SPRAWOZDANIA ARCHEOLOGICZNE 76/1, 2024
PL ISSN 0081-3834
DOI: 10.23858/SA76.2024.1.3547

Walenty Pankowski[1], Małgorzata Rybicka[2],
Joanna Piątkowska-Małecka[3]

RED DEER ANTLER ARTEFACTS FROM GORDINEŞTI II – ”STÎNCA GOALĂ” AND VYNNYKY-”ZHUPAN”: SHAPE-AND-TRACE FORMATION PROCESSES IN NATURAL, FUNCTIONAL AND DEPOSITIONAL CONTEXTS

ABSTRACT

Pankowski W., Rybicka M. and Piątkowska-Małecka J. 2024. Red Deer Antler Artefacts from Gordineşti II-”Stînca goală” and Vynnyky-”Zhupan”: Shape-and-Trace Formation Processes in Natural, Functional and Depositional Contexts. *Sprawozdania Archeologiczne* 76/1, 533-553.

The paper scrutinizes the red deer hard tissues from the contexts attributed to the Trypillia Culture’s final phases. Having once been reported elsewhere, the objects under study are this time conceptualized in terms of shape-and-trace formation processes, with an eye to incorporating them into research advances under the topic of the late Trypillia transformation, including typological affiliation, radiocarbon dating, archaeoecology, subsistence studies, *etc*. Particular attention is paid to artefacts that lack the overwhelming power of the tiniest wear marks, but do display extensive topographic features of manufacture and use. The formalized shape-and-trace aspects for the antler artefacts are proposed, which are considered to be suitable rather for a morphological than for a morphographic systematization of a prehistoric antler assemblage. An interpretative application of the shape-and-trace approach for the sake of clarification of both past currents in morphogenesis of artefacts and praxis of their use is only possible in a systemic context of knowledge about habitats and lifestyles of the past.

Keywords: Early Bronze Age, Late Trypillia, faunal hard tissues, bone and antler industry, subsistence, adaptation
Received: 15.09.2023; Revised: 18.11.2023; Accepted: 19.01.2024

1 National Academy of Sciences of Ukraine, Institute of Archaeology, Volodymyr Ivasiuk Ave. 12, 04210 Kyiv, Ukraine; valpankovskiy@gmail.com; ORCID: 0000-0001-7821-9190
2 University of Rzeszów, Institute of Archaeology, Moniuszki 10, 35-201 Rzeszów, Poland; mrybicka@interia.eu; ORCID: 0000-0001-9889-3481
3 University of Warsaw, Institute of Archaeology, Krakowskie Przedmieście 26/28, 00-927 Warszawa, Poland; jmalecka@uw.edu.pl; ORCID: 0000-0002-2269-2736

INTRODUCTION

The Gordineşti Group represents the latest phase of the Trypillia Culture. Until not too long ago, the economy, sedentism, and subsistence of the Gordineşti Group's population have been among the issues studied on a very limited basis. However, it is the settlement site of Gordineşti II-"Stînca goală" (Dergachev 1980; Rybicka *et al.* 2023a; 2023b) which now constitutes the exception due to the systematic multidisciplinary research. Particularly, subsistence studies have shown that cultivation of cereals with animal husbandry such as cattle, sheep, goat, and, to a lesser extent, pig were the main sources of food supplies for those who lived there (Croitor and Sîrbu 2017; 2019; Rybicka *et al.* 2023b). The protein diet was supplemented with wild fauna (Croitor and Sîrbu 2019). Another significant hill-top location attributed to the Gordineşti Group is in the city of Vynnyky near Lviv in Western Ukraine and the site there is called "Zhupan" (Fig. 1).

The geographical locations of the sites under study are remarkably diverse and quite distant from each other, yet the sites are nonetheless similar in terms of their affiliation within the same time scale of the late Trypillia Gordineşti Group and the types of landscape they occupy (Figs 1 and 2; Hawinskyj and Rybicka 2021, 15, Fot. 1; Rybicka *et al.* 2023a): these both are situated upon flattened tops of rocky limestone hills called "Bald Rock" (Stînca goală) and "Chieftain" (Zhupan).

Currently, we have a series of radiocarbon-based values at our disposal for the sites under scrutiny. From Gordineşti II-"Stînca goală", a group of twelve ^{14}C dates was obtained, which enables the chronological expanse of the settlement to be outlined within the time range of 3500-3000 cal. BC (Król and Rybicka 2022; 2023). It should be emphasized that no evidence of archaeological cultures other than Trypillia was found in the contexts recovered in Gordineşti. From Vynnyky-"Zhupan", only two samples have been analyzed so far, yet even these two enable the inclusion of the Trypillia settlement features into the cal. BC time range mentioned above (Król and Rybicka 2022).

Both in Gordineşti II-"Stînca goală" and Vynnyky-"Zhupan", there are well-defined and homogenous archaeological contexts such as houses, pits, fortifications, and occupation deposits providing rich samples of faunal hard tissues. The osteoarchaeological research was focused on the osseous records discovered in 2016-2019 (Sîrbu *et al.* 2017a; 2017b; 2019; Sîrbu and Król 2021; Rybicka *et al.* 2023a; Verteletskyi *et al.* 2023).

In recent years, bone and antler artefacts attributed to the Gordineşti Group of the late Trypillia Culture have been subjected to study in terms of raw material structure and use-wear patterns (Pankowski 2019; 2023; Pankowski and Piątkowska-Małecka 2023). At present, there are few other habitation contexts of the Gordineşti Group providing significant data and concepts on manufacture and use of bone, antler and horn artefacts due to use-wear and technological studies.

Among faunal hard tissues in Gordineşti II-"Stînca goală", in addition to the large sample of remains of domestic animals such as cattle, sheep, by the pit, and pig, those of the

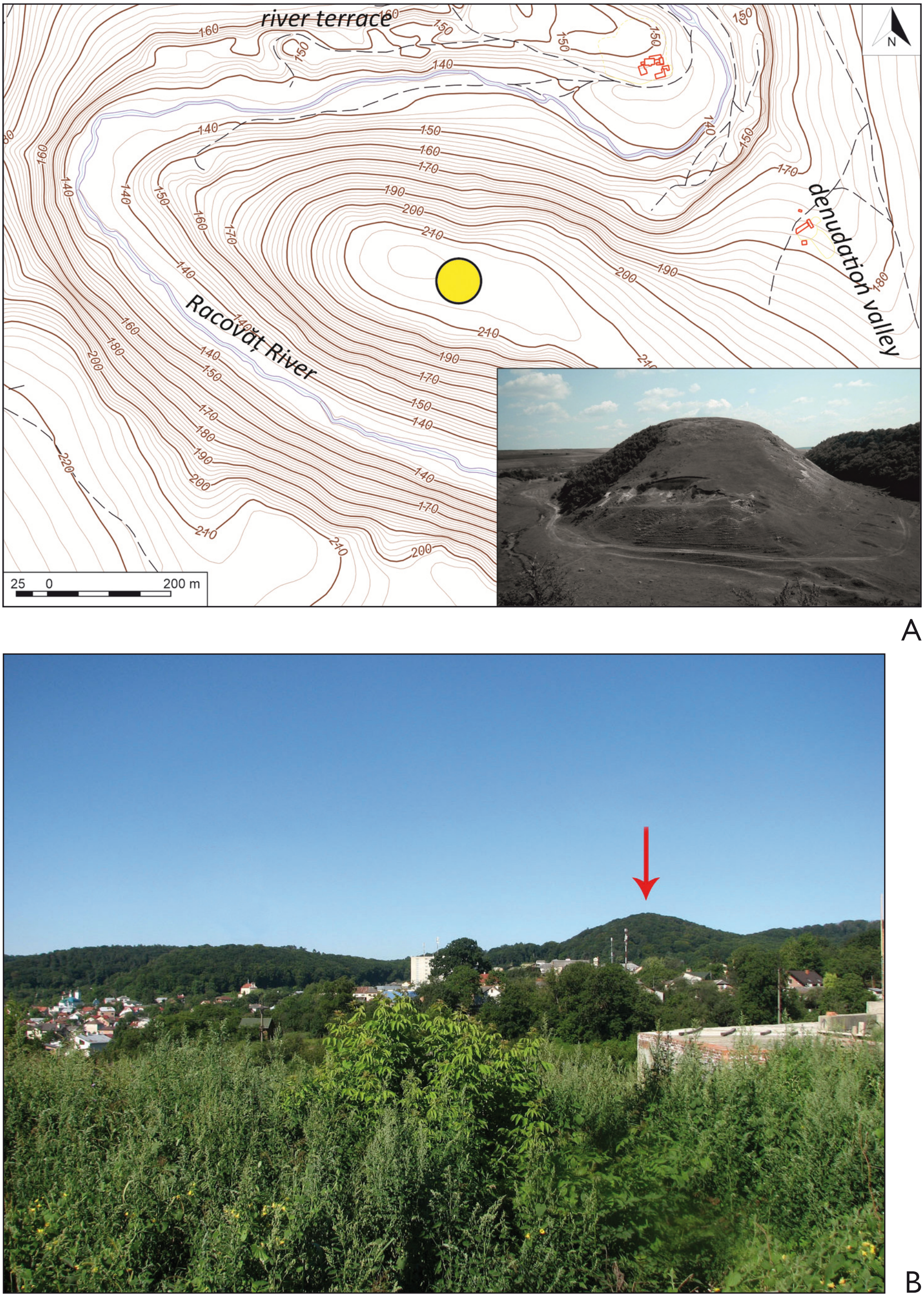

Fig. 1. Location and view of the settlement Gordineşti II-"Stînca goală", Edineţ district (A) and view of the site Vynnyky Zhupan, Lviv district (B) (after Król and Rybicka 2023; Hawinskyj and Rybicka 2021)

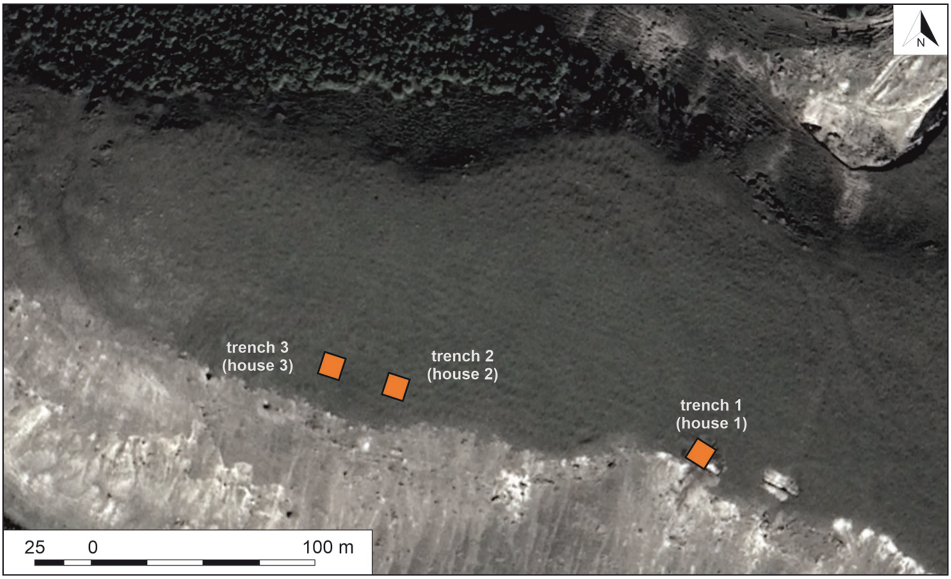

Fig. 2. Gordineşti II-"*Stînca goală*", Edineț district. Location of the excavated houses (after Król, Rybicka 2023)

wild beasts were identified as well (Croitor and Sîrbu 2017; 2019; Rybicka *et al.* 2023b). The remains of the red deer are of particular interest, since these are represented by both skeletal elements and shed antlers (Croitor and Sîrbu 2017, 216ff; 2019, 153; Pankowski 2023, 53-67). In Vynnyky-"Zhupan", both bone and antler remains of red deer were also reported to have been found (Pankowski 2019, 203; Pankowski and Piątkowska-Małecka 2023, 163-179). The red deer antler industry in Zhupan is only represented by the pit finds of detached pieces of hoe heads (?).

Red deer bones are basically identified as butchering waste and signatures of meat consumption practices, while some antler objects were recognized as documenting manufacture in the form of tools and débitage. In the late Trypillia habitation contexts of Gordineşti, the most remarkable aspect of antler technology is that the natural raw material configurations such as tines, beams and their combinations have been widely reshaped and used for tools, while nothing is known about small pieces elaborately carved from antler cortical tissue (Sîrbu *et al.* 2023, 37, 97, 105, 154, 176, figs 17: 9-12; 3: 1-4, 6; 11: 7; 30: 5, 6, 10; 11: 2, 3). In Gordineşti, according to Sîrbu *et al.* (2023), 19 artefacts of bone and 16 artefacts of antler industry have been found. The latter were roughly classified as adzes, smoothers, a handle, shaft-hole hoe heads, and a shaft-hole sleeve; some antler specimens are interpreted as manufacturing waste, especially when it comes to the curved tips of antler tines. To date, only part of the sample has been subjected to traceological expertise, which, beyond any preliminary considerations, turned out to contain two ambiguous antler objects.

Fig. 3. Gordineşti II-"*Stînca goală*". Red deer antler beam-and-tine shaft-hole object with single side bevel bit: a – left cheek view; b – upper eye view; c – right cheek view; d – lower eye view; e – butt view; f – cutting edge view (photo by the authors)

This paper aims to revisit the samples of red deer antler, raw and worked alike, discovered in Gordineşti II-"Stînca goală" and Vynnyky-"Zhupan", including such instruments as the shaft-hole tool head ('axe head') and the pressure flaker (Pankowski 2023, 57-59) (Figs 3-6). Here, we would like to present some considerations and assumptions concerning

Fig. 4. Gordineşti II-"*Stînca goală*". Red deer antler tine pressure flaker: a-c – surface aspects; d – hemispherical point view (photo by the autors)

Fig. 5. Gordineşti II-"*Stînca goală*". Surface aspect of the red deer antler object displaying sawn marks next to the shaft hole (photo by the autors)

