on flattened blank.

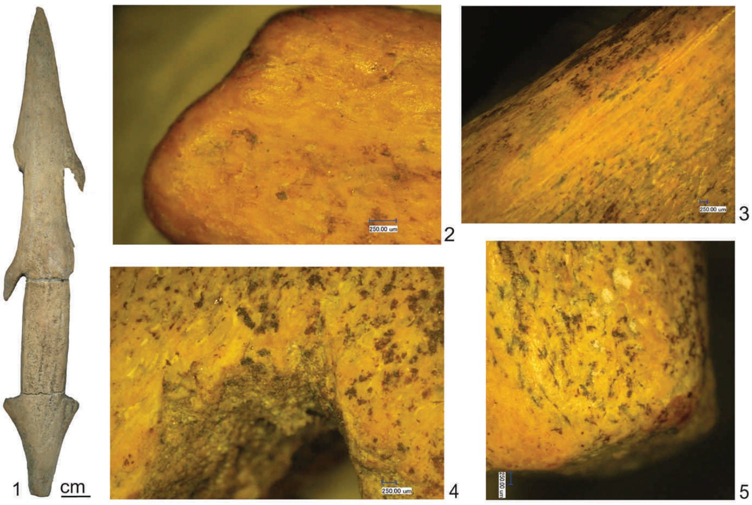

Fig. 10. Harpoon made from antler of Cervus elaphus.

the fracture edges, was thoroughly shaped, until the pearling was removed.

The last artefact from this category has very interesting marks (Fig. 11.7), that raises a series of questions concerning its framing (and due to its powerful fracture). It presents convex-concave morphology, one of the sides is of convex shape and the other has two protuberances. The antler was fractured longitudinally, from the main beam, if we consider the width of the piece, but the exact technique is unknown due to subsequent modifications. The longitudinally fractured side still retains an area of the distal part, that is obliquely arranged – bevelled style, with a strong usage polishing. Because of this shape the artefact was probably a finished tool. But when we observe the opposite side, two protuberances are, that were removed by two different methods; the rest of the protuberances are unfortunately fractured. When we observe the artefact from the proximal part, the first protuberance is distinguished from the superior side by successively deeper and deeper removals, whose marks are still marginally visible. A new longitudinal sawing is applied on the protuberance, starting from the inferior side that is different from the second protuberance. But the area appears coarse since it has not finishing or usage marks. We may assume that the tool was fractured and later recycled and transformed into another type of tool. This action wasn't completed and in this case we may speak about a preform.

Preforms – made on whole blanks

We included three tine points, out of which two eye tines and a bez tine, to this category of preforms. The removal from the branch was made by direct percussion (in 2 artefacts) and by indirect percussion (1 artefact). In the first sample, the arrangement of the active part begun with direct percussion as the main method of surface modification, but the action was not finished. In the second sample, at distal level the brands of shaping by longitudinal scraping are visible, under a fracture that seems natural, and this suggests that the artefact was a preform. Finally, the third sample, a bevelled (Fig. 12.1) part was created at distal level by percussion in an oblique plan (the marks of the percussion are still visible at the periphery of the bevelled piece), but the tool was not finished.

A second category is represented by two eye tines, where the arrangement of the perforation suggests that a volume modification was intended. The tine was removed from the branch by direct percussion

