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Data regarding the experimental manufacture of Roman objects made of domestic herbivores horns

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Abstract: **Data regarding the experimental manufacture of Roman objects made of domestic herbivores horns.** Processing hard animal materials in Roman times was an important occupation. In any Roman settlements there were certainly workshops where objects were being made out of the bones and horns of domestic animals. One such workshop was found on Insula 3 of the ancient Roman town named Colonia Dacica Augusta Ulpia Traiana Sarmizegetusa, and a similar case was registered in Histria. The workshop provided residual bone ends, cut segments, finished items, in the process of being made or discarded. Upon closer analysis, I found that the horny part of the cattle, sheep and goat horns are lost in time as they are 100% organic nature, this being the reason why in the Roman sites there are no artefacts made out of these horn parts. Experimental archaeology has helped to restore some parts of the bovine and goat horns, to see differences or similarities with antlers, in terms of processing. Thus, I made a comb, different chips for games, a hair pin, a pendant and a dagger button of bovine horn, as well as a dice and a needle of goat horn. After processing the horns of domestic animals, I could see that they can be altered by heat (so they can be shaped), that they are as suitable for making items as the horns of wild animals, that they have a pleasant translucent appearance and that they were certainly used by the Romans in making different types of objects.

Keywords: cattle, experimental archaeology, hard materials of animal origin, processing, Roman times, sheep and goat horns.

Archaeological Data

Bone and horn were the raw material for making people's weapons, ornaments and tools ever since the Palaeolithic (C. Beldiman, 2007).

During Roman times, processing hard materials of animal origin was an important occupation of artisans. The presence of bone or horn artefacts in most Roman sites, be they urban or rural settlements, legion or auxiliary forces camps, leads us to conclude that the processing of such materials was very well represented in Roman settlements.

As far as the province of Dacia is concerned, here objects of bone or horn are plentiful in settlements. C. Timoc (2007) made a "repertoire" of settlements with traces of bone, horn and ivory processing in the province. These locations are: Apulum, Brâncoveneşti, Cristeşti, Cumidava, Drobeta, Ilişua, Mehadia, Micia, Pojejena, Porolissum, Potaissa, Romita, Romula, Sucidava, Tibiscum and Ulpia Traiana Sarmizegetusa.

In the province capital, a workshop processing hard material of animal origin could be investigated. Following the archaeological excavations led in the summer of 2009, in the area located west of Forum Vetus of Colonia Dacica Augusta Ulpia Traiana Sarmizegetusa (Fig. 1), generically named „Insula 3" a building with wooden walls (Fig. 2/1-2) that apparently housed such a workshop was partially found (G. Băeştean, M. Barbu, 2010). In this building, but also in the nearby areas, we have identified numerous fragments of bone and horn, which were raw material (Fig. 3/1-2), residual bone

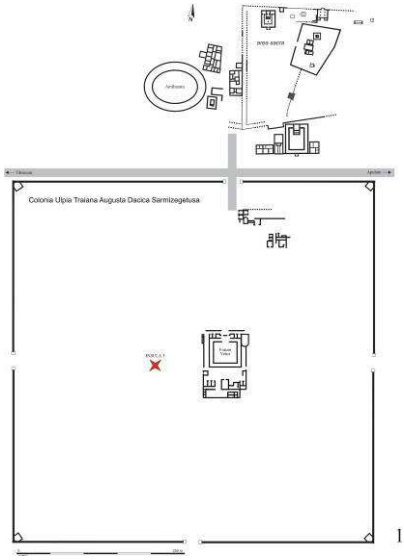

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Fig. 1 – Topographic Plan of Colonia Dacica Augusta Ulpia Traiana Sarmizegetusa (G. Băeştean, M. Barbu, 2010).

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Fig. 2 – 1-Workshop for processing bones and horns, before emptying the complexes, discovered on Insula of Colonia Dacica Augusta Ulpia Traiana Sarmizegetusa (G. Băeştean, M. Barbu, 2010); 2 – Workshop for processing bones and horns, before emptying the complexes, discovered on Insula 3 of Colonia Dacica Augusta Ulpia Traiana Sarmizegetusa (G. Băeştean, M. Barbu, 2010).