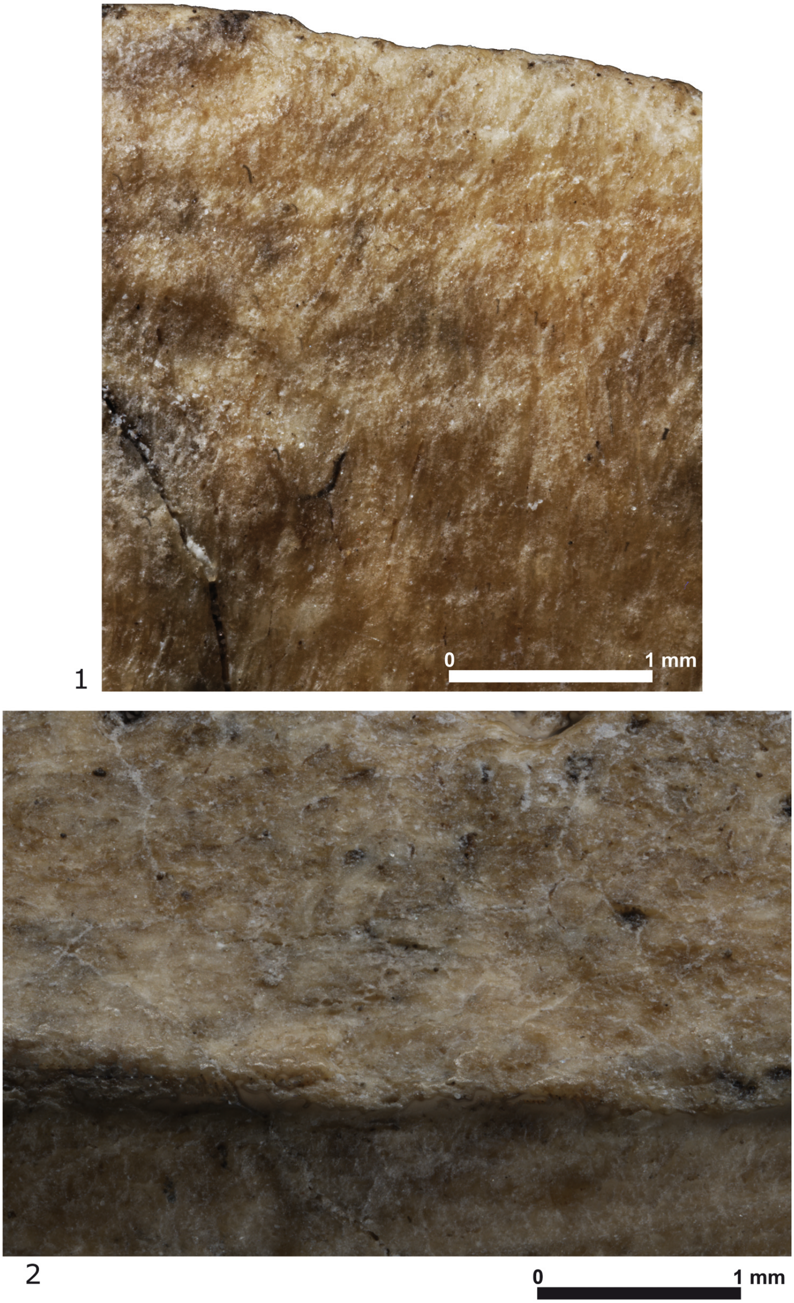

Fig. 6. Gordineşti II-”*Stînca goală*”. Surface aspects of the red deer antler shaft-hole object:
1 – convex surface of the bit close to the cutting edge; 2 – frontal view at the cutting edge; the upper half of the picture displays the flatness of the bevelled bit (photo by the autors)

archaeozoological, use-wear and raw material structure studies of the red deer hard tissues from these two sites, with an emphasis on their supply, exploitation, and deposition. What was the special reason to revisit the issue? What is important here is the idea that the instrumentally induced alterations to the natural appearance in antler are all conceptualized as traces/marks of various scales and should therefore be considered within the frameworks of an overall shape-and-trace formation process (morphotraceogenesis) (Giria 2015; Pankowski 2019). From such a perspective, archaeological traceology should operate both with tiniest surface formations, like polish with its special microtopography, linear scratches, *etc.*, and with the much bigger loci like flake scars, bevelled areas, facets, clusters of convergent scrapemarks, crater-like boreholes and full-thickness perforations through the spongy and cortical tissues, and the like.

Among late Trypillia humanly modified antler objects there are many that are known to lack well-developed microscopic use-wear evidence, although they do display well-defined surface modifications and shape alterations (Pankowski 2019; 2023). These are the first ones to which we refer our readers, by reproducing the most demonstrative surface conditions (Fig. 6), but not renewing the detailed discussion on topography and research glossary for those surfaces. Here, the macroscopic loci of traceological evidence is revisited most so that more interrelated attributes could be involved in studying type formation processes in antler industries of the palaeometallic epoch.

We also tend to shy away from giving a cursory and therefore superficial essay of the richest experience in systematization of prehistoric bone and antler industries. The variety of the approaches is known and needs comparative theoretical analysis, which has already become a special research trend (*cf*. Beldiman 2001; Vitezović 2016). By hoping that the vocabulary of this paper will coincide exactly with that of the earlier studies, we would risk falling into vain expectations, since here and there the scopes of the concepts may vary greatly, and so do the analytic perspectives, while the historians of the method can dissect, compare and classify them in the due course. We submit the present paper to a volume published in honour of the eminent scholar, Jolanta Małecka-Kukawka, and consider this to be the most appropriate platform for a proposal of the debatable and still emerging conceptual system, as long as the topic's cyclopaedic presentation has not yet been elaborated fundamentally, and a suitable textual space and editorial format have not yet been found.

RESEARCH PRINCIPLES, CONCEPTS, AND TERMINOLOGY

When dealing with the phenomena of humanly induced morphotraceogenesis (artificial shape-and-trace modification) in antler industries, it is advisable to use specialized concepts and terms (Pankowski 2019, 198; 2023, 46, 47). Here, the most useful concepts are *'shape'* and 'surface' with their varieties, and 'trace' ('mark'), that is, a visible sign of the fact that the texture and/or shape of an object were modified by displacing and/or removing its own substance, or else by applying some foreign substance, to imprint features that may demonstrate the forces and instruments that affected the object.

In the raw materials of hard faunal tissues, with the structural diversity they have, their own proper shapes do exist, and they necessarily contribute to the appearances of artefacts. It happens occasionally that an artefact's proper shape and a natural shape of antler are the same. In some rare occasions, as the integrity of the raw material dissociates beyond antler carving, and its parts enter the manufacture, the raw material proper (own) shapes cannot be called natural.

In technofunctional classification (Pankowski 2017), the increasing intensity, with which the proper shapes in hard faunal tissues have been exploited, is conceptualized in terms of accommodation, modification, and conversion.

Accommodation refers to the use of antler in its whole natural shape (natural accommodation) or else its pieces (partial accommodation) without more alterations previously added in the course of shape-and-trace formation. They are apt, although they were not produced on purpose. But while in use, both kinds of accommodats, like artefacts of the other two technoclasses (see below), wore down to alter their shapes; also, they were cleaned and reshaped. Partial accomodats are in some ways similar to R. L. Lyman's (1984) expediency tools. In A. P. Borodovskiy's (1997) technosystems, natural accomodats correspond to some objects in terms of adapting natural shape of antler, while partial accommodats are parallel to the blanks, in which the natural shape of antler as well as its fragments were used selectively. Red deer antler was taken from special environmental reservoirs and was subject to cutting, chopping and sawing into parts (Choyke 1984, 20, 26, 35; 2005, 141). Being treated this way, the break-resistant material (Borodovskiy 1997, 23, 24; Filippov 1978, 23, 24; Gerasimov 1941, 74; Iziumova 1949, 15, 16) tended to produce shavings, while occasional splinters were few. The manufacturing waste that turned out to be useable tools (van Gijn 2007, 111, Afb. 9) and blanks (Borodovskiy 1997, 83-84), were subjected to handiwork and therefore should be defined differently in technofunctional classification (see below). Among the examples of natural accommodation of antler are hunting trophies from the highland sanctuaries accumulated over the longer term (Kaloev 1971, 258, 265) and, say, offerings associated with the building of prehistoric fortresses (Choyke 2005, 134, fig. 5). Partial accommodation is all in all rare in antler industries.