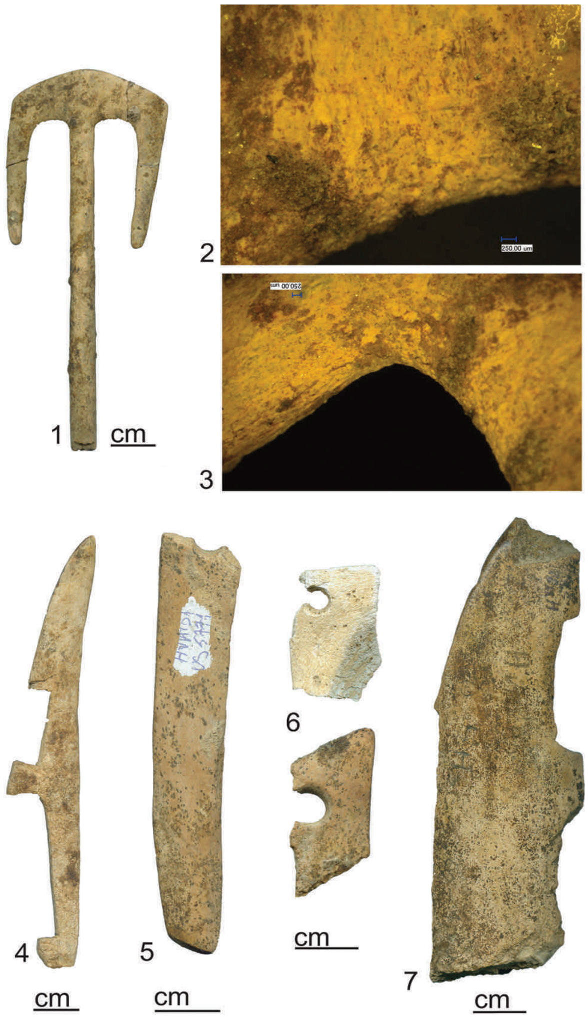

Fig. 11. Functionally indeterminate artefacts.

along the entire circumference. The perforation was made with successive percussion technique, that deepened the cavity to perforation, but the operation was not finished. The distal end was recently fractured in both samples.

Preforms – made on flattened blanks
For the manufacturing of one of the artefacts an intersection area between two bez tines was used at the rim, thus attaining a triangular morphology (Fig. 12.2). The traces of cutting by percussion are still visible in the intersection. Then a longitudinal and deep scraping was applied, that is visible in the marginal areas, which removed the pearling, and is superposed by an oblique and deep abrasion, probably for the regularization of the area. The artefact has no usage traces, which probably means that it was a preform.

The second artefact could also be a preform according to the arrangement of a polisher. It has traces of burning that destroyed a series of marks due to the altering and chipping of the surface. The section of the artefact is plan-convex, with convex convergent edges and fractured ends. The antler was longitudinally fractured and the fracture edges and the lower part of the tool were flattened due to abrasion. The artefact probably had the end arranged in a bevelled form, but it is unfortunately fractured.

A beam fragment with subrectangular morphology, a convex-concave section and concave edges is also present. The technique of transversal debitage is unknown, because both ends were fractured. The antler was longitudinally cut off by percussion (bipartitioning). At one of the ends the decortications of the pearling by percussion can be seen despite the fracture, which is superposed by a longitudinal scraping.

Finally, a tine point was included into the category, which had no identifiable detachment technique from the antler, because the end was not preserved (Fig. 12.3). A blank was extracted out of the base, probably by percussion as proven by some peripheral marks that could also derive from a delineating action. Then the fracture edges were regulated on their entire length by fine cuts that formed the surface and may be assigned to the *taille au canif* technique (*Provenzano 2001*) (Fig. 12.4, 30x magnification). The same fracture marks appear on the other three tine fragments that also belong to preforms.

Preforms – made on intermediary blanks
Three artefacts could be assigned to this category and they have a longitudinal extraction as a specific element, not for the formation of a blank, but for another preformed tool to process the original matrix. This is a method of volume modification. The first artefact is made on tine and fractured at one of the ends. The branch was removed by direct percussion around the entire circumference, followed by final regular removal percussion. Towards the other end an extraction method can be identified, that was made by a direct transversal and a longitudinal percussion, maybe for the creation of a ditch, given its narrow size, a fact that would have not allowed the extraction of a splint with optimum dimensions, but other conclusions are difficult to make due to the fracturing of the tool.

The second artefact is an eye tine (Fig. 13.4) that had the pearling removed with the decortication technique at the proximal and middle part on the concave side. In a second stage, a ditch was made at proximal side by successive splintering (Fig. 13.5, 30x magnification).

The third example (Fig. 13.1) was removed from the branch by direct percussion around the entire circumference, followed by bending. In longitudinal sense, a percussion ditch was created with superposed splintering alternating on both sides of the ditch (Fig. 13.2, 20x magnification). On the distal side the pearling was partly removed and sharpened, probably in order to arrange the active side of the tool (Fig. 13.3, 20x magnification). With the percussion technique several etching sides were created. Unfortunately, the distal extremity is fractured and we do not know its morphology.

Whole blanks
We identified three blanks (two on tine and one on beam), that were obtained by the transversal debitage of the antler by indirect percussion around the entire circumference until the cancellous tissue was touched, and in two samples, followed by the removal by percussion (Fig. 14.3; Fig. 14.4, 30x magnification) or, in one sample, bending. The direct percussion (Fig. 14.5, 30x magnification; Fig. 14.6) was used to obtain seven blanks on beam and eleven blanks on tine, cut at both ends with a debitage method by sectioning.