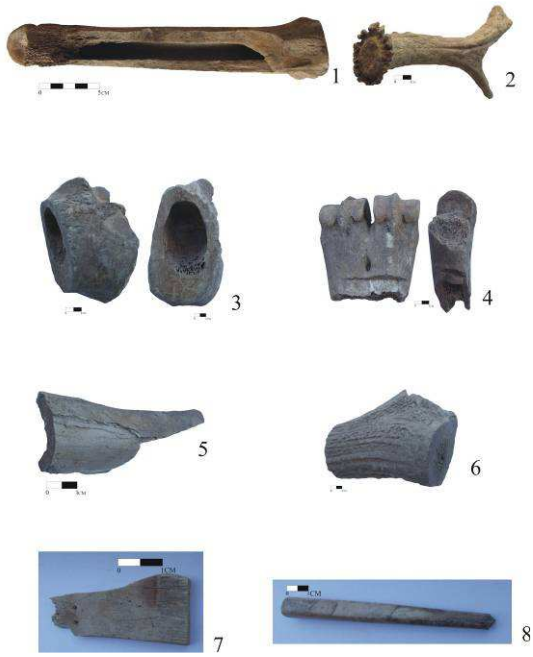

Fig. 3 – 1-Deer bone with cutting marks found in the workshop on Insula 3 (G. Băeştean, M. Barbu, 2010); 2–Antler found in the workshop on Insula 3 (G. Băeştean, M. Barbu, 2010); 3 and 4-Residual bone ends found in the workshop area on Insula 3 (G. Băeştean, M. Barbu, 2010); 5–Cattle bone fragment with cutting marks found in the workshop area on Insula 3 (G. Băeştean, M. Barbu, 2010); 6–Antler fragment with cutting marks found in the workshop area on Insula 3 (G. Băeştean, M. Barbu, 2010); 7–Discarded plate made of antler found in the workshop area on Insula 3 (G. Băeştean, M. Barbu, 2010); 8 – Discarded hair pin made of deer bone found in the workshop area on Insula 3 (G. Băeştean, M. Barbu, 2010).

ends (Fig. 3/3-4), cut segments (Fig. 3/5, 6) finished items (Fig. 4/1-4) being processed (Fig. 3/7) or discarded (Fig. 3/8) (G. Băeştean, M. Barbu, 2010).

Studying the existing hard material of animal origin items in these contexts we have seen that, as far as the raw material used is concerned, a significant amount was represented by horns of domestic herbivores, especially cattle and goats (Fig. 5/1). Researcher Sabine Deschler-Erb (2005) shows that in Roman times the workshops

processing animal hard material use mainly the bones and horns of domestic animals, this being due to community development and the human settlements that have and sacrifice a big number of cattle, sheep and goats (Fig. 5/2-3). Also, the excessive hunting led to a scarcity of wildlife in the vicinity of Roman towns.

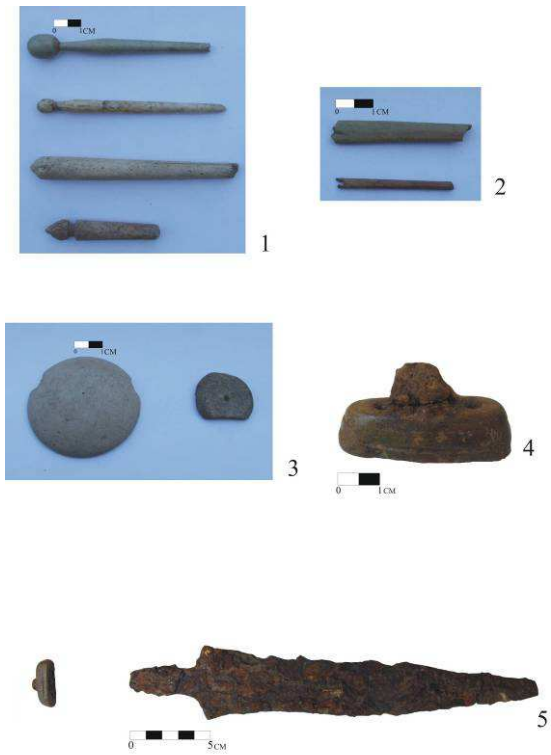

Fig. 4 – 1-Hair pin fragments made of bone and horn found in the workshop area on Insula 3 (G. Băeştean, M. Barbu, 2010); 2–Sewing needle fragments made of bone found in the workshop area on Insula 3 (G. Băeştean, M. Barbu, 2010); 3–Chip fragments made of bone found in the workshop area on Insula 3 (G. Băeştean, M. Barbu, 2010); 4–Roman dagger button made of antler found on Insula 3 (G. Băeştean, M. Barbu, 2010); 5–Roman dagger dating from the beginning of the 2nd century AD found on Insula 3 (G. Băeştean, M. Barbu, 2010).

We have been surprised as, although the cattle and goat horns appeared in large numbers, we have found no item − either finite, discarded or being processed − made of such material. The cattle horns show traces of axe cutting for separation from the skull, while the sheep and goat horns, whose skull end is cut with the axe or saw, are treated with more attention, probably being more appreciated. In all cases the tips of goat horns are missing because they were always cut with the saw (G. Băeştean, M. Barbu, 2010).

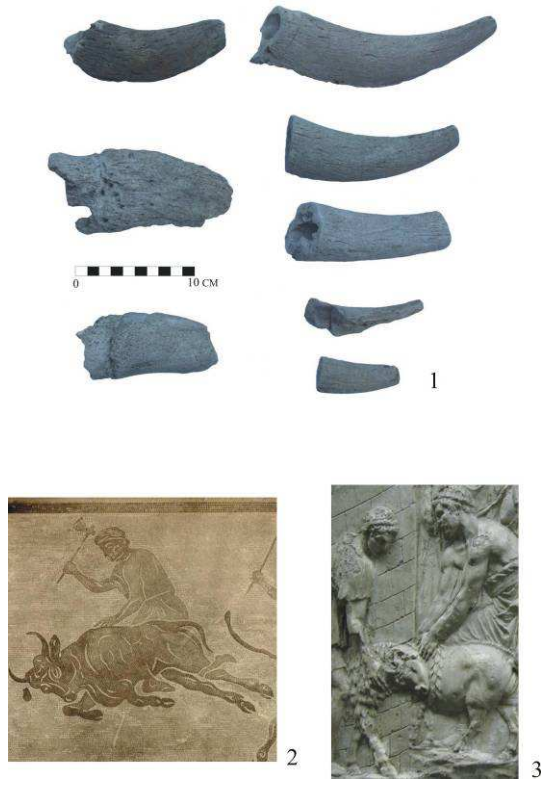

Fig. 5 – 1-Cattle, sheep and goat horns found in the workshop area on Insula 3 (G. Băeştean, M. Barbu, 2010); 2–Roman mosaic representing the killing of cattle Ostia) (Photo: Marius Barbu); 3–Relief detail on Trajan's Column representing domestic animals (Photo: Marius Barbu).

A similar situation can be observed in the case of Histria − Basilica Extra Muros Sector. Here, out of a total of 77 hard material of animal origin items investigated, 16 were segments of cattle, sheep and goat horns (C. Beldiman *et al.*, 2010). We find out that these processes are "spare parts of the skull separated through carving, fracturing or transverse saw cutting, segments of various lengths (proximal-mesial, mesial, mesio-distal), sawn to make artefacts (rings?, muffs?, other still unspecified types of items). These items show the fact that they come from a hard animal material processing workshop." (C. Beldiman *et al.*, 2010,

p. 33).

The absence of finished items can be explained by the fact that what has been discovered in archaeological excavations is the centre of the horn, namely the bone, with a spongy appearance, without any value in making the objects. However, the large number of items of this kind shows that the outer horny shell was used in these workshops, but because of its 100% organic nature it did not last in time, decomposing (S. Deschler-Erb, 2005).

Conducting the experiments

Since the Roman items made of horns of cattle, sheep and goats cannot be investigated because they have not been preserved to this day, I have tried to revive this craft experimentally, to see how this type of hard material of animal origin looks like and how it behaves, compared with the items made of deer bone and antler that we know and whose properties we have previously investigated experimentally (M. Barbu, 2009).

Obtaining raw material and primary processing

The domestic herbivore horns (Fig. 6/1) are a readily available raw material in the settlements of the Roman period. They are always taken from dead animals, as they can be detached from the skull by saw cutting or axe chopping. This type of hard material of animal origin can be processed immediately after killing an animal, as there is no need for special treatment like with bones (M. Barbu, 2009). In a few days later after killing an animal (time varies depending on the environment and storage temperature), the bone inside the horn can be easily removed due to the decomposing of the highly vascularised soft tissue which covers it. The fact that many goat horn bone fragments archaeologically discovered bear sectioning traces shows that the horn was cut quickly, with the bone still inside (Fig. 5/1).