Modification, in its turn, is the realm of change and use of the given, which preserves either (a) basic structural configurations in toto (natural modification), or (b) selected elements in their organic consistency (partial modification). Unlike the accommodative approach, significant alterations in the course of shape-and-trace formation are required. In A. P. Borodovskiy's technosystems, natural modificats may be found among the artefacts based on natural shapes as a whole, while partial modificats correspond to the blanks obtained from selective use of natural shapes and then transformed by handiwork. In antler industries, natural modificats are, *e.g.*, tools for breaking rawhides, digging, and ore mining (Borodovskiy 1997, 81, 82, pl. 44: 8; 2007, 46, 80). Highly widespread antler tines and beams modified into hoe heads or, say, shaft-hole axe sleeves, are partial modificats (*cf.* Borodovskiy 1997, 82).

And, finally, conversion means that the raw material is transformed into artefacts by converting whole antlers in the manner that their natural structures only preserved on a restricted basis. The resulted convertats are therefore relatively small. In A. P. Borodovskiy's technosystems, they correlate with extreme loss of the natural shape during the transformation of basic blanks such as the use of expedient fragments or selected pieces produced by controlled cutting and splitting.

Consequently, a proper shape, being a whole or a portion, become an *acquired shape* when worked and used; and as soon as regular blanks may be produced from a whole or a portion, they will be acquired too.

Accordingly, there are two kinds of surfaces within the variability of antler raw material. The one, which is still intact, is a proper (own) surface, with outward proper surface and inward proper surface included. A proper surface, with the antler tissue disclosed, normally produces a series of fractured expanses, *i.e.*, exposed proper surfaces. Manufacture and use, in their turn, produce acquired surfaces; one should not confuse them with the bigger and the biggest among the traces, *e.g.*, percussive flake scars, while acquired surfaces normally display hierarchies of various traces.

On both proper and acquired surfaces, traces of manufacture and use are found, and this is the reason why they are named receptive surfaces. A receptive surface is not another kind beyond the other two, since the receptiveness is a function or a possibility the surfaces may have, for it needs a trace to emerge that we may call a surface truly receptive.

Cumulative (resultant) shape, as well as cumulative (resultant) surface, are newly introduced trial concepts, which will be found below in the text.

In terms of **shapes**, the shape-and-trace formation process in a past functional context can be represented like this:

<table>
<tr><th colspan="2">In raw materials selected</th><th colspan="2">In artefacts expedient, manufactured, and utilized</th></tr>
<tr><td rowspan="3">proper (own) shape</td><td rowspan="2">natural shape</td><td>natural shape</td><td rowspan="2">integral shape resulting from accommodation or modification of the raw material</td></tr>
<tr><td>acquired shape</td></tr>
<tr><td>proper shape's expedient portion</td><td>acquired shape</td><td>partial shape resulting from accommodation, or modification, or conversion of the raw material</td></tr>
</table>

Similar relations in terms of **surfaces** may look as follows:

<table>
<tr><th colspan="3">In raw materials selected</th><th colspan="2">In artefacts expedient, manufactured, and utilized</th></tr>
<tr><td rowspan="4">→
proper (own) surface
→</td><td rowspan="2">outward surface</td><td rowspan="4">←
proper exposed surface
←</td><td colspan="2">due to the property of trace-receptiveness:</td></tr>
<tr><td>proper, trace-receptive surface</td><td>acquired, trace-receptive surface</td></tr>
<tr><td rowspan="2">inward surface</td><td colspan="2">due to the property of trace-receptiveness:</td></tr>
<tr><td>proper, trace-receptive surface</td><td>acquired, trace-receptive surface</td></tr>
</table>

RED DEER ANTLER INDUSTRY SAMPLE FROM GORDINEŞTI: AN OVERVIEW

The first section of the annotated directory compiles miscellanea of review, introductory and reference nature commonly found in museum inventories and ID cards, and occasionally applicable to various research purposes.

Shaft-hole axe head (Fig. 3): No. 11, 2019, Unit VI, – 0.32 m. Length, mm – 173, head's height, mm – 64, shaft hole diameter, mm – 22, bevelled surface's length, mm – 61 (Pankowski 2023, 57-59, figs. 20-22; Sîrbu *et al.* 2023, 114, 154, fig. 10: D; 30: 10).

Pressure flaker (Fig. 4): No. 10, 2019, Unit VI, cell 71, – 0.3 m. Length, mm – 74.5, hafting diameter, mm – 19.5, working end diameter, mm – 13 (Pankowski 2023, 59, fig. 23; Sîrbu *et al.* 2023, 113, 154, fig. 30: 5).

The following section specifies parallel correspondence between the given – raw material structures – and the ways they were modified (A); the resultant formations are complemented with written descriptions of legacy marks of manufacture (B) and use-wear marks imposed (C). Use-wear marks, following the above, can be both macro- and microscopic.

Shaft-hole axe head

A: raw material selection and modification; an operational sequence is implied to have occurred in the past, but is not emphasized

proper shapes and surfaces (structured)	**acquired surfaces** contributing to the **acquired shape**	axe head elements: **a resultant shape**
main beam (cortex + spongiosa)	●transversal truncating, distally for the bottom sleeve rim and proximally for the top rim (Fig. 3: a-f) ● spongiosa coring (Fig. 3: b, d)	**shaft sleeve**
central/3rd tine (cortex + spongiosa)	● charring and transversal cutting (?); 7^{o}-30^{o} bevelling (Fig. 3: a, c) ●heat hardening? (Fig. 3: c)	**Spike**
beam & tine	cored beam stub & bevelled tine	tube & point

B: manufacture

acquired shapes and surfaces	**shape-and-trace formation**	**shape-and-trace formation topography and geometry**
●beam truncated ●beam stub cored	●circumferential flint filing ●flint cutting and chiselling	● discrete and robust grooving (Fig. 5) ● removal, smooth and hollow (Fig.3: a, c)
●tine beveled*	● solid rock multidirectional abrading, fine-grained particles irregularly located, no sawdust involved**; burning and flint cutting? ●burning?	● low and smooth plane, sharp and clean; longitudinal, transversal and diagonal v-shaped grooves; no clusters of grooves, no extensive polish (Fig. 6)**; black and brown colouration ●black and brown colouration

* Side bevelling specialises tools as axes (shaft-hole adzes) that work best in transversal logging and carpentry; *cf.* van Gijn 2005, 51, fig. 4; Maigrot 2005, 122, fig. 7: 10; Orłowska and Osipowicz 2017, 121-122, 131, fig. 2: a, b.
** *cf.* Christidou and Legrand 2005, 392-394; Orłowska and Osipowicz 2017, 120.

C: trace-receptive surfaces

acquired shapes and surfaces	axe head elements: **a resultant shape**	**shape-and-trace formation topography and geometry**
beam truncated beam stub cored	**shaft sleeve**	
tine bevelled	**Spike**	fine-wavy and smoothly sloped cutting edge (Fig. 6: 1), fine-lumped at its margin (Fig. 6: 2, left), scarce flake scarring and excoriations (Fig. 6: 2, right)*

* Most probably renewed by regrinding, with post-depositional effects added. For well-developed use-wear patterns representing a variability of linear and nonlinear relief textures please see, *e.g.*, Orłowska and Osipowicz 2017, 123-125, fig. 3: A-G, L; 4: B-F, L.

Pressure flaker

A: raw material selection and modification; an operational sequence is implied to have occurred in the past, but is not emphasized

proper shapes and surfaces (structured)	**acquired surfaces** contributing to the **acquired shape**	pressure flaker elements: **a resultant shape**
tine (cortex + spongiosa)	transversal truncating, distally and proximally (Fig. 4) distal end rounding (Fig. 4: d)	**Spike**
Tine	tine truncated and semi-rounded	Point

B: manufacture

acquired shapes and surfaces	**shape-and-trace formation**	**shape-and-trace formation topography and geometry**
tine truncated and rounded*	●proximally: most probably removed by post-depositional breakage (Fig. 4: a, bottom) ●distally: cutting and abrading are most probable (Fig. 4: a, d)	●fracture ● faceted semi-rounded area all around a concentrated working site

* Antler tine pressure flakers are attributed due to sub-rounded or subconical points (Inizan *et al.* 1999, 32, 148, 149; Poplevko 2002; Zhilin 2012, 228-231).