Flattened blanks
They aren't numerous, but are dominate over the whole blanks. We identified two artefacts deriving from the beam at the intersection part of the tine (probably the rim), transversally cut at all the ends by percussion, where the specific cuts are still visi-

Fig. 12. Different types of preforms.

ble. The same technique seems to have been used also for the longitudinal debitage of the antlers. Another type of blank was made on the point of the tine and transversally cut by direct percussion in two artefacts. Then a process of bipartition or longitudinal cutting was initiated by direct percussion that was quite irregular.

Finally, we will mention three blanks made on beam with a rectangular (Fig. 14.2) and triangular (Fig. 14.1) morphology and a convex-concave section. The sectioning method was the transversal removal from the antler, made by direct percussion in 2 artefacts and by indirect percussion in one artefact. The longitudinal debitage was made by indirect percussion either parallel (in 1 sample) or convergent (in 2 samples). According to their dimensions the blanks could have been used for the forming of harpoons.

Wastes – made on whole blanks. We identified two possible debris or tine points. The first artefact was removed from the branch by direct percussion that was applied around the entire circumference. The marks are obvious at the peripheral part of the etching area under the form of some cuts. The negatives are in scale and with an irregular form. A bending was probably applied at the part of the cancellous tissue, since the saw teeth fracture of the detaching plan was the irregular. The second artefact was removed by direct percussion, made on 2/3 of the antler circumference, after which the bending was applied.

Another type of waste is represented by two tine points, where the removal was made by indirect percussion, which created removal negatives, with a regular surface and quite wide. The percussion was made around the entire circumference. Percussion was applied in the end in the first artefact, creating a regular removal plan, and bending (saw teeth fracture) in the second artefact. The segment of a point, whose sectioning was made by direct percussion at both ends, was identified in the third sample.

Finally, we identified a tine point that could not be attributed to this category without problems (Fig. 15.1). It was assigned to the category of wastes since a blank for a possible tool was extracted from it. The debitage method implied the first stage of forming of the future blank by direct percussion while tracing a line that functioned as a *bande d'arrêt* (Fig. 15.2, 20x magnification). The extraction itself seems to have been made by indirect percussion in the longitudinal direction. The remained piece was not finished and could have been used as a blank for another tool. Moreover, it was excavated in an occupational level, which means it was not abandoned as waste.

Wastes – made on flattened blanks. On artefacts is a beam fragment with three concave ends from a transversal debitage and a plan-convex section from a longitudinal debitage (Fig. 15.3). The transversal debitage was made by direct percussion around the entire circumference, followed by removal percussion. On one of the parts a longitudinal debitage was applied by percussion, which produced a 11,3cm long, 5,3cm wide and only *c.* 0,8cm thick blank.

Another is an antler fragment, possibly a beam due to its pronounced pearling, with a subrectangular

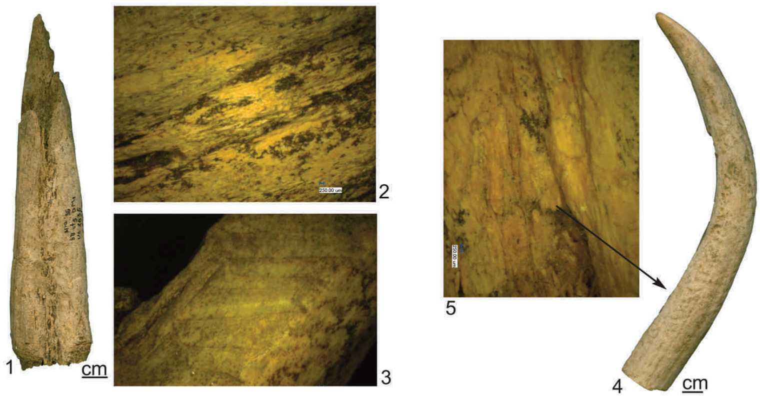

Fig. 13. Preforms made on intermediary blank.

form. The removal marks can be seen at one of the ends, which is transversal debitage made by direct percussion. That was followed by a longitudinal debitage made by percussion. At the opposite part a triangular end was created by small successive removals, which presents the rest of a projectile point debitage (Fig. 15.4).

One sample is a fragment that was made from the intersection between two tines. A splint was extracted by longitudinal convergent debitage out of the branch using the indirect percussion technique.

Conclusions

The exploitation system of the animal resources by a human community is based on a series of technical sub-systems (*Arbogast* et al. *2006*), that always follows the same stages: acquisition, transformation and consummation. They refer to a series of modifications made to the raw material, and later to the products obtained from it. The regrouping of all the elements results after an operational sequence – wastes and finished objects, their analysis concerning the acquisition of raw materials, the technological processes from which they resulted and their use, do not constitute only an archaeological study method, but also play a crucial role in the understanding of the material conditions of the human life (*social production*) (*Risch 2008*) in prehistory.

Acquisition

The antler can be obtained from two possible sources: hunting for sub-products and collecting. Thus, if it derives from a hunted animal, the acquisition of the antler is secondary in nature, since the main objective is nutrition. If we are talking about a shed antler, the acquisition was made for a purely technical purpose without any nutritional reason in order to gather sufficient quantity from an optimum material. According to specialists, the shed antler is suitable for processing, because the surface of the sections with compact tissue (the area used for processing) is more extended since it is at its developmental maximum. Knowing the specific properties of each material and their morphology and anatomy was essential for the prehistoric populations in order to select the best materials and to exploit the optimum areas for technological processes. And, indeed, the study of these artefacts allowed us to conclude that the majority of the fragments belonged to shed antlers. Nevertheless, we must underline that inside the material from the Hârşova-tell the number of basal fragments is reduced and, in most of the cases, their quality is not that of debitage waste, but of finished tools. This is problematic if, in certain situations, the branch wasn't partially cut outside the site and introduced under the form of blanks. In the specialty literature it is often mentioned that the antlers were soaked before further processing: shrouded in leather and permanently humidified with water (*Chech 1974*); immersed in boiled water (*Zurowski 1973; Check 1974*); macerated in solution of plants (*Ulbricht 1978*); or impregnated (*Möller 1983*). Our experimental studies demonstrated that the mere immersion in water at ambient temperature for a couple of days softens the superficial layers of the antler, which facilitates further processing. Additionally, there are studies that demonstrated that the processing is more efficient, especially in the longitudinal debitage by indirect percussion, if the antler is dry (*Tejero* et al. *2012*), because it can absorb the impact in the case of impregnation with water.

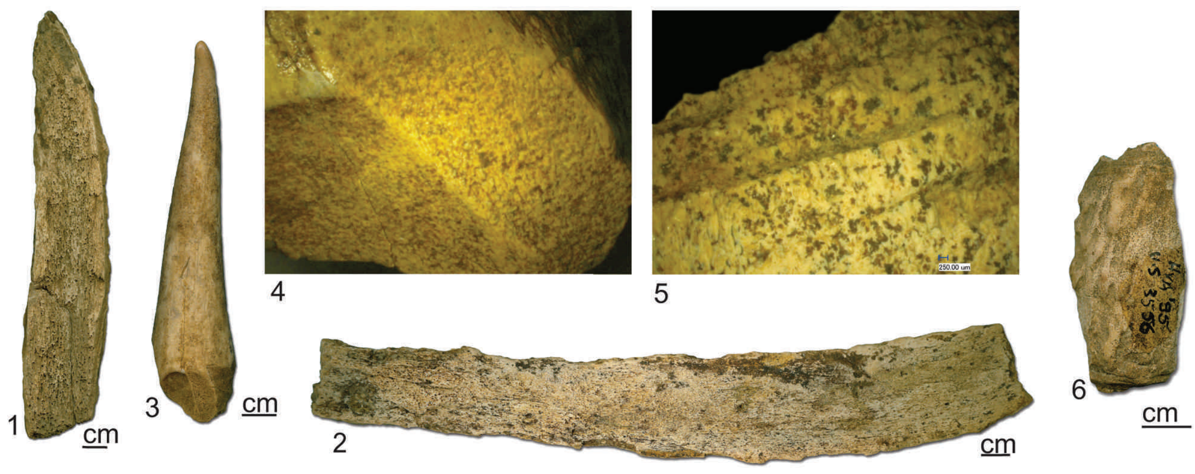

Fig. 14. Different types of blanks.

