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Economic significance of *Cervus elaphus* Linnaeus, 1758 in the Gumelnița culture (5th mill. BC): from food to technical resources

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Economic significance of *Cervus elaphus* Linnaeus, 1758 in the Gumelnița culture (5th mill. BC): from food to technical resources

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ABSTRACT
The region between the Danube and the Carpathians is a key area for research into prehistoric periods, particularly those relating to the 5th millennium BC. This period is marked by the evolution of the Kodjadermen-Gumelnița-Karanovo VI technocomplex characterized by significant changes in human subsistence strategies, social organization, and technical innovations. Key evidence of these upheavals includes: stratified sites that were occupied for generations, with villages rebuilt in the same locations. Archaeologically, the increased frequency of hunting practices during the Gumelnița period is particularly evident in the intensive exploitation of red deer (*Cervus elaphus* Linnaeus, 1758), both as a source of food and as a raw osseous material for the manufacture of equipment. Our study explores this phenomenon along two dimensions: 1) Economic value: the analysis of cervid remains provides insights into hunting strategies, seasonality, methods of collecting antlers from the skull or the butchering patterns of animal carcasses. Zooarchaeological data also contribute to understanding how cervids were integrated into the diet and, more generally, into the economy; and 2) Technical use: the role of cervids in artifact production. We will study which anatomical elements of the skeleton were used (bones, teeth, antler) and which operational patterns were applied to them to produce which types of objects. A discussion will focus on the case of red deer canines that were not used directly but reproduced as adornments in other raw materials. Comparisons will be made between phases A2 and B1 of the Gumelnița culture, and case studies will consider finds from a series of important tell settlements from the Lower Danube.

KEY WORDS
Lower Danube,
hunting strategies,
meat resources,
cutting,
hard animal material,
bone industry,
processing scheme.

RÉSUMÉ
Importance économique du Cervus elaphus *dans la culture Gumelnița (Ve millénaire avant J.-C.) : de la ressource alimentaire aux ressources techniques.*
La région située entre le Danube et les Carpates est une zone clé pour la recherche sur les périodes préhistoriques, en particulier celles relatives au Ve millénaire avant J.-C. Cette période est marquée par l'évolution du technocomplexe Kodjadermen-Gumelnița-Karanovo VI, caractérisée par des change-

ments importants dans les stratégies de subsistance humaine, l'organisation sociale et les innovations techniques. Parmi les preuves clés de ces bouleversements, on peut citer des sites stratifiés qui ont été occupés pendant des générations, avec des villages reconstruits aux mêmes endroits. Sur le plan archéologique, la fréquence accