Quaternary International 438 (2017) 201–211

Contents lists available at ScienceDirect

Quaternary International

journal homepage: www.elsevier.com/locate/quaint

Spatulas and abraded astragalus: Two types of tools used to process ceramics? Examples from the Romanian prehistory

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ARTICLE INFO

Article history:
Available online 1 September 2015

Keywords:
Neolithic
Spatulas
Abraded astragalus
Technical transformation sequence
Functional hypotheses
Experimental replica

ABSTRACT

In most of the Neolithic and Chalcolitic assemblages, north of the Danube, constantly appear two types of artifacts: spatulas made on longitudinal bipartitioned rib and abraded astragalus. Some specialists considered them tools used in different stages during the *chaîne opératoire* of ceramics production. Starting from this functional hypothesis, we developed an experimental program in order to establish its reality. Thus, the first task included the processing of tools, using both the types of raw materials (rib of *Bos taurus* and astragalus of *Ovis aries/Capra hircus*), and the technical transformation sequences identified in the case of archaeological artifacts. After the tools were processed, the spatulas were used in the action of modeling the ceramics' form, in order to eliminate the excess of raw material and to homogenize the surface. The astragalus, abraded prior to their utilization, were used for ceramic finishing, in order to mechanically polish the surface. In a third stage, the wear traces, developed on experimental samples, were compared with those present on archaeological pieces, illustrating a high degree of similarity. Our experimental program demonstrated the importance of experimental archaeology in the reconstruction the collective *savoir-faire* of Prehistoric communities.

1. Introduction

In Romanian archaeology, the pieces of hard animal materials for a long period of time, produced limited interest. Most studies mentioned in a single phrase their presence or, in the best of cases, there was an enumeration of the main typological categories, without functional or technological considerations. This is not unexpected, considering the preeminence of ceramics in Neolithic studies.

The very few excavation reports (e.g., Dumitrescu, 1924, 1965, 1966) or older studies (e.g., Comșa, 1985, 1986; Bolomey and Marinescu-Bîlcu, 1988, 2000; Andreescu, 1995, 1997, 2002; Andreescu and Popa, 1999–2000), concerned particularly with the animal hard material industry, aimed only at morphologic deciphering or the identification of similarities, with the purpose of classifying them in different typological categories. Traditional archaeology developed around identification and classification. Entire series of pieces, having the morphology of the active part as a common element, were integrated in an unique functional category, with no description of the wear traces, which would have allowed a more exact interpretation and a matching according to the real manner in which they were used. Moreover, publication of drawings which, by their nature, have a high degree of subjectivity, does not allow a reevaluation of those pieces.

In the last decade, an increased interest for this field has been manifested. Research tends to be oriented towards the reconstruction of the succession of the technical transformation sequences which allow the reestablishing of the "lost context" of these pieces. For the Neolithic on the Romanian territory, studies based on systematic technical-typological analysis include those coordinated by C. Beldiman and D.-M. Sztancs (e.g., Beldiman, 2007; Beldiman and Sztancs, 2009, 2013; Sztancs et al., 2010, 2013), especially for early Neolithic, or our own studies (e.g., Mărgărit et al., 2009, 2014a, 2014b; Mărgărit and Popovici, 2011, 2012; Mărgărit and Radu, 2014; Mărgărit, 2014a), especially on the archaeological assemblages of the Gumelnița culture. Moreover, starting from the microscopic observations of the original objects, compared with the experimental results, specialists have tried to establish data bases for the different microscopic traces (e.g. Sztancs et al., 2013; Vornicu, 2013; Mărgărit, 2014b).

The experimental reference bases necessary for the understanding of Neolithic and Chalcolithic osseous industries north of the Danube are still few, despite the extraordinary potential, and there remains much work in order to reach the level attained especially by the French school (e.g., Sidéra, 1993; Christidou, 1999;

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http://dx.doi.org/10.1016/j.quaint.2015.07.057
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Maigrot, 2003; Le Dosseur, 2006; Legrand, 2007; Manca, 2013). To begin to fill this gap, we have designed an experimental program (see http://www.eneolithicbonetools.ro/results/experimental-archaeology), extended during several years, to identify the transformation schemes and the usage modalities of the different artifacts, identified at the Neolithic and Chalcolithic communities.

2. Materials and methods

In most of the Neolithic and Chalcolithic assemblages north of the Danube, two types of artifacts constantly appear: spatulas made on longitudinal bipartitioned ribs and abraded astragalus. In the first case, the selected species was *Bos taurus* and in the second, *Ovis aries/Capra hircus*. Some Romanian specialists considered them tools used in different stages during the *chaîne opératoire* of ceramics production, with no interrogation regarding the wear traces identified at these pieces. Starting from this functional hypothesis, we developed an experimental program in order to establish its reality. Thus, the first task included the processing of tools, respecting both the types of raw materials and the technical transformation sequences identified in the archaeological artifacts. Thus, after the tools were processed, the spatulas were used in the action of modeling the ceramics' form, in order to eliminate the excess of raw material and to homogenize the surface. The astragalus, abraded prior to their utilization, were used for ceramic finishing, in order to mechanically polish the surface. In a third stage, the wear traces, developed on experimental samples, were compared with those present on archaeological pieces. The experimental and archaeological objects were examined with a stereoscopic microscope (Olympus SZ61, 20–90× magnification) and a digital microscope (VHX-600; 30–150× magnification), and pictures were focused with the aid of a camera incorporated within the digital microscope. Analytical criteria for the technological and functional interpretation of micro-stigmata were established based on comparison with recent publications on the osseous industries in Prehistory (e.g. Maigrot, 2003; Sidéra and Legrand, 2006; Legrand, 2007; Legrand and Sidéra, 2007; Gijn van, 2007; Gates St-Pierre, 2010; Buc, 2011).