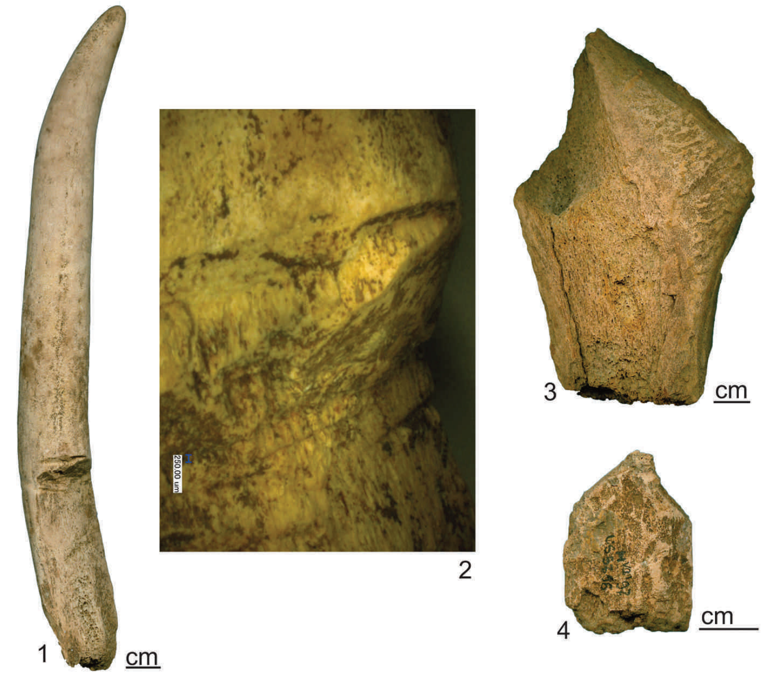

Fig. 15. Debitage wastes.

In the Gumelniţa tell from Hârşova, the provision with antler is local, since numerous bones of *Cervus elaphus* were discovered at the settlement. Furthermore, the *Cervus elaphus* was the second most hunted animal at the site, only preceded by wild boar (*Bălăşescu* et al. *2005*). The antlers grow from april to july, when they reach maximum calcification, and they fall off at the end of the winter, *i.e.*, in march for the adult specimens (*Provenzano 2001*). The antler can then be attacked by rodents, carnivores, invertebrates, even by the stag shortly after its fall (*Averbouh 2000; 2005; van Gijn 2007*) and the community from Hârşova needed it in a good shape. In these conditions, the collection could be made only in the period when the antlers fell off. So we can assume the existence of a seasonal cycle of acquisition, towards the beginning of spring. The experimental studies already showed a special resistance of weapons and tools made of antler, so the renewal of the objects was made after a certain amount of time. On the other hand, a surplus of raw material in the form of untransformed blanks was maintained at the tell, therefore the expeditions for antlers were not too frequent and at no times there appeared to be a problem or a 'crisis' of raw materials despite the seasonal availability of the antler. These blanks illustrate a pretty big standardization in dimensions, a fact that may suggest a preferential gathering. Moreover, we identified that there was a selection of the hunted animals, since male animals were preferred, because they provided a bigger quantity of raw materials (*Bălăşescu* et al. *2005.146*). In conclusion, we can talk about an attentive management of the raw material, which ensured a permanent availability of the antlers in order to replace the damaged tools.

The collection of antlers has no archaeological evidences, but we can argue that the ethnographic examples, in which a certain economic activity is ritualized (*Choyke, Darockzi-Szabo 2010; Boguszewski, Lozny 2011*), are numerous and the social context seems to prevail over the technical nature for what the social value of a certain kind of artefact represents (*Pétrequin* et al. *2006*). In the same time, studies show that the production is strongly divided by gender (*Wood, Eagly 2002; Waguespack 2005*), meaning that it is executed only by a single gender, following some strict stages that are impossible to ignore. For instance, in the population on the river Sepik in New Guinea, women make most of the pottery, but ceremonial vessels – like the big cups or the big jars – are only modelled by women, and later decorated by men with a complex decoration, because only they have the power to manhandle the dangerous signs of the world of spirits (*Pétrequin, Pétrequin 2006*).

Transformation

Most specialists agree to the statement that technology depends on social attitudes in the first place (*David 2007; Dobres 1995; 2010; LeMoine 1997; Stone 2011 etc.*). In these conditions the regrouping of all the elements resulted after a technical transformation sequence and the identification of the repetitive operation sequence in raw material processing can offer the key for the identification of some cultural traditions. The technical transformation sequence of the antler is quite long, from a branch obtaining several tools, and implies numerous techniques, strongly influenced along the mentioned cultural limitations by the raw material restrictions (dimensions, mechanical properties, form *etc.*). These are more obvious in the case of antler in contrast to other materials (*e.g.*, lithics), because they are predetermined by the anatomical form of the material.

Since we excavated all the constitutive parts of antler at the Hârşova-tell, we would ideally be able to reconstruct assemblages like they are made for the lithic industry. But the specific techniques for antler industry – like percussion, sawing, grooving, and scraping – remove some small-sized splints from the raw material and these cannot be recovered and the components of one branch of antler cannot be connected. Nevertheless, we identified four types of antler products in our inventory:

- debitage wastes – wastes deriving from the extraction of the blank or processing of the antler that can no longer be reused;
- blanks – unshaped products with debitage marks that can be later transformed into finished objects;
- preforms – pieces in different processing stages, important because they keep the marks of the operational sequence especially of the shaping stage;
- finished objects, that were used for different activities.