Horn length and thickness vary from one individual to another depending on species, breed, sex and age. Comparing the central bone part of the horns with the exterior horny one, I noticed that, for the cattle, the first is about 2/3 the length of the second. For goats, the bone part is approximately half the length of the horny side (Fig. 6/2). The difference between the length of the bone part and the horny part is represented by a full horny tip. It is this horny tip that is most suitable for processing, the massive tissue proper for processing being superior to any deer bone or antler thickness. From this point of view, the cattle horn tip is a processing material superior to animal bones and deer horns, being surpassed only by ivory.

Physical characteristics

The physical nature of the material is problematic for the débitage of cattle, sheep or goat horn segments. The growth of the horny wall as superposed layers makes it almost impossible for it to be cut through carving. The results of such actions are the splintering and cracking of the horny tissue (Fig. 6/5). The only method suitable for primary processing of this type of material is sawing.

Another important feature of cattle, sheep and goat horns is their elasticity, which recommends them to be used in order to obtaining objects that are to be subjected to mechanical stress. Also, I have noticed that these horns can be modelled, as they are thermally deformable. A first attempt was direct exposure to flame, but the horny tissue caught fire, being destroyed. A much better method is to immerse it in boiling water. I have experimented this by boiling a curved cattle horn segment (Fig. 6/3) for three minutes. After removal from boiling water, I placed the segment under a 20 kg metallic weight, and after several minutes of cooling I could see that the segment under discussion had been distorted considerably (Fig. 6/4).

Obtaining the items

I have tried to manufacture items from cattle and goat horns similar to the items made of deer bone and antler found in Roman sites.

Comb

In Roman times there is a variety of combs made especially from antler (D. Ciugudean, 1997). As far as the combs are concerned, this preference for antler at the expense of deer bone can be seen in other epoch as well (A. Ganciu, 2001-2002), the best explanation for this being the increased elasticity of the horn. This type of object requires high elasticity because the thin teeth break very easily if made of a brittle material such as bone.Therefore, the superior elasticity of domestic herbivore horns probably made them an ideal raw material for making

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Fig. 6 – 1-Cattle and goat horns; 2–Horny and bony parts of a goat horn; 3–Cattle horn segment; 4-Cattle horn segment thermally distorted; 5-Cracked cattle horn segment.

these types of items.

Initially, I cut a segment from a cattle horn base, using a saw with small teeth (Fig. 7/1). By chopping with a knife and then by superficial grinding I gave this segment a semicircular shape (Fig. 7/2). The most difficult part was cutting the comb teeth. I made fifteen parallel cuts (Fig. 7/3), using the same saw with small teeth. The comb teeth obtained were finished with a knife blade, the tips being sharpened with an iron file. The applied decoration is typically Roman and consists of several engraved concentric circles (Fig. 7/4). To be more visible, red paint based on iron oxide was applied into the incised circles (Fig. 7/5).

Chips

The Roman chips, in the form of disks of variable diameters, were often made of bone and served as game items for ancient games. These items are almost always decorated with concentric circles (D. Alicu *et al.*, 1994).

To make such cattle horn chips, I could use two different areas of these horny processes, the manufacturing method varying depending on the chosen area. The first method is similar to the method used to manufacture bone chips (M. Barbu, 2009) and consists of extracting a relatively straight plate from the horn base which I ground to give it a round shape. The second method consists of cutting cross sections of the horn tip, thus quickly obtaining round disks. This part of the horn is usually dark; therefore, the chips obtained are black or dark brown (Fig. 10/1), which is very convenient because for any game it was necessary to have two sets of items, different in colour, just like in the modern backgammon games, for example.

The decoration with concentric circles was as follows: first I calculated the item center and incised a small socket in that place (Fig. 8/1). Using a set of simple tools such as compasses and using the central socket as a fixed point, I incised fine concentric circles, which I then deepened with the same tools. It should be noted that these concentric circles must be made from the inside out (from small to large) as the gradual deepening of the center point makes it difficult to draw small circles (Fig. 8/2-4). The decoration in this case was also inserted with red paint (Fig. 8/5).

Hair pin

Hair pins are objects with a dual role. On the one hand, they have a practical role, holding the hair or fixing accessories in order to achieve different hair styles, and on the other hand, they are ornaments, often being beautifully decorated. They were made of different materials (bronze, silver, gold, bone, horn and probably wood) and are found in all types of sites (towns, villages, villa rustica, castra and cemeteries) and in all provinces of the Empire (M. Barbu, 2009). The main criterion by which these artifacts are classified is the shape and type of ornament on top (N. Gudea, I. Bajusz, 1990-1991).

To make a hair pin I have extracted a longitudinal segment from a cattle horn. Because it was slightly curved, I straightened it using thermal deformation. The conical shape was obtained by carving and scraping with an iron knife. The finish was obtained by grinding the item with two different grain sandstones. A spiral decoration was incised by hand with an iron file. It should be noted that the manufacturing time was reduced to two hours, which is about half the time required to make a similar bone pin (Fig. 9/1).

Sewing needle

Sewing needles made of bone are a tool category with a very long life. To make a Roman sewing needle I have extracted a longitudinal segment of a goat horn. Carving was similar to that described at the previous item, in this case the most important operation being the perforation. The hole was made by pressing the item with a very thin knife tip. During this time, the needle was rotated under the iron tool pressure. The operation was repeated on the opposite side and in just forty seconds the horn item was completely perforated (Fig. 9/2). The increased elasticity of the goat horn reduces considerably the risk of breaking the opening area, which is the weakest point of bone needles.

Dice

The most popular of the Roman gambling games were the dice games. The Roman dice are cubical (or tend to be) and have six sides with engraved points from one to six. The six sides have a standard point position, the sum of the points on two opposite sides always being equal to seven. In this way, the one-point side will be opposed by the six-point side, the two-point side by the five-point one, and the three-point side by the four-