C: trace-receptive surfaces

acquired shapes and surfaces	pressure flaker elements: **a resultant shape**	**shape-and-trace formation topography and geometry**
tine truncated and rounded	**Spike**	eroded and smoothed by post-depositional weathering*

* Antler tine pressure flakers are attributed due to well-visible flint knapping use-wear (Inizan *et al.* 1999, 32, 148, 149; Poplevko 2002; Zhilin 2012, 228-231).

DISCUSSION

In artefactual osteoarchaeology, worked red deer antler studies may produce seminal observations regarding raw material selection, manufacture techniques, and ways of tool use in the past. It appears to be a truism that research like this enables new insights and interpretations concerning antler naturfacts (ecofacts) and artefacts in the ways similar to those applied to the lithic industries studies (Małecka-Kukawka 2001; 2012, 470; 2019).

The overall appearances (cumulative shapes and surfaces resulted from functional contexts in the past) of the pieces of antler selected here may suggest that it is woodworking and flintknapping that should be listed among the purposes and functions of the tools. However, both the macro- and microtraces observed may, in turn, support the fact that we should refrain from insisting on something special which could be ever chopped or dug with the Gordineşti beam-and-tine 'axe head', and it is exactly due to its bit, which even now looks freshly sharpened or refreshed. If we, due to the special conditions of the archaeological record, now and then deviate from making a list of manufacture processes in rural economy and crafts and household activities, then the shape-and-trace formation data constantly inform us about the variability that was expedient technological behaviour in the past. Being perfectly aware of the fact that the following assumption may seem to have little to do with the expertise of real use-wear record, we nonetheless find it useful to note that in the face of a lack of use-wear data, we would risk simplifying the whole picture by classifying the variability of perforated and pointed and bevelled antler objects exclusively as shaft-hole working attachments such as axe heads, mattock heads, hammer heads *etc*. The total lack (or a low density) of expected use-wear patterns resulting from digging soil or chopping wood and the like may indicate that at least some of these artefacts, if not many, may have been used as, say, pegs for holding tents and haystack covers and goat leashes or similar devices. Since the collection of shaft-hole tools from Gordineşti is gradually increasing both in kinds and numbers (Sîrbu *et al*. 2017a, fig. 2: 7; 2019, 109, fig. 12: 11; Croitor and Sîrbu 2017, 217, fig. 1: A), including frontally bevelled varieties, there is still a chance to classify and detail this diversity in due course.

And so, the large-scale traceological evidence provides a sufficient layer of data on cultural formation, diversity, and change in the late Trypillia inventories made of antler. Particularly, the sub-rounded point of the antler tine from Gordineşti (Fig. 4) is an attribute that affiliates the artefact with the 'Tools' group among the 'Instruments' subclass, which, in turn, represents the class of 'Equipment for productive actions' (Pankowski 2023, 62). The same classificatory disposition can be presumed for the shaft-hole beam with its bevelled tine, though one may choose here between a tool's head as such and anything else among 'Instruments', which may seem suitable for other actions than chopping wood or digging ground, just in view of its bevelled end (see above). But most importantly, both the 'flaker' and the 'head' provide regular shape-and-trace patterns and, therefore, typological content, since they represent a special approach of partial modification of antler (Pankowski 2023, 63). A record like this is especially useful with freshly made, refreshed, barely worn, poorly preserved, and alike artefacts.

Red deer evidence in the faunal samples derived from Gordineşti II-"Stînca goală" (Croitor and Sîrbu 2017, 216ff; 2019, 153) and Vynnyky-"Zhupan" (Pankowski and Piątkowska-Małecka 2023, 163-179) provides a substantial material signal of the natural environment within and around those sites. Indeed, in the plant macroremains sample from the fully excavated homestead units at Gordineşti II-"Stînca goală", ash tree and oak were evidenced (Sady-Bugajska 2023, 36, 39), to mark the ecosystem of deciduous forests most probably full of red deer in the late 4th millennium BC.

The very fact that the faunal record from Gordineşti-"Stînca goală" has yielded both red deer antler and artefacts made of it (Sîrbu *et al.* 2019, 109, fig. 12: 9, 10) is, of course, insufficient to prove that the local community was constantly engaged in hunting red deer. Naturally, the presence of antler at the site could well have been a result of gathering activities of the locals who could occasionally scour the area for the valuable raw material in the woods within easy reach of their hill-top village (Pankowski 2023, 63, figs. 36, 37). It is interesting that some detached antler bases and beams and tines in Gordineşti and Vynnyky display tooth marks left by both mice and squirrels. It is not easy to decide with all possible certainty whether every single gnawed specimen is derived from shed or cut antler, though some of them are definitely shed ones (Sîrbu *et al.* 2017a, fig. 2: 8; 2019, 109, fig. 12: 12; Croitor and Sîrbu 2017, 217, 218, fig. 1: B; Pankowski 2019, 203, fig. 22: 1; 2023, 63-67, figs. 29-32, 36, 37). It seems that the past antler gatherers needed to collect antlers as soon as possible during the shedding season before they were devoured by rodents; the latter could nonetheless continue eating various antler objects already in settlement contexts. But after all, both shed antlers and antler artefacts are the things which could have been brought home by the Gordineşti folk from somewhere else or received as gifts or in exchange. However, it is the relative abundance of red deer skeletal bones among faunal remains from the site's occupation deposits (Croitor and Sîrbu 2019, 153) that may clearly suggest that the protein diet has been routinely supplied in Gordineşti with meat and fat of this species, while skeletal elements, antlers, raw hides, tendons, and wool could have been obtained directly from the carcasses of the hunted animals.

Are there many weapons in Gordineşti to signalize red deer -or any other – hunting? Actually, there are only a few of them. There is not enough evidence for the use of ranged weapons such as bow and arrows and spears. It is possible that slings and lassoes or blowpipes were used, but the archaeological record available provides no basis for such a suggestion. According to Ghenadie Sîrbu's personal communication, only two or so flint arrowheads were found in Gordineşti (we probably can observe them after Dergachev 2021, fig. 13: 3, 4), and we do not consider that it is possible that red deer would let humans approach them with flint axes in their hands, any huntsmen using such a weapon would have been skilled tomahawk throwers. It is these flint wedge-shaped 'axe heads' that are especially numerous at the sites of the Gordineşti Group (*cf.* Dergachev 1980, fig. 31: 47, 48; Sîrbu *et al.* 2019, fig.

14; Dergachev 2021, fig. 13: 5, 6), but we still do not have sufficient use-wear evidence to subdivide this conglomerate into real hunting/battle axes and, for example, adzes or mattocks.

Subsistence studies have additional support, given the fact that a perforated red deer tooth was found in Gordineşti-"Stînca goală" (Pankowski 2023, 59-62) and that canine teeth personal ornaments are among principal signatures of the hunting activity and hunting magic among those who made and wore them (d'Errico and Vanhaeren 2002, 211 ff.). Red deer canine decorations as well as bone imitations of them have already appeared twice in burials of the Gordineşti Group, including those from the grave discovered at the eponymous burial ground; in addition to these, a pressure flaker sleeve made of red deer antler as well as red deer bones and skull fragments were reported to be found in the burials of the Gordineşti Group (Dergachev 2021, 46; Dergachev 2022, 290, 294, 297). In riverine areas, such as the Dnister region, red deer hunting near watering spots was commonly practiced in early Trypillia times, providing the abundance of bones in the site deposits (Zbenovich 1980, 98, 100, 141-143; Belan and Logvinenko 1986). From now on, the question for future comparative research can be put as follows: does the red deer hunting specialization of the Chalcolithic settlement in Bernashivka I on the Dnister River (Zbenovich 1980, 141, 142, 144, 149, 150) pose a sort of analogy of the situation that took place in Gordineşti II, already in the conditions of the Early Bronze Age? However, the archaic faunal sample signalizes a good portion of aurochs among game animals, which by no means is the case in Gordineşti.