2.1. Spatulas

In the north Danubian space, the Romanian literature (Boroneanț, 2000; Păunescu, 2000), and direct study on some Mesolithic archaeological collections (Mărgărit, 2005, 2008), have not underlined the use of ribs as blanks for tool processing. The Mesolithic communities used the long bones diaphysis, derived from medium and large sized mammals, transformed as points and, more rarely, in bevelled-tools. The spatulas appear at the beginning of the Neolithic, for example, at Starčevo-Criș level (c. 6200–5300 BC) from Măgura "Buduiasca" ("Boldul lui Moș Ivănuș") and afterwards at the Dudești horizon (middle Neolithic – c.5500–5000 BC), in the same settlement. For the Starčevo-Criș culture, in the Romanian territory, 20 spatulas were processed on longitudinal bipartitioned ribs (Beldiman and Sztancs, 2013). Subsequently, they are present in all the Prehistoric cultures, from early Chalcolithic (5000–4500 BC) (e. g. Măgura "Buduiasca" – Vădastra culture; Radovanu – Boian culture), until late Chalcolithic (4600/4500–3800/3700 BC) (Hârșova-tell, Borduşani-Popină, Vitănești, Sultana-Malu Roşu, Măriuța-tell (Mărgărit et al., 2014b), Cunești (Mărgărit et al., 2013); Baia– Gumelnița culture (Mihail and Ștefan, 2014); Suceveni-Stoborâni – cultural aspect Stoicani Aldeni (Beldiman et al., 2012)). Archaeological publications allowed us to identify the spatulas processed on the bipartitioned ribs and on other sites from the Balkan area: Starčevo-Grad (Starčevo culture) (Vitezović, 2013a), Grivac (Starčevo-Criș and Vinča cultures) (Vitezović, 2013b), Drenovac (Vinča culture) (Vitezović, 2011), and Vitkovo (Vinča culture) (Vitezović and Bulatović, 2013). Pieces of this type appear also in Hungary, in levels belonging to the cultural ensemble Starčevo-Criș-Körös, as in the case of the settlement from Ecsegfalva 23 (Choyke, 2007; Toth, 2012) or in the Chalcolithic, at Győr-Szabadrét-domb (Choyke, 2014).

The spatulas have an approximately rectangular morphology, with parallel rectilineal edges, slightly curved profile and an active extremity with a convex (Fig. 1, 1) or pointed morphology (Fig. 1, 2). The flat blank, a semi-rib, was obtained by three different methods of bipartition: direct percussion, abrasion on a stone, and scraping. These techniques were applied until spongy tissue was reached. Then, by indirect percussion, the two semi-ribs were partitioned. The active front was shaped by abrasion, applied from the inferior side for the convex spatulas, and combined with bilateral sawing with the abrasion for finishing pointed spatulas.

In their extended and fine usage polish (fine chips or depressions are lacking), spatulas seem to correspond to a functionality characterized by a prolonged movement on soft materials, such as skins (Averbouh and Buisson, 2003; Raskova Zelinkova, 2010) or clay pot processing (Struckmeyer, 2011). It was suggested that their manufacture out of longitudinally cut ribs had the purpose of assuring the flexibility of the equipment (Tartar, 2009).

2.2. Abraded astragalus

This type of artifact raised a higher interest than the spatulas, benefiting from numerous studies, so we were able to follow its presence through Prehistory, with the functional hypotheses proposed. For the period prior to the early Neolithic, no astragalus processed by abrasion have been identified in the north Danube area. The first pieces are confirmed at the level of Starčevo-Criș culture, as in the case of the settlement from Măgura "Buduiasca" ("Boldul lui Moș Ivănuș") (Mărgărit et al., 2014c). They are also present in the middle Neolithic (Dudești culture) at Măgura "Buduiasca", and in the early Chalcolithic, in the settlement from Radovanu (Boian culture) (Mărgărit et al., 2014a), and the settlement from Cheia (Hamangia culture) (Voinea and Neagu, 2009). They were also identified in the Precucuteni culture, at Ghigoești-Trudești (Marinescu-Bîlcu, 1974), Isaiia (Ursulescu et al., 2004), Târpești (Marinescu-Bîlcu, 1974) and Târgu Frumos (Vornicu, 2014). These pieces are present in the middle Chalcolithic, especially for the Gumelnița culture, at Hârșova-tell, Borduşani-Popină, Vitănești, Măriuța-tell (Mărgărit et al., 2014b), Cunești (Mărgărit et al., 2013), Gumelnița (Dumitrescu, 1966), Însurăței-Popină I (Pandrea et al., 2002), Năvodari-Insula la Ostrov (Marinescu-Bîlcu et al., 2001, 2003), and Iepurești (Kogălniceanu et al., 2014). An abraded astragalus deposit was discovered in a burned dwelling from the Cucuteni settlement of Poduri-Dealul Ghindaru (Bejenaru et al., 2010). In other sites from the Balkan area, abraded astragalus are present at Drenovac (Vitezović, 2011), Divostin (Vitezović, 2013c), and Pavlovac-Kovačke Njive (Vinča culture) (Vitezović, 2015).