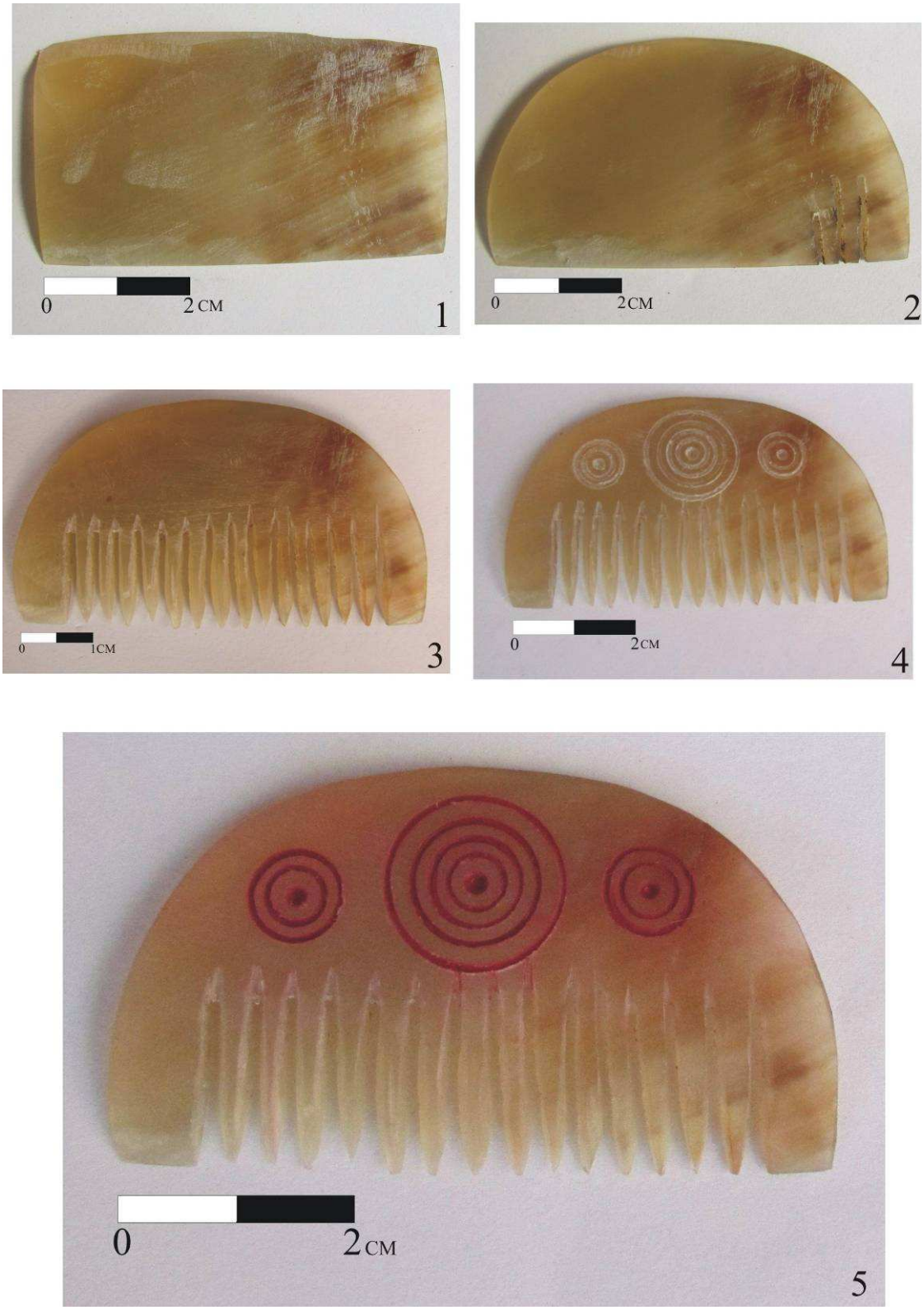

Fig. 7 – 1-Cattle horn plate; 2–Semicircular plate made of cattle horn; 3–Making comb teeth; 4–Decorating combs; 5–Cattle horn comb.