Unlike Stînca goală, red deer hard tissue remains in Zhupan are few. This place was hardly intended for regular butchering of carcasses, and the dogs didn't feast on food scraps and leftovers here; it was antler tools, pieces of antler, and selected meaty portions that have occasionally been brought there from the foot of the mountain (Pankowski and Piątkowska-Małecka 2023, 163-179). Here, it seems likely enough that the antler specimens just mentioned may represent dry splinters of heavily damaged and poorly preserved tools, given the assumption (Pankowski 2019, 203) that they most probably served as hoe heads when the highlanders dug waste and storage pits through the limestone underlayer, as well as the observations on antler knapping, which is unlikely to have become widespread here and elsewhere in the Late Chalcolithic (*cf.* Kempisty 1958, 136, 137; 1961, 313-316, 317-319), since fresh antler is too tough to be easily knapped.

SYNOPSIS

The above appositely recalls, in particular, that microtraces are not the only thing that traceology focuses on, since it covers the whole shape-and-trace formation process as the morphotraceogenesis, and the smallest ones are only part of a bigger one. The pressure flaker of Gordineşti, for instance, is an almost perfect case of making up for the lack of use-wear microtraces with what is commonly referred to as 'shape'. And yet, S. A. Semenov's

(1970, 6) functional analysis is searching for surfaces displaying at least few well-preserved microtraces of wear, and in case it fails to find them because of heavy antler weathering, then the complementary evidence of the tool's general 'shape' turns into an index evidence. One may even say that there are some well-recognizable 'shapes' that can be linked to the most probable uses. This, of course, is not a reason to skip the microanalysis of surfaces even in cases when nothing useful was found there, as happened in our case. In truth, archaeological traceology is about *complex use-wear patterns* and the ways they relate to the shapes of things. But as we take them ranked, marks of variable size classes must have contributed to the shape, so that for lack of microtraces we should have checked whether some bigger patterns have disappeared; specifically, if linear microtraces of manufacture abrasion have been erased, an abraded facet remains; in case the abrasion was wear, the resulting facet would be a bigger use-wear trace, which remained. And if so, then the prehistoric pit features, like dugout basements and pit-traps (Semenov 1970, 6), will be the large-scale manufacture traces in the ground, though micro-scale traces of their manufacture and use would hardly have been imprinted against the sand and loam for too long.

For those who are looking for the shape formation processes in bone and antler artefacts, and hence typogenesis in unfolding cultural change, shape-and-trace evidence of various ranks is needed, especially considering that the Gordineşti people alternated cutting twigs in the woods with digging fortifications upon the hill; in this regard, the antler débitage from the stony moat-and-rampart area in Gordineşti would be of interest (*cf*. the Zhupan case). Although, of course, loggers, ditchers, and flint knappers must have been aware of green antler as a shatter resistant material. To gain such knowledge, it was enough to look at how the red deer behave and pay attention to the natural wear of the antlers. Burning could be used to enhance and solidify this valuable property, although we tend to presume burning and charring prior to tine bevelling, just to make truncation easier (*cf*. Semenov 1970, 145). In terms of classification, partial modification in red deer antler artefacts is well-distinguishable from among techno-functional approaches (see *Research Principles*…) due to the natural elements of antler routinely used, tines in particular, with some of these left attached to organic carriers, which are main beams. In tool making, unlike antler, spacious cortical tissue blades of tubular bones underwent an overall converting approach, and some were used as expedient chance splinters (*i.e*., via accommodation of parts) (Pankowski 2023, 47-56, 63, 67). The small-sized integral shape in canines is modified for personal ornaments (Pankowski 2023, 59-62, 67, 68).

When it comes to the Chalcolithic and Early Bronze Age in the forest-steppe south of Eastern Europe, it seems to be quite realistic that the red deer bone and antler industry had not yet dispersed into isolated areas of highly specialized bone and antler carving, nor had it been scattered into enclosed cells of use as well as amongst art stylistic trends (as is observed in the Late Bronze and Early Iron Ages in the same region). Specifically, both knapped lithic tools and those shaped of ground stone were used when making antler tools and canine beads, while in the flint knapping, in turn, pressure flakers made of antler tines were applied, and some antler picks could be of aid in digging holes for pottery and daub clays, various rocks, and minerals. In Gordineşti and Vynnyky, the manufacture and use of red deer antler and bone for both tools and personal ornaments (considering their most relevant and probable purposes, functions, and designs) appear to be quite evenly available to the community's adults and teenagers and at least some kids, with all possible age-class subdivisions and preferences thereof.

Acknowledgements

The research was carried out as part of the project: NCN Opus 15 no. 2018/29/B/HS3/01166 – *Gordineşti II-Stînca goală as an example model of development and decline of fortified settlements of the Tripolye Culture at the end of the 4th mill. BC.*

References

Belan N. G. and Logvinenko N. A. 1986. Blagorodnyi olen rannetripolskogo poseleniya Bernashivka na Srednem Dnestre. *Vestnik zoologii* 6, 23-26.

Beldiman C. 2001. Tehnologia şi regnul animal în preistorie: istoricul cercetărilor asupra industriei materiilor dure animale şi evoluţia concepţiilor metodologice. *Analele Universităţii Creştine "Dimitrie Cantemir"* 4, 25-64.

Borodovskiy A. P. 1997. *Drevnee kostoreznoe delo yuga Zapadnoy Sibiri (vtoraya polovina II tys. do n. e. – pervaya polovina II tys. n.e.)*. Novosibirsk: Izdatelstvo Instituta arkheologii i etnografii SO RAN.

Borodovskiy A. P. 2007. *Drevniy reznoy rog Yuzhnoy Sibiri (epokha paleometalla)*. Novosibirsk: Izdatelstvo Instituta arkheologii i etnografii SO RAN.

Choyke A. M. 1984. An Analysis of Bone, Antler and Tooth Tools from Bronze Age Hungary. *Mitteilungen des Archäologischen Instituts der Ungarischen Akademie der Wissenschaften* 1982/1983, 12/13, 13-57, 299-303.

Choyke A. M. 2005. Bronze Age bone and antler working at the Jászdózsa-Kápolnahalom tell. In H. Luik, A. M. Choyke, C. E. Batey and L. Lőugas (eds), *From Hooves to Horns, from Mollusc to Mammoth. Manufacture and Use of Bone Artefacts from Prehistoric Times to the Present, Proceedings of the 4th meeting of the ICAZ Worked Bone Research Group at Tallinn, 26th-31st of August 2003* (= *Muinasaja teadus* 15). Tallinn: Tallinn Book Printers Ltd, 129-156.

Christidou R. and Legrand A. 2005. Hide working and bone tools: experimentation design and applications. In H. Luik, A. M. Choyke, C. E. Batey and L. Lőugas (eds), *From Hooves to Horns, from Mollusc to Mammoth. Manufacture and Use of Bone Artefacts from Prehistoric Times to the Present, Proceedings of the 4th meeting of the ICAZ Worked Bone Research Group at Tallinn, 26th-31st of August 2003* (= *Muinasaja teadus* 15). Tallinn: Tallinn Book Printers Ltd, 385-396.

Croitor R. and Sîrbu Gh. 2017. Animal remains from the Late Eneolithic settlement of Gordineşti II-Stînca goală (Edineţ district). Part 1. *Revista Arheologică* 13/1-2, 215-219.

Croitor R. and Sîrbu Gh. 2019. Animal remains from the Late Eneolithic settlement of Gordineşti II-Stînca goală (Edineţ district). Part 2. *Revista Arheologică* 15/2, 151-156.

Dergachev V. A. 1980. *Pamiatniki pozdnego Tripolia (Opyt sistematizatsii)*. Kishinev: Shtiintsa.

Dergachev V. A. 2021. *Late Tripolye and Maykop*. Rzeszów: Wydawnictwo Uniwersytetu Rzeszowskiego.

Dergachev V. A. 2022. *Pozdnee Tripolie – Maikop (s katalogom pogrebalnykh kompleksov pozdnego Tripolia)*. Kishinev: CEP USM.

d'Errico F. and Vanhaeren M. 2002. Criteria for Identifying Red Deer (*Cervus elaphus*) Age and Sex from Their Canines. Application to the Study of Upper Palaeolithic and Mesolithic Ornaments. *Journal of Archaeological Science* 29, 211-232.

Filippov A. K. 1978. Tekhnologiya izgotovleniya kostianykh nakonechnikov v verkhnem paleolite. *Sovetskaya arkheologiia* 2, 23-32.

Gerasimov M. M. 1941. Obrabotka kosti na paleoliticheskoy stoyanke Malta. In P. P. Efimenko (ed.), *Paleolit i neolit SSSR* (= *Materialy i issledovaniya po arkheologii SSSR* 2). Moskva, Leningrad: Izdatelstvo AN SSSR, 65-85.

van Gijn A. L. 2005. A functional analysis of some late Mesolithic bone and antler implements from the Dutch coastal zone. In H. Luik, A. M. Choyke, C. E. Batey and L. Lőugas (eds), *From Hooves to Horns, from Mollusc to Mammoth. Manufacture and Use of Bone Artefacts from Prehistoric Times to the Present, Proceedings of the 4th meeting of the ICAZ Worked Bone Research Group at Tallinn, 26th-31st of August 2003* (= *Muinasaja teadus* 15). Tallinn: Tallinn Book Printers Ltd, 47-66.

van Gijn A. L. 2007. Gebruikssporen- en residuanalyse van prehistorische voorwerpen: Een kijkje in de hersenpan van de makers en gebruikers. In R. Jansen and L. P. Louwe Kooijmans (eds), *Van contract tot wetenschap: tien jaar onderzoek door Archol B. V. Leiden, 1997-2007*. Leiden: Archol, 103-113.

Giria E. 2015. Sledy kak vid arkheologicheskogo istochnika (konspekt neopublikovannykh lektsii). In O. V. Lozovskaia, V. M. Lozovskii and E. Iu. Giria (eds), *Sledy v istorii. K 75-letiyu Viacheslava Evgenevicha Shchelinskogo*. Sankt Petersburg: Institut istorii materialnoy kultury, 232-268.

Hawinskyj A. and Rybicka M. 2021. *Konstrukcje budowlane kultury pucharów lejkowatych ze stanowiska Winniki-Lisiwka na zachodniej Ukrainie*. Rzeszów: Wydawnictwo Uniwersytetu Rzeszowskiego.

Inizan M.-L., Reduron-Ballinger M., Roche H. and Tixier J. 1999. *Technology and Terminology of Knapped Stone followed by a multilingual vocabulary (Arabic, English, French, German, Greek, Italian, Portuguese, Spanish)*. Translated by J. Féblot-Augustins (= *Préhistoire de la Pierre Taillée* 5). Nanterre: C.R.E.P.

Iziumova S. A. 1949. Tekhnika obrabotki kosti v diakovskoe vremia i v drevnei Rusi. *Kratkie soobshcheniya Instituta istorii materialnoy kultury* 30, 15-25.

Kaloev B. A. 1971. *Osetiny (Istoriko-etnograficheskoe issledovanie)*. Moskva: Nauka.

Kempisty A. 1958. Narzędzia z kości i rogu południowej grupy kultury pucharów lejkowatych z terenu Wyżyny Małopolskiej. *Materiały Starożytne* 4, 301-322.

Kempisty A. 1961. Ze studiów nad sposobami obróbki surowca kostnego i rogowego w kulturze pucharów lejkowatych. *Wiadomości archeologiczne* 27/2, 133-143.

Król D. and Rybicka M. 2022. Chronologia radiowęglowa stanowisk grupy Gordineşti kultury trypolskiej z północnej Mołdawii i zachodniej Ukrainy. *Archeologia Polski* 67, 9-30.

Król D. and Rybicka M. 2023. Radiocarbon chronology of the settlement Gordineşti II-*Stinca goală*, Edinet region. In M. Rybicka, P. Kittel, D. Król, M. Makohonienko, W. Pankowski, J. Piątkowska-Małecka, A. Rauba-Bukowska, A. Sady-Bugajska, Gh. Sîrbu, A. Wacnik, K. Wasylikowa, P. Gębica, K. Cywa, A. Hawinskyi and D. Verteletskyi 2023. *Gordineşti II-Stînca goală site and the settlement context in western Ukraine at the end of the 4th millenium BC*. Rzeszów: Wydawnictwo Uniwersytetu Rzeszowskiego, 24-30.

Lyman R. L. 1984. Broken Bones, Bone Expediency Tools, and Bone Pseudotools: Lessons from the Blast Zone around Mount St. Helens, Washington. *American Antiquity* 49/2, 315-333.

Maigrot Y. 2005. Ivory, bone and antler tools production systems at Chalain 4 (Jura, France): late Neolithic site, 3rd millennium. In H. Luik, A. M. Choyke, C. E. Batey and L. Lõugas (eds), *From Hooves to Horns, from Mollusc to Mammoth. Manufacture and Use of Bone Artefacts from Prehistoric Times to the Present, Proceedings of the 4th meeting of the ICAZ Worked Bone Research Group at Tallinn, 26th-31st of August 2003* (= *Muinasaja teadus* 15). Tallinn: Tallinn Book Printers Ltd, 113-126.

Małecka-Kukawka J. 2001. *Między formą a funkcją. Traseologia neolitycznych zabytków krzemiennych z ziemi chełmińskiej*. Toruń: Wydawnictwo Uniwersytetu Mikołaja Kopernika.

Małecka-Kukawka J. 2012. Traseologia – badanie mikrośladów. In S. Tabaczyński, A. Marciniak, D. Cyngot and A. Zalewska (eds), *Przeszłość społeczna. Próba konceptualizacji*. Poznań: Wydawnictwo Poznańskie, 464-471.

Małecka-Kukawka J. 2019. Results of microwear analysis of flint artefacts from the site Gordineşti II-*Stînca goală*, Edineţ District, Republic of Moldova. In A. Diachenko, M. Rybicka, D. Król and Gh. Sîrbu (eds), *Between the East and the West. Dynamic of Social Changes from the Eastern Carpathians to the Dnieper in the 4th – beginning of 3rd Millennium BC (Preliminary study)*. Rzeszów: Wydawnictwo Uniwersytetu Rzeszowskiego, 173-177.

Orłowska J. and Osipowicz G. 2017. Searching for the function of the Early Holocene heavy duty bevel-ended tools: remarks from experimental and use-wear studies. In N. N. Skakun, M. G. Zhilin, H. Plisson and V. V. Teriohina (eds), *The Stone Age and the Chalcolithic: Manufacturing Technology and Functions of Artefacts Made of Bone and Antler in Prehistoric Eurasian Cultures*. Kazan: Kazanskaya Nedvizhimost, 119-139.

Pankowski V. 2017. A Systematic Outline for the Osseous Industries in the North Pontic Palaeometallic Age. *Journal of Historical Archaeology & Anthropological Sciences* 1/4, 146-152.

Pankowski V. 2019. The Late Tripolye and the Funnel Beaker Industries of Bone and Antler from Volhynia to Galicia: The UPTE Contribution. In A. Diachenko, M. Rybicka, D. Król and Gh. Sîrbu (eds), *Between the East and the West: Dynamics of Social Changes from the Eastern Carpathians to the Dnieper in the 4th – beginning of 3rd Millennium BC (Preliminary study)*. Rzeszów: Wydawnictwo Uniwersytetu Rzeszowskiego, 197-216.

Pankowski W. 2023. Late Trypillia Culture Worked Bone and Antler Assemblage in Gordineşti II-'Stînca goală', Moldova. In M. Rybicka, P. Kittel, D. Król, M. Makohonienko, W. Pankowski, J. Piątkowska-Małecka, A. Rauba-Bukowska, A. Sady-Bugajska, Gh. Sîrbu, A. Wacnik, K. Wasylikowa, P. Gębica, K. Cywa, A. Hawinskyi and D. Verteletskyi 2023. *Gordineşti II-Stînca goală site and the settlement context in western Ukraine at the end of the 4th millennium BC.* Rzeszów: Wydawnictwo Uniwersytetu Rzeszowskiego, 46-68.

Pankowski W. and Piątkowska-Małecka J. 2023. Radioulnar Exploitation Upon Zhupan and Lysivka Mounts Near Vynnyky, Western Ukraine, in Trypillia and Funnel Beaker Times. In M. Rybicka, P. Kittel, D. Król, M. Makohonienko, W. Pankowski, J. Piątkowska-Małecka, A. Rauba-Bukowska, A. Sady-Bugajska, Gh. Sîrbu, A. Wacnik, K. Wasylikowa, P. Gębica, K. Cywa, A. Hawinskyi and D. Verteletskyi 2023. *Gordineşti II-Stînca goală site and the settlement context in western Ukraine at the end of the 4^{th} millennium BC.* Rzeszów: Wydawnictwo Uniwersytetu Rzeszowskiego, 163-180.

Poplevko G. N. 2002. K metodike opredeleniya posrednikov i retusherov iz roga i kosti. In E. V. Yarovoy (ed.), *Drevneyshie obshchnosti zemledeltsev i skotovodov Severnogo Prichernomoria (V tys. do n.e. – V vek n.e.): Materialy III Mezhdunarodnoy konferentsii, Tiraspol, 5-8 noyabria 2002 g*. Tiraspol: PGU, 45-48.

Rybicka M., Król D., Kittel P., Sîrbu Gh., Makohonienko M., Słowiński M., Sucharyna-Thomas L. and Pokutta D. 2023a. Late Tripolye Culture Settlement Spatial Pattering: Case study from the Gordineşti II-Stînca goală site, Northern Moldova. *Praehistorische Zeitschrift* 98/2, 538-556.

Rybicka M., Wacnik A., Pokutta D., Kittel P., Okupny D., Król D., Sady A., Pankowski W., Sîrbu Gh., Makohonienko M. and Słowiński M. 2023b. Was Gordineşti II-Stînca Goală abandoned due to cultural changes or environmental impacts? A case of the Late Trypillia settlement in Northern Moldova. *Sprawozdania Archeologiczne* 75/1, 51-75.

Sady-Bugajska A. 2023. Results of archaeobotanical studies at the Neolithic sites from 4^{th}-3^{rd} millennium BC in the highlands of Ukraine and Moldova. In M. Rybicka, P. Kittel, D. Król, M. Makohonienko, W. Pankowski, J. Piątkowska-Małecka, A. Rauba-Bukowska, A. Sady-Bugajska, Gh. Sîrbu, A. Wacnik, K. Wasylikowa, P. Gębica, K. Cywa, A. Hawinskyi and D. Verteletskyi 2023. *Gordineşti II-Stînca goală site and the settlement context in western Ukraine at the end of the 4^{th} millennium BC.* Rzeszów: Wydawnictwo Uniwersytetu Rzeszowskiego, 31-45.

Semenov S. A. 1970. *Prehistoric Technology, an Experimental Study of the oldest Tools and Artefacts from traces of Manufacture and Wear.* Translated and prefaced by M. W. Thompson. Bath: Adams & Dart.

Sîrbu G. and Król D. 2021. Dwellings and their nearest surroundings in the 4^{th} millennium BC in the eastern Carpathian area: a case study from the Gordineşti II-Stînca goală settlement. *Sprawozdania Archeologiczne* 73/2, 93-108.

Sîrbu Gh., Rybicka M., Diachenko A., Król D., Sîrbu L. and Burlacu V. 2019. Preliminary results of archaeological investigations at the Gordineşti II-*Stînca goală* settlement. The 2016 campaign. In A. Diachenko, M. Rybicka, D. Król and Gh. Sîrbu (eds), *Between the East and the West. Dynamic of Social Changes from the Eastern Carpathians to the Dnieper in the 4^{th} – beginning of 3^{rd} Millennium BC (Preliminary study).* Rzeszów: Wydawnictwo Uniwersytetu Rzeszowskiego, 103-126.

Sîrbu Gh., Rybicka M., Leviţki O., Diachenko A., Król D., Sîrbu L. and Burlacu V. 2017a. Investigaţiile arheologie din aşezarea Gordineşti II-Stînca goală. Campania anului 2016. In *Cercetări arheologice in Republica Moldova. Campania 2016. Sesiunea naţională de rapoarte*. Chişinău, 25-27.

Sîrbu Gh., Sîrbu L., Leviţki O., Rybicka M. and Król D. 2017b. *Raport despre investigaţiile arheologice din aşezarea Gordineşti II-Stinca goală (campania 2016)*. Arhiva MNIM, nr. inv. 589, Chişinău.

Sîrbu Gh., Sîrbu L., Leviţki O., Burlacu V., Heghea S., Rybicka M., Król D. 2023. *Raport despre investigaţiile arheologice din aşezarea Gordineşti II-Stînca goală (campania 2016-2021)*. Rzeszów: Wydawnictwo Uniwersytetu Rzeszowskiego.

Verteletskyi D., Havinskyi A. and Rybitska M. 2023. Poselennia trypilskoi kultury ta liichastoho posudu na hori Zhupan u misti Vynnyky poblyzu Lvova. Davni ta novi vidkryttia. In M. Rybicka, P. Kittel, D. Król, M. Makohonienko, W. Pankowski, J. Piątkowska-Małecka, A. Rauba-Bukowska, A. Sady-Bugajska, Gh. Sîrbu, A. Wacnik, K. Wasylikowa, P. Gębica, K. Cywa, A. Hawinskyi and D. Verteletskyi 2023. *Gordineşti II-Stînca goală site and the settlement context in western Ukraine at the end of the 4th millennium BC*. Rzeszów: Wydawnictwo Uniwersytetu Rzeszowskiego, 137-162.

Vitezović S. 2016. *Metodologija proučavanja praistorijskih koštanih industrija*. Beograd: Srpsko arheološko društvo.

Zbenovich V. G. 1980. *Poselenie Bernashevka na Dnestre (k proiskhozhdeniiu tripolskoi kultury)*. Kiev: Naukova dumka.

Zhilin M. G. 2012. Rogovye posredniki i otzhimniki v mezolite Volgo-Okskogo mezhdurechia. *Kratkie soobshcheniya Instituta arkheologii* 227, 223-232.