From the technological point of view, abrasion of the one, two or four sides took place which helped diminish the protuberances specific for this type of bone, which finally gave the pieces an approximately rectangular morphology (Fig. 2, 1). In a few cases, a perforation was made at the level of the depression present on the dorsal side, through rotation (Fig. 2, 2). Morphometrically, the dimensions are standardized, being determined both by the choosing of a single species, and by a similar processing technique. The technological analysis started from several suppositions concerning the technical transformation sequence of these pieces. These suppositions were later assessed by the microscopic study. The rectilinear aspect of the edges might have been created through previous processing (for example, cutting by sawing), but no

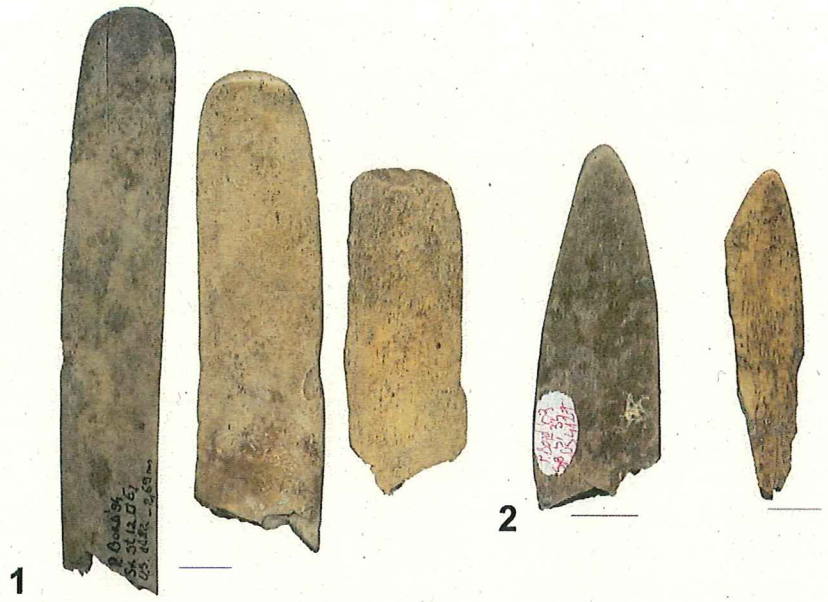

Fig. 1. Exemples of archaeological spatulas. 1) Spatulas with convex extremity (Chalcolithic settlement of Borduşani-Popină). 2) Spatulas with pointed extremity (Chalcolithic settlements of Borduşani-Popină and Hârşova-tell).

stigmata have been identified. The conclusion is that they were transformed exclusively through abrasive action of linear friction. Another technological reflection was related to the presence of a perforation. The study under the microscope showed that the abrasion followed the perforation, as it destroyed its edges, and also that the pieces were suspended for a long time on a thread, as the grooves that appeared following the perforation process have been preserved in very few cases. The conclusion is that, regardless of the function they had, the items were perforated from the beginning of the process of technological transformation, to be put on a thread, in order to avoid losing them.

In the literature, the significance of these pieces raise debates, determined by their presence over an impressive chronological (from Neolithic until modern time) and spatial (Europe, Asia, Africa, America, Australia) distribution. For this type of piece, a first functional hypothesis is domestic utility, the result of the intense friction with another body, strongly abrasive, aiming, for instance, at ceramic finishing (Meier, 2013) or skin processing (Riedel and Tecchiati, 2001), which implies the fact that the abrasion marks are functional and not technological. A second hypothesis tries to demonstrate the utilization of these astragalus in different settings, in this sense existing attestations for diverse chronologic periods and remote regions (Neolithic, Bronze Age, Ancient Greece and Rome, Middle Ages, modern Iran and Mongolia, natives in Australia or America) (e.g., Amandry, 1984; Lewis, 1988, 1990; Eisenberg, 1989; Gilmour, 1997; Elster, 2003; Choyke, 2010; Korzakova, 2010). Also, the possibility of their utilization in different ritual practices, for instance in divination (Amandry, 1984; Zidarov, 2005; Prummel and Halici, 2011) cannot be denied.

Another functional interpretation is whether these artifacts could have been mainly pendants and the observed abrasion was a result of a very long duration of use, possibly over several generations. Could these pieces be elements destined, from the beginning, to be attached in composite ornaments? Perforation

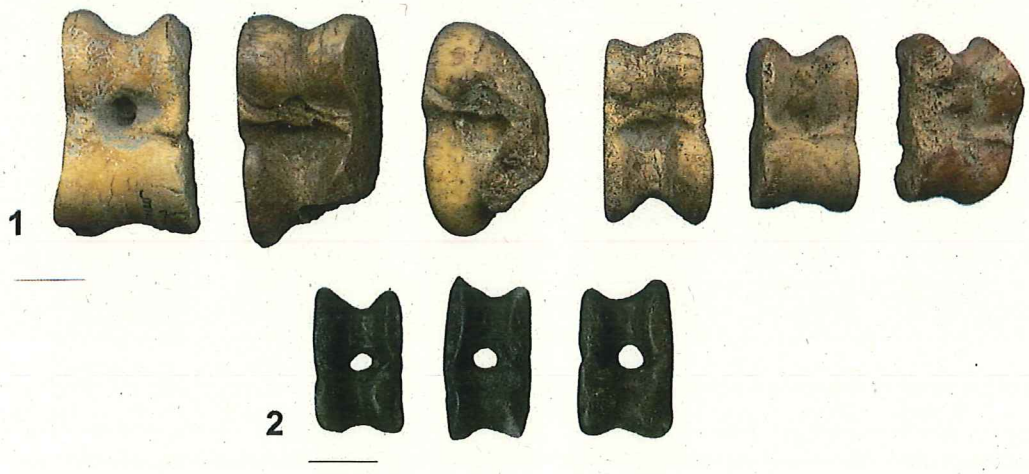

Fig. 2. Exemples of archaeological astragalus. 1) Flattened astragalus (Chalcolithic settlement of Borduşani-Popină). 2) Flattened and perforated astragalus (Chalcolithic settlement of Iepureşti).

precedes the abrasion, so from the very beginning it was aimed at suspension of the pieces with a thread. Ethnographic studies demonstrate the resilience of the artifacts of osseous materials, which could be left as an inheritance over generations (Choyke, 2009). Two points suggest that the main raison for processing these pieces was not adornment. Study of the archaeological materials indicated that the abrasion which affects the sides of the astragals led to the development of a mat surface, with deep and irregular disposed scratches (Fig. 9, 3–4). If the abrasion would have been strictly aesthetic, (pieces with a rectangular morphology), obtained by abrasion with a stone, it would have resulted a surface with macroscopic polish, with long, regulated parallel striations (Fig. 9, 1). Moreover, if this abrasion might have resulted from usage (friction with clothes, skin or the friction of the pieces between them), subsequently to prolonged suspension, the macroscopic polish should be even more intense, microscopically characterized by the presence of fine striations, disposed sporadically. The modifications in volume of the surface would have been irregular and a perfectly rectilinear surface could not have appeared, as in the archaeological samples. A second hypothesis is function in two stages, in the sense that the piece might have been used as a burnisher in an abrading action, on a strongly abrasive surface (ceramics), and then it might have been turned on a new side as the different sides were worn out, until the final exhaustion (until the piece was impossible to hold). During a second stage, the piece might have been turned into a bead, part of a necklace. This second opinion appears better adapted to the technological and usage observations obtained for the abraded astragalus.

Holmgren (2004) invokes, in the case of astragalus deposits, another possibly commercial value, medium of exchange, some sort of primitive money. We cannot ignore the extraordinary symbolic importance of these pieces which was probably imprinted in the collective mentality of some communities, as long as they were replicated in gold (the Neolithic necropolis from Varna (Poplin, 1991; Slavchev, 2010)); in stone (Bronze Age, at Gonur Depe

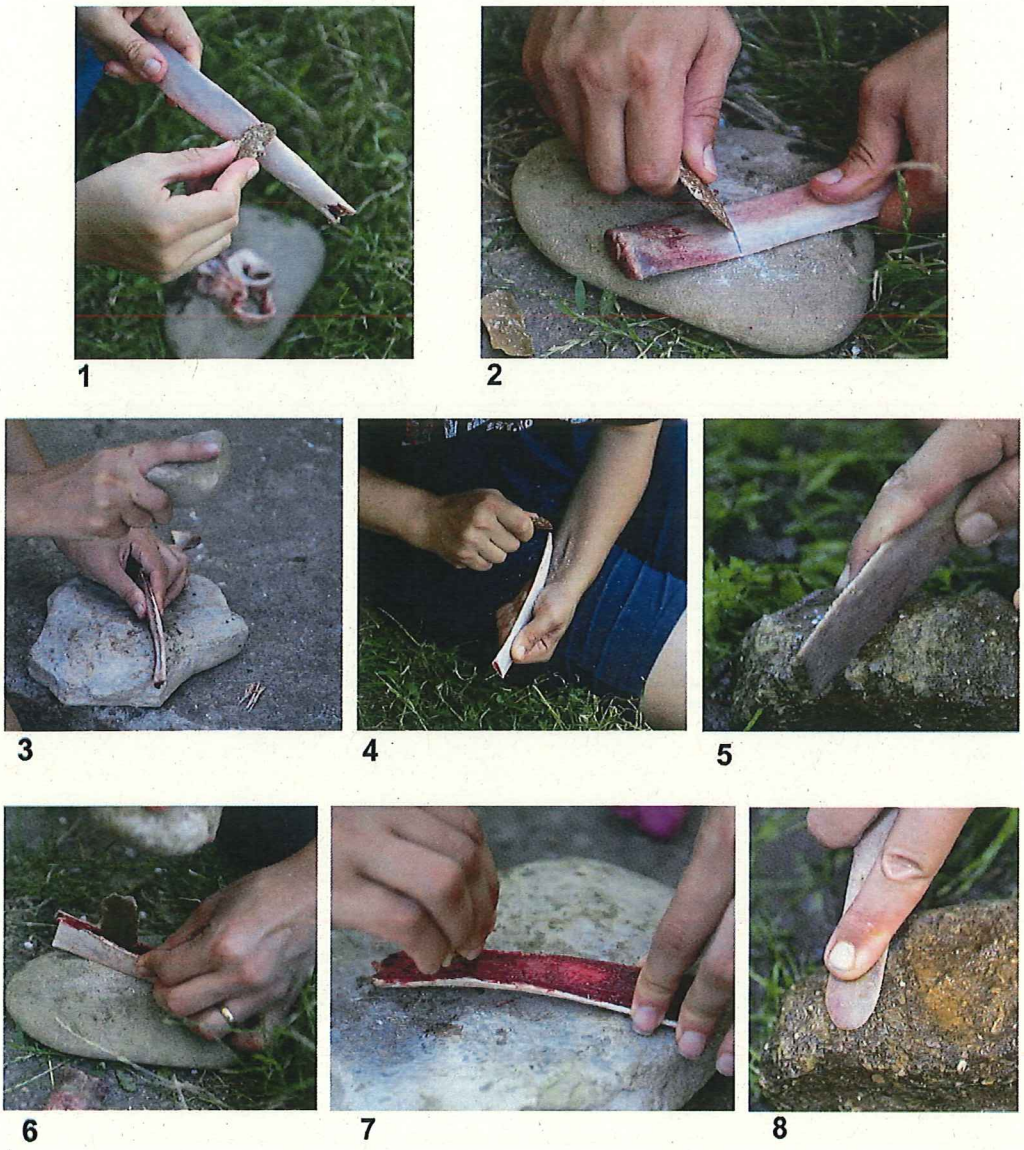

Fig. 3. Technical transformation sequence for processing spatulas – experimental program. 1) Cleaning of the surface. 2) Segmentation by sawing. 3) Bipartition by direct percussion. 4) Bipartition by scraping. 5) Bipartition by abrasion. 6) Bipartition by indirect percussion. 7) Cleaning of the spongy tissue. 8) Abrasion of the extremity.

Fig. 4. Working hypothesis for experimental spatulas. 1) Method of utilization for spatulas with a convex extremity. 2) Method of utilization for spatula with a pointed extremity.

(Turkmenistan) (Moore, 1993), or clay, glass, bronze or marble (classic Antiquity (Amandry, 1984; Dandoy, 2006)).

3. Experimental results

3.1. Spatulas

3.1.1. Technical transformation sequence

Starting from this functional hypothesis and from functional and technological stigmata identified at the archaeological pieces, an experimental program aimed to reconstruct both the processing modes and those of use, specific to the two types of pieces analyzed in this study. The experiments were made on fresh bones. The experiments have demonstrated that when the ribs are air-dried more than 5 days, they lose moisture and the bipartition proceeding is much more difficult to apply, often with accidents in the bipartition process of the two blanks. The processing of ribs requires an important time investment but it also provides a special blank – flat and wide, starting from which various tools can be made: spatulas, points, figurines, and even adornments. Moreover, the morphology and dimensions of the resulted blanks are quite easy to control and visualize, which allows production of series of standardized objects, such as spatulas. The first stage of rib processing consists in the cleaning of the surface (Fig. 3, 1), at the level of the periost, because a greasy surface will lead to slipping of the lithic tools during processing. The second stage is the removal of the extremity by sawing (Fig. 3, 2), followed by flexion, because this area has a strongly spongy structure, inadequate for its utilization as a blank for pieces.

Rib bipartition, which offers two identical blanks, was made by three techniques: direct diffuse percussion (Fig. 3, 3), scraping (Fig. 3, 4), and abrasion (Fig. 3, 5). The first technique may be applied with the aid of a stone hammer, with short and successive hits, leading to the elimination of small splinters, a process continued until the spongy tissue is reached. In the other cases, for scraping, a lithic piece with a sharp edge (or large splinter) is used. The bipartition by abrasion method uses a stone with a strongly abrasive structure. The objective of these two techniques is to eliminate matter at the level of the edges, as powder, and to reach the spongy tissue. The necessary time for the finishing of the operation is about 40 min (scraping) and 80 min (abrasion), implying good control of the bipartition, and ensuring two regular blanks. Moreover, the semi-ribs obtained following these two methods have regular debitage edges, limiting the time necessary for shaping. In the case of bipartition by percussion, the debitage edges preserve traces of the impact points. In the case of archaeological pieces, no special attention commonly was paid to the shaping operation.

The bipartition of the two blanks was made by indirect percussion, in this case requiring special attention on the force used on the intermediary tool, in order to avoid accidental cracks. The intermediary tool may be either a lithic piece or a bone one, the appropriate hammer being a pebble of approx. 350–400 g. More important, at the level of this operation, is the application force of the hit, in order to control the propagation of the crack. In numerous cases, the crack deviated sideways and two identical blanks were not obtained. The intermediary tool is placed in the spongy tissue, at the end of the rib, and hit with the hammer, for the initiation of the longitudinal fissure (Fig. 3, 6). It will be moved during the separation of the two blanks. The active front negative of the intermediary tool remains impressed in the spongy tissue, after the separation of the two blanks. In the archaeological samples, these marks are no longer preserved, because the spongy tissue, for both semi-ribs, will be removed, with an endscraper, in order to

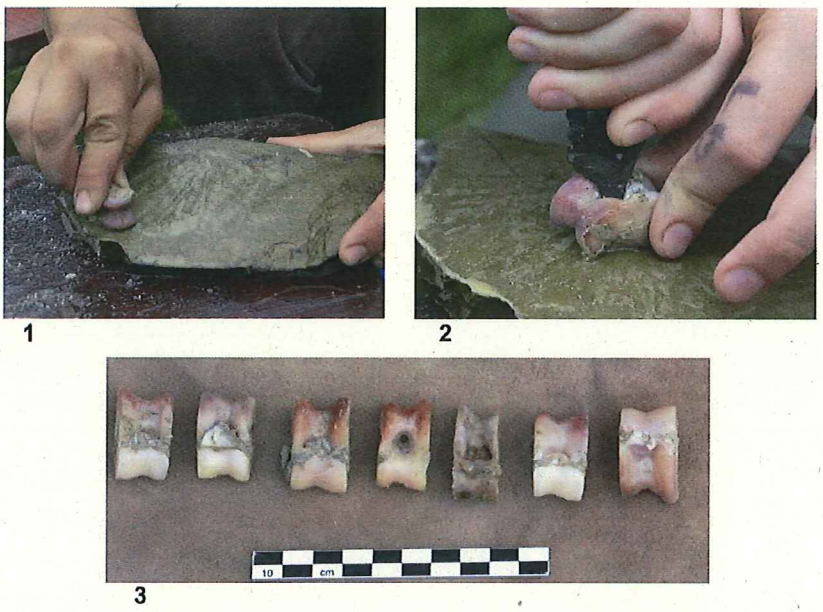

Fig. 5. Experimental processing of astragalus. 1) Abrasion of the astragalus. 2) Perforation of the astragalus. 3) Processed astragalus.

ensure a clean and regular surface (Fig. 3, 7). Afterwards, the entire inferior side was cleaned by abrasion, on a strongly abraded stone. At the same time, the shape of the active extremity was given directly by abrasion, for the spatula with a convex extremity (Fig. 3, 8). Items with a pointed extremity can be shaped by sawing, followed by abrasion for the finishing stage. The operation does not require a very long time (10 min), especially using strongly abrasive stones, which allow the quick removal of material. Moreover, the process can be quickened if water and sand are added periodically.

3.1.2. Working hypothesis

Thus, after the tools were processed, the spatulas were used in the action of modeling the ceramics' form, in order to eliminate the excess of raw material and to homogenize the surface. For highly realistic results, a type of clay which was similar with that used for the processing of ceramics present in the studied Prehistoric settlements was used. The pieces were used for the processing of several pots. The utilization time for each vessel was registered thoroughly, the utilization time reaching 2 h. Spatulas were extremely useful in order to regularize the shape of the ceramics and to eliminate excess material. Spatulas with a convex morphology (Fig. 4, 1) are very well adapted for the interior of the pottery while spatulas with a pointed morphology (Fig. 4, 2) are useful in order to regularize the exterior and mouth.

3.2. Astragalus

3.2.1. Technical transformation sequence

In this case fresh bones were used, but, unlike the ribs, air-dried bones could also be used because no bipartition is required. The ovicaprins astragalus, selected for the experiment, were abraded, on the lateral and medial sides, for 10 min, on a strongly abrasive stone (Fig. 5, 1). From time to time water was added, in order to speed up the process. One of the samples was perforated using a drill, by rotation, from the dorsal side, at the level of the depression. The operation finished in 15 min (Fig. 5, 2). Unlike the previous typological category, it takes a reduced investment of time because the matrix maintains a large part of the anatomic volume (Fig. 5, 3). The use of previous abrasion on a stone was chosen because, in a first attempt using unmodified technologically astragalus, they systematically slipped from the trajectory and could not be easily held. The ceramic polish failed to appear, so the technological

Fig. 6. Processing ceramics with an astragalus.

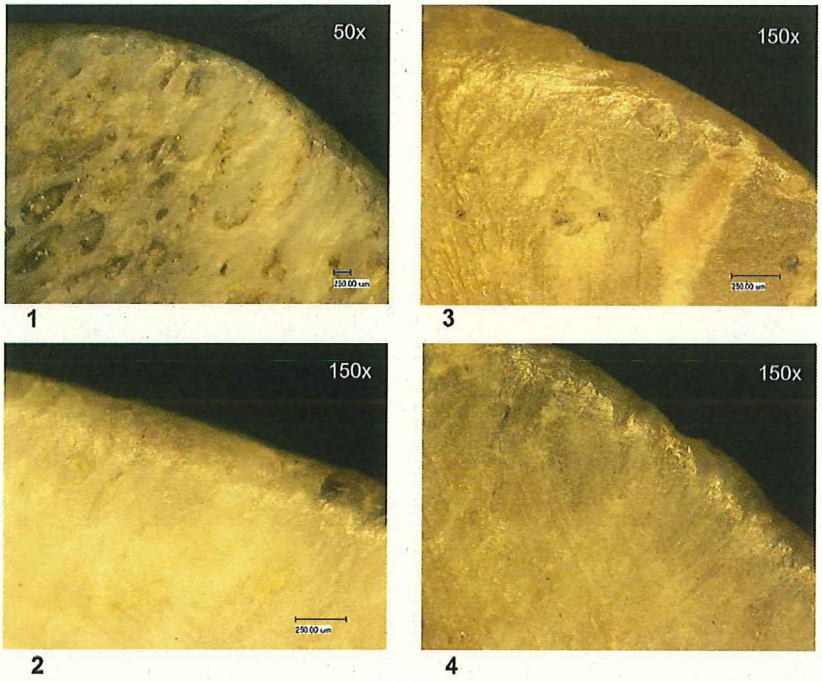

Fig. 7. Wear traces present at the level of the spatulas extremity 1) Convex extremity after half an hour of use (experimental). 2) Convex extremity after two hours of use (experimental). 3) and 4) Use-wear identified at the archaeological pieces.

solution was better adapted to the need of having a flattened surface in contact with the ceramics.

3.2.2. *Working hypothesis*

The abraded astragalus were used for ceramic finishing, in order to polish/shine of the surface. It was impressed a linear frictional movement, sometimes completed with circular movements, applied with a moderate pressure (Fig. 6). This procedure was used on the already formed pottery which was dried for at least 24 h. The result is the development of a polished surface which ensures a greater resistance and which may fix the little cracks or accidents on the surface. The subsumed utilization time for astragals was 1 h.

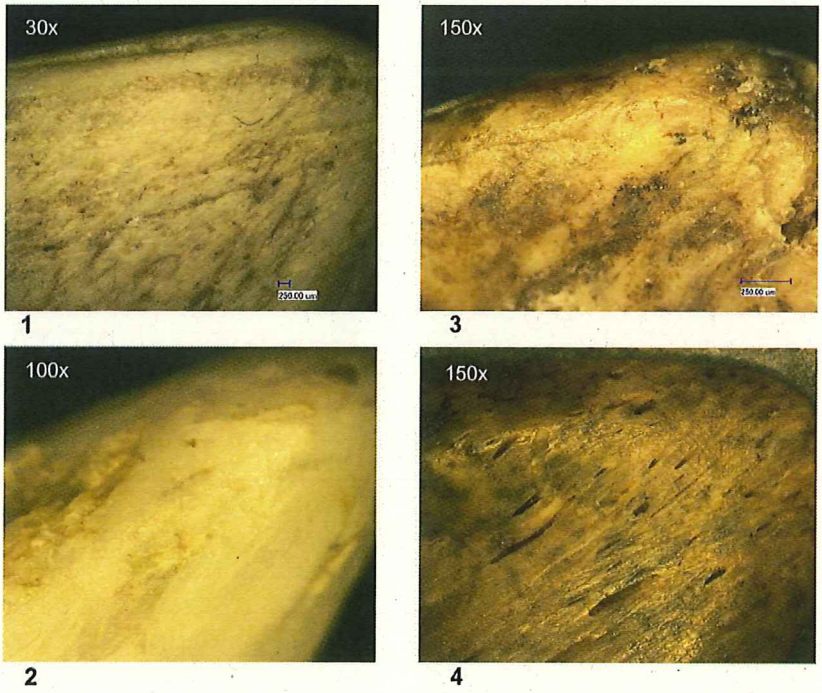

Fig. 8. Wear traces present at the level of the spatulas extremity 1) Pointed extremity after half an hour of use (experimental). 2) Pointed extremity after two hours of use (experimental). 3) and 4) Use-wear identified at the archaeological pieces.

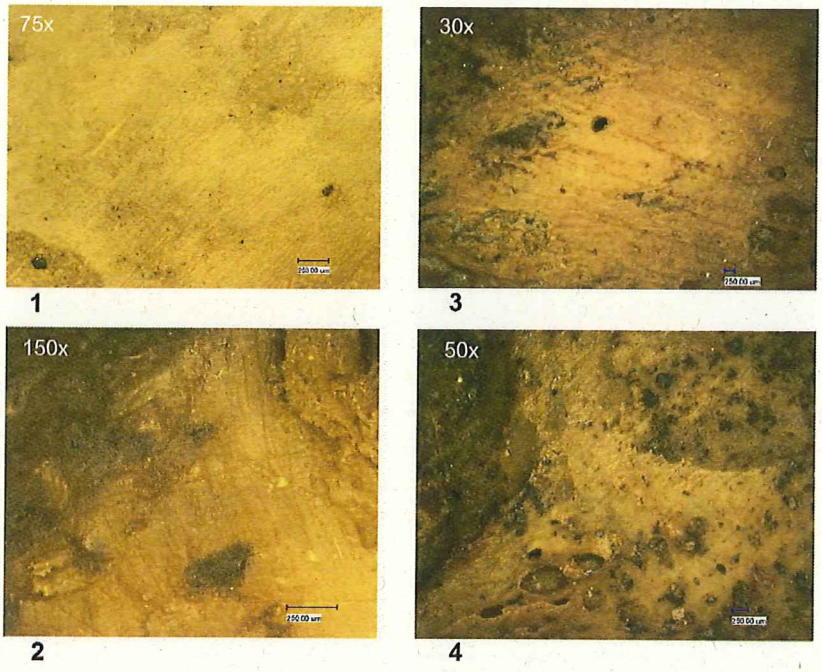

Fig. 9. Wear traces present at the surface of the flattened astragalus. 1) Surface abraded on a stone (experimental). 2) Surface used for processing the ceramic (experimental). 3) and 4) Use-wear identified at the surface of the archaeological pieces.

Macroscopically, it did not show evolution of the abrasion surface morphology.

4. Discussion

The experimental spatulas and flattened astragalus were analyzed under the microscope, with the purpose to identify the specific marks after use for ceramic processing. The intensity, extent and type of the wear traces developed at the level of the active surfaces were noted.

A second stage involved comparison with the wear traces present at the level of the extremity for the archaeological samples. The extremity of the convex spatulas used experimentally got a macroscopic, invasive polish, with scratches at 90° to the extremity, which covered the technological, abrasion ones (Fig. 7, 1–2). The material is constantly eliminated, following the friction proceeding, but the extremity keeps its convex form. The pictures show that the same data were also registered for the archaeological pieces (Fig. 7, 3–4). In the case of the pointed spatulas, the experimental samples suffered a radical modification of the extremity, after two hours of utilization. The area of the sides implicated in the ceramics processing tends to gain a concave morphology and the intersection angle becomes more and more sharpened. The wear evolved laterally, and the usage marks are bifacial, peripheric, with longitudinal scratches at 90° to the piece's axis (Fig. 8, 1–2). The microscopic marks are also obvious at the level of the archaeological pieces (Fig. 8, 3–4).