The attribution of artefacts to one of these categories is not simple, since a lot of the samples are problematic either due to their fractures or to the fact that they were processed with different objectives (*e.g.*, the object was debitage waste in the first stage, when a blank was detached from the antler's base; and later it became a finished object in the second stage, because the debitage piece was still big enough to be transformed into a tool). Another problem is to differentiate between marks made by the technological process and those of function when the antlers were still in use by the animal considering that the stag used its antlers as a 'tool' or 'weapon', which then led to fractures, chiselling, polished areas *etc.* (*Jin, Shipman 2010*), and therefore we should be cautious when interpreting artefacts made from antler.

The *Cervus elaphus* antler industry from Hârşova-tell includes a total of 127 artefacts, which were attributed to four categories of products and sub-products according to the operational sequence. Numerically speaking the finished products predominate the assemblage (66 artefacts or 52%), followed by blanks (28 artefacts or 22%), debitage waste (9 artefacts or 7%), preforms (16 artefacts or 13%) and undetermined samples that were too fractured to be attributed to the other categories (8 artefacts or 6 %) (Fig. 16).

The numbers and percentage of the finished products are presented in the next table according to the different typological categories of finished products (Fig. 17).

The study of these categories leads to the identification of two specific technological stages – debitage and shaping – necessary for the obtaining of a finished product. With the debitage three types of blanks could be achieved: whole blanks, flattened and intermediary blanks. Axes or parts from the basal range were used for the flattened supports, because blanks with a significant width were normally preferred for the clearing of the barbs for harpoons (the most significant category of finished tools produced on flattened blanks). For the whole blanks (especially when we speak about those that remained in this stage) we identified standardization in the choice of the branch from which the blank derived, a fact that illustrates, once more, the selection of the raw material. When we look at the percentages, we can see a preference for the utilization of the blanks in anatomical volume (73%), in contrast to flattened blanks by longitudinal debitage (46%). We can also speak of strong productivity, since all the parts of a branch were used and no wastes were produced in the technological process, which is most obvious in the bipartition example where two similar blanks were obtained from the same area.

When we look at debitage blocks (*e.g.*, blanks, waste) and finished tools that still bear these marks, we identified two blank production methods: a transversal debitage where blanks are produced by sectioning (which is the most frequent method at Hârşova-tell) and a longitudinal debitage where blanks are produced by bipartiotion and extraction. In transversal debitage the following techniques are used: removal by direct percussion (identified in 53 samples – the number is probably bigger, but many pieces are fractured at extremities and therefore difficult to identify), followed by indirect percussion (7 samples), then by sawing (1 sample) and scraping (1 sample), always associated with a bending or a direct percussion for the final separation each of them leaving specific traces for its identification. In longitudinal debitage (*fendage*) indirect percussion (16 samples) was used as the main technique, since the grooving technique could not be identified for the technical transformation sequence by bipatition, while for the blank production by extraction direct percussion was used (3 samples).

For the surface transformation scraping was the most used technique. It can give the object its final form, since it is in some cases the only stage of shaping (the case of the points on whole blanks). The next technique, present with these procedures, is removal by direct percussion, used mostly for clearing.

These two techniques can be combined with abrasion and, rarely, with polishing. For the method of volume modification, the main technique used was perforation made by the following techniques: by cutting – sawing (15 samples), percussion (4 samples) and by drill rotation (4 samples). Another volume modification technique was sawing, used for the detachment of the harpoons barbs and of the different protuberances (23 samples). We identified an additional technique, called *taille au canif* (*Provenzano 2001*), on several preforms, which was used for the arrangement and regularization of the fracture edges.

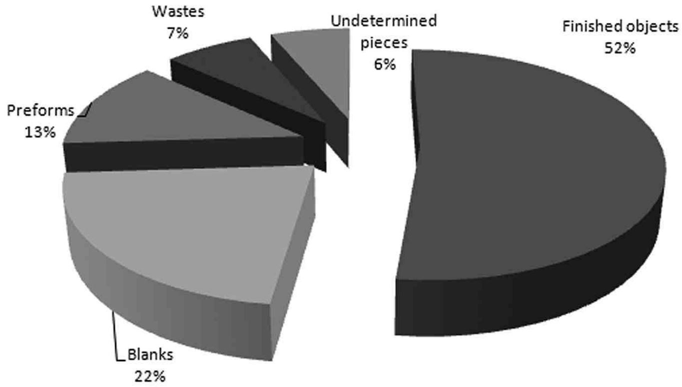

Fig. 16. The percentage of the debitage products and subproducts.