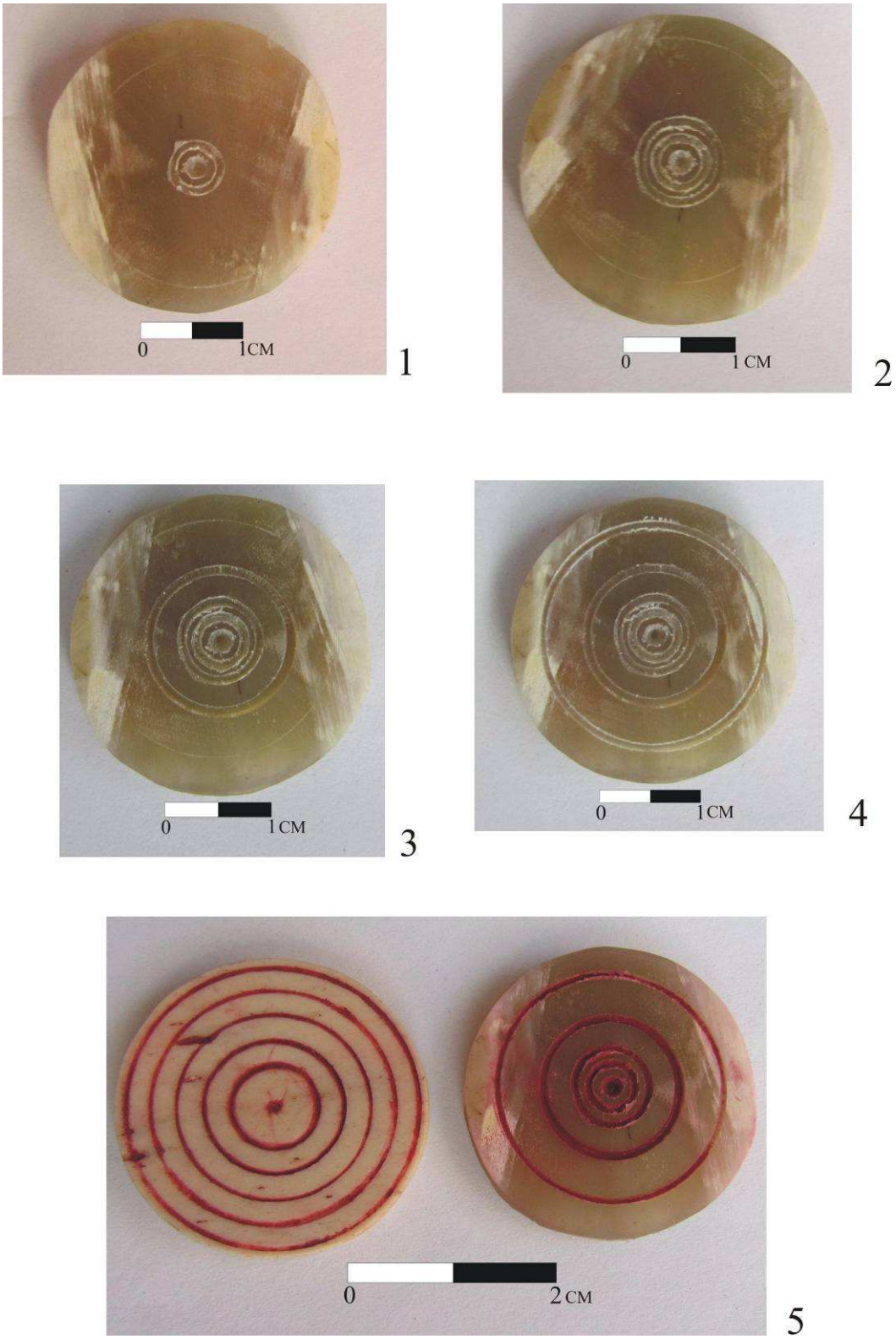

Fig. 8 - 1-4-Decorating stages of a cattle horn chip. 5–Chips made of cattle bone and horn.

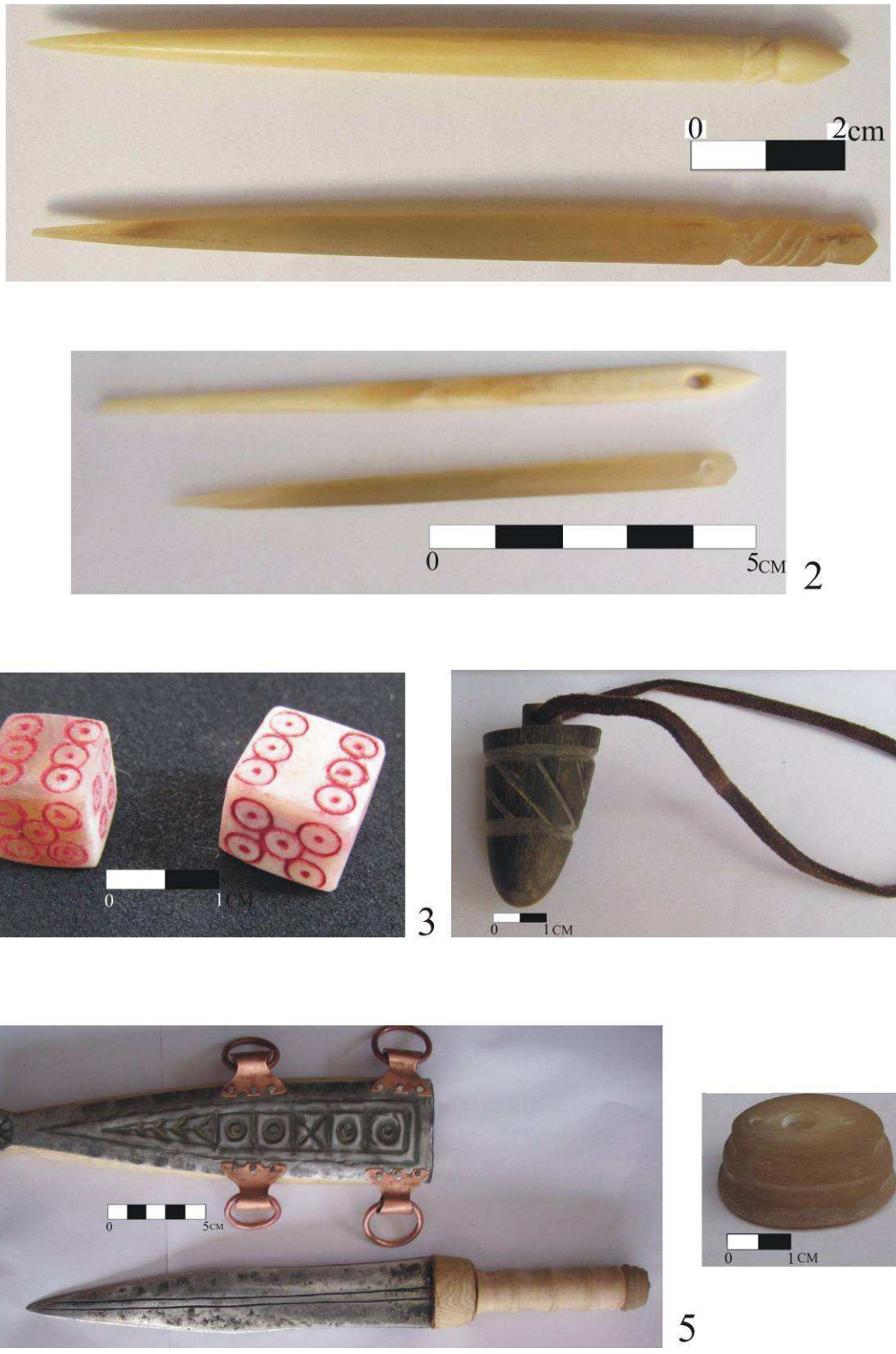

Fig. 9 – 1-Hair pins made of cattle bone and horn; 2–Sewing needles made of goat bone and horn; 3–Dice made of goat horn and antler; 4–Pendant made of cattle horn; 5–Roman dagger replica; 6–Roman dagger button made of cattle horn.

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Fig. 10 – 1-Items experimentally made of cattle horn; 2–Usage of cattle horn comb.

point one. It is possible that this rule appeared in order to prevent cheating (M. Barbu, 2009).

Thick bone segments needed for making dice. For this reason, tubular cattle bones or deer horn tips are preferred (M. Barbu, 2009). The problem of wall thickness is void for dice made of sheep and goat horns or especially cattle horns. In this case, I have used the tip of a goat horn which I cut with a saw. The resulting segment was polished on coarse sandstone until a cube was obtained. The engraved circles were made with a small iron compass, dipping the item in water for several hours, which made marking easier (Fig. 9/3)

Pendant

A range of pendants made of antler or teeth of various animals are present in Roman sites. In the specialised literature, these items are considered to be amulets with symbolic and magical value (D. Ciugudean, 1997).

Such an amulet was obtained by cutting the tip of a cattle horn. It was perforated in a similar manner to that used in piercing the sewing needles. The decoration (Fig. 9/4) was done with an iron file. Pendants made of other organic materials such as hooves or claws (elements of strong symbolic importance) belong to the same category of items.

Dagger button

The Romans, organized in a professional army, had military equipment as standardized as possible. However, the very complex fighting equipment, the regular change of fighting technique and tactics (and therefore of the equipment) and the many auxiliary troops gathered from the whole Empire, lead to a wide variety of Roman military equipment items. Among these items there are a number of weapon elements made of horn or bone (M. Bishop, J. Coulston, 1993; L. Boca, 1983). These elements made of bone and horn did not represent the working part of any weapons, but were grips or accessories for various weapons.

In this case, I could make a Roman dagger button, the making of the dagger (Fig. 9/5) itself being discussed in another paper. This button (Fig. 9/6) was made of cattle horn tip cut with a saw. The item was finished with sandstone, the decoration with an iron file, and the three holes with a narrow knife blade.

Conclusions

Following the completion of the experiments described above, I could draw certain conclusions regarding the items made of domestic herbivore horns.

I have seen that these horns can be modelled, as they are thermally deformable. Moreover, their high elasticity makes them suitable for manufacturing certain types of objects such as combs (Fig. 10/2).

I have noticed that this material can be processed like wood, the processing time for objects made of cattle, sheep and goat horns being reduced by almost 50% of the time required to make the same types of bone items.

The pleasant, translucent appearance which gives the adornment items a unique beauty should not be overlooked.

The main conclusion is that this material is as at least suitable for processing as bones or antlers. I have noticed that a wide range of Roman objects with different uses can be made starting with ornaments and ending with tools, game chips or military equipment items.

Given all this, and corroborating the experimental data with the archaeological traces of the presence of cattle, sheep and goat horns in the Roman workshops processing hard material of animal origin, I can say that, in Roman times, the items made of the horny coating of the horny processes of domestic herbivores were used on a large scale.

Acknowledgements

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