For the astragalus illustrated, in the first case, the surface of a piece exclusively abraded on a stone (Fig. 9, 1). The area shows a macroscopic polish and is covered by long, dense parallel striations. In the second picture after one hour of utilization on ceramics, the surface became matted, the abrasion striations disappeared, with deeper, quite rare and irregular striations (Fig. 9, 2). The last two images (Fig. 9, 3–4) derive from archaeological examples and indicate that the intensity and extent of the artifacts wear, as deformation volume of the active surfaces, were similar to wear produced by experimental working. The fact that at the level of the active surface does not develop a macroscopic polishing surface, as in the case of spatulas, may derive from the fact that the clay was processed, in this case, almost dried, thus becoming harder and more abrasive.

Inventorying the abraded spatulas and astragalus in a series of settlements in the north–Danube territory indicates two types of artifacts present in all the Neolithic and Chalcolithic cultures. They were extremely helpful for the Prehistoric communities, which did not feel the need to remove or to replace them. Moreover, no significant mutations of the technical transformation sequences along the Neolithic and Chalcolithic were identified. Considering the raw material, this is an opportunist selection because the bones were recovered from the species which are constantly present in settlements, even if their percentages showed variations during the Neolithic and Chalcolithic. In the settlement from Măgura "Buduiasca" (continuously inhabited from early Neolithic to early Chalcolithic), in the sequence Starcevo-Criş I (early Neolithic), the bones of *Ovis aries/Capra hircus* have percentages of 67% and those of *Bos taurus* of 25%. At the level of the Dudeşti culture (middle Neolithic) and Vădastra (early Chalcolithic), percentages are 13–15% for *Ovis aries/Capra hircus* and 70% for *Bos taurus* (Bălăşescu and Mărgărit, 2014). The osseous material exploitation suggests the domestic character of the set composition, including the repurposing of food waste as artifacts to be used in domestic activities (in this case, ceramic processing). It also reflects knowledge, by the Prehistoric communities, of the selected bones' properties, because they are well adapted to their subsequent utilization. The rib of *Bos taurus* offers the widest blank, compared to other species, while the astragalus of *Ovis aries/Capra hircus* is very easy to hold, after processing. Both operational schemes are quite productive, not producing large quantities of unusable debitage wastes, the matrix being transformed almost entirely in blanks with standardized dimensions and forms.

5. Conclusion

This study focused on some Neolithic bone tools, often neglected in use-wear analysis. These categories were not randomly neglected because, at the archaeological level, it is quite difficult to identify them and to place them into the technical and production system of the Neolithic communities. This also happened because their utilization manner could depend on the one hand on the community's cultural traditions, and on the other on the user's skills and abilities. Such are the traditional communities whose social organization is characterized by the division of labor between sexes (Godelier, 1982). For instance, women do not have access to certain types of tools or activities, or they develop only certain types of activities. It cannot be determined whether the privilege of the production and utilization of the pieces studied here was reserved to certain persons. The considerations of social nature are few and thus study is limited to the technological and functional nature.

Moreover, the archaeological assemblages do not have a homogenous character, differing according to the raw materials, the morphology of the active part, and the location of the usage marks. All these variables create a succession of questions concerning the equipment, the context of its usage and the vestiges attached to the different stages of this activity (Beyries, 2002). For instance, the prehistoric communities used tools from different raw materials for the same purpose and with similar results. Experimental studies made on lithic pieces (Crandell et al., 2015) demonstrated their use in the production of ceramics: polished stones by quartz, quartzite, or chert, used to burnish entire surfaces of ceramics. The result seems to be the same with the usage of the abraded astragalus: the achievement of a regular surface for ceramics, without cracks, with mechanical polish. It is thus impossible to identify the precise place of the two tools in the Neolithic community. The questions are numerous: were they used by different social/sex categories, was a typological category/raw material more valuable culturally than the other, did one replace the other or did they function in parallel, was one of them better adapted functionally or as structural/mechanical properties? The experimental studies demonstrated that the pieces of osseous materials are more resistant than those made of stone and in the case of fracture, they could be replaced in form through technical gestures (Guthrie, 1983; Arndt and Newcomber, 1986). Considering the deficiencies in published data, it is impossible to draw a final picture of the weight of the artefacts made of *Bos taurus* ribs and *Ovis aries/Capra hircus* astragalus in the settlements of Neolithic communities. The two blanks (rib and astragalus) are little diversified, but selection was strictly of a technological nature, in the sense that these bones are perfectly adapted to the shape of the future tools, which does not indicate selection of a cultural nature (without excluding this possibility).

Summing up, the experimental program demonstrated that this functional hypothesis may be one of the utilization variants for the two types of artifacts. These categories of tools were perfectly functional during the practiced activities. The evolutionary manner of the morphology for the active part and of the usage, identified in the experimental pieces, finds analogies in the archaeological items. Other utilization hypothesis (er. skin processing for spatulas) cannot be excluded, and will be checked during future experimental programs. At the level of experimental archaeology and traseology, in the Romanian territory, knowledge on this kind of industry is still incomplete for Prehistory. The general conclusion which guides these studies is that the technical-functional determinations of the tools of animal hard materials must be established based on the correlation between the experimental results, the study of micro and macro-marks (Averbouh and Provenzano, 1998–1999; Averbouh, 2000), functional analogies – ethnographic comparisons (Beyries, 1997; Torrence, 2001), and archaeological data.

Acknowledgments

This work was supported by a grant of the Romanian National Authority for Scientific Research, CNCS – UEFISCDI, project number PN-II-RU-TE-2011-3-0133.

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