Generally, the techniques and methods used are quite varied and the dimensions of the blanks are superior to the finished pieces, since the initial size of blanks is reduced at different stages of the operational sequence. The result of this operational sequence is congruence between the blanks and the debitage waste on one hand, and between blanks and finished objects on the other.

Production

In literature numerous types of tools are united under the generic term of bevelled objects, the common element between them being the arrangement of the active parts by the intersection of two convergent sides. The main question for us was whether these tools had an identical function. The variations observed in the morphology of the distal part, in the dimensions of the pieces, and in the morphology of the fractures may indeed correspond to different functions, because the function of the tool depends on its morphological and technological characteristics. Still, this hypothesis is hard to prove (one type of morphology for one type of function), therefore we analysed micro-traces on each artefact in order to see what could be identified from the activities to which the artefact was submitted. A powerful impediment in the identification of the function of these artefacts is the fact that all were fractured at a proximal level except for one. We could attribute the traces at the distal end – a strongly *emoussé* end – which was rounded with strong polish and fine perpendicular scratches, visible with the naked eye, to the category of transformation tools used for the processing of slender materials.

The artefacts that we attributed to the mattock category are characterized by specific traces of usage, *e.g.*, longitudinal polishing and scratches (appeared at the contact with the abrasive particles from the soil) and cutting (from the shock against the gravel). Moreover, in agricultural areas in Bulgaria red deer antler tools were used until the end of the 19th century that were able to penetrate the soil up to 6–8cm deep (*Skakun 1992*).

We attributed the artefacts to the intermediary category, when they exhibited specific traces of hard impact on both extremities. The proximal ends with a rectilinear initial morphology present peripheral and superposed longitudinal subsidence and cutting after use. The distal ends, that present specific bevel-

Typological categories	Num. of artefacts	Percentage
Harpoon	19	29%
Hammer	1	1%
Wedge	4	6%
Projectile point	3	5%
Mattock	2	3%
Beveled object	8	12%
Handle	9	14%
Indeterminate	20	30%

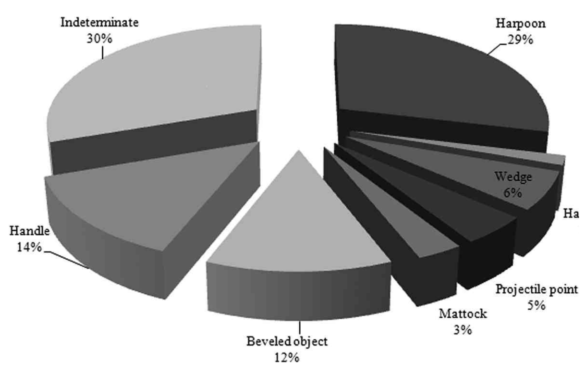

Fig. 17. The percentage of the finished pieces made from* Cervus elaphus *antler.

led ends, also exhibit ramming and cutting disposed on *fil du tranchant* and an intense polish with longitudinally developed stripes. All these traces are typical for chisels, used for wood or for removing the crust, and the fact that a hard hammer was used in their production.

Antler points can be assigned to projectile points, if they fulfil these conditions: "*non seulement parfaitement acuminées, mais aussi soigneusement raclées, voire polies, ogivales pour combiner à la fois la faculté de pénétration et la solidité, et enfin calibres*" (*Rigaud 2006.230*). Our points are indeed compatible with these elements and that means the antler points were used as weapons.

The antler hammers that were identified in the assemblage from the tell show traces that can be associated with carving, with retouching and with laminar debitage according to professional literature on this subject.

The greatest number of artefacts at the tell can be attributed to harpoons and several are made from *Cervidae* antler. Traditionally, the harpoons are connected to fishing. The studies at Hârşova-tell illustrated that fishing, next to hunting and the gathering of molluscs, represent the main food sources for this community. Among the species suitable for fishing with a harpoon are catfish, zander, cyprinids and even crap, during spawning (*Bălăşescu* et al. *2005*).

Finally, many artefacts were used as handles, which are useful for hafting tools made from hard animal matter, lithic or even copper, enabling these tools to be handheld.

Recycling

We identified two types of fractures in our assemblage that according to experimental data (*Legrand 2000; Petillon 2006*) seem to be of functional nature, belonging to bending fractures, produces after the shock caused by utilisation:

● The saw teeth fractures – in our artefacts they are mostly located at proximal side in the hafting area. But they may also appear at the intermediary part at the distal side, *e.g.*, when they are used as wedges for splitting wood.

● The *en languette* fractures– in our assemblage they are mostly located at the distal side and they seem to be the result of a strength obliquely exerted to the axis of the tool. This forms a fracture of two opposite sides, resulting or not to a triangular intermediary fragment (*Legrand 2000; Goutas 2004*) – we could not identify any such fragments in our assemblage.

When an object is damaged, it may be mended or abandoned if the type of fracture makes the rearrangement impossible. The recovery may also be made in two ways (*Goutas 2008*):

● By mending, if the tool can be repaired, keeping its original form and function. In this case the identification is quite difficult because it usually implies the use of some shaping techniques (abrasion, polishing), that can destroy the previous actions of fixing the fractures. The only two samples that can be included to this category are a harpoon from the subtype A2, where the surface of the fractured barb was mended by scraping, and a harpoon from the sub-type B2 that presents a functional *en languette* fracture at the distal part, where they tried to fix the point by removing the fractured surface, but the operation was not finished.

● By recycling, if they could not be kept in their original form and function. Unfortunately, we could identify only few recycled tools in our assemblage, where the fracture at the perforation was mended to ensure a transversal hafting and the creation of an orifice for a longitudinal hafting. Another recycling example is that of a piece chisel that, after fracturing, was recycled by removing some protuberances, but the tool remained in a preform stage.

Archaeological context

According to the stratigraphic context of the analysed artefacts, we cannot discern if specialized structures such as workshops existed at this site, but which could be identified at the site Borduşani-Popină, dated to the same period as Hârşova-tell and attested by agglomerations of debitage waste, blanks, preforms and specialized tools (*Mărgărit* et al. *2010*). All types of artefacts were deposited randomly at the site and are different types of production are mixed. Only the finished objects can be attributed to occupational contexts (dwelling, inhabiting, construction), which means that these tools were still in use, while only one mattock and an intermediary piece were excavated in the waste area, both are strongly fractured, which suggests that they were abandoned. And as was already mentioned, in the Hârşova-tell community recycling of antler tools is not obvious; generally they were abandoned after losing their function or after fracturing. Blanks, preforms and debitage wastes were mostly excavated in filling pits and occupational layers.

Chisels, which are finished tools, were more frequent in the later occupational layers which could correspond to the last period of habitation by the Gumelniţa community. It is possible that the absence of chisels in earlier layers points to a certain specialization that, for the moment, is difficult to interpret. This could be due to the fact that operations that acquired the use of antler chisels were more common in later occupational periods or could point to a certain specialization in the community that is difficult to outline. Additionally, the analysed artefacts present many whole objects in the younger layers, which may show that antler processing was more intense in these than compared to the older layers.

Among the other types of tools only the harpoons projectile points (19 samples) allow for more sufficient observations. Their frequency stands for the activities in which they were used. Nevertheless, 6 of the samples have traces of secondary burning, which means they were probably burned in their finished form. And from these burned projectile points only three were discovered in the destruction layers of two burned dwellings (SL 50 and 58), the others were discovered in the exterior occupational contexts. The question remains whether these three projectile points were intentionally deposited in the dwellings that were later burned. But if that was the case, the presence of the remaining three projectile points found in the external occupational layers can be explained only by an accidental burning, a fact that makes this interpretation difficult.

Therefore we could attribute symbolic value to the contexts in which harpoon projectile points were intentionally deposited. But if we bear in mind that other types of harpoon points were discovered in dwellings (even if they were only partially researched), *e.g.*, two undetermined fragments in SL 58 and a support, a projectile point and an undetermined fragment in SL 19, we may also confirm that these also presented the inventory of these dwellings and that they were kept for various reasons. The same tools were excavated in dwellings no. 26, 42 and 54, but were unburned. The discovery of these tools inside dwellings, next to other tools that were part of the daily inventory (*e.g.*, lithic tools or ceramic recipients *etc.*), may be considered a very probable reflection of reality. This situation is not exceptional since it was observed also in other geographic or cultural areas (*Stefanović 1997.364; Popovici 2010. 99*).

In this study we tried to present an integrated image of the different ways of exploitation of animals by Eneolithical communities for obtaining tools made of hard animal material and different ways in which these objects were reintegrated in the cycle as a way to exploit the environment. From a technological perspective, the study is not relevant if it is not discussed also in the social context in which these activities took place or the relations between the respective community and its natural resources are analysed. In other words, "*traces are defined as all physical attributes resulting from the social life of subjects as well as objects*" (*Risch 2008.516*). We started our work on this premise, but were unfortunately faced with some methodological limitations, which are interdependent with those of the research field, but also contextual, as we already underlined, due to the lack of similar studies for other Gumelniţean settlements, which could allow for a technical-economic and social description of this culture in the context of hard animal material industry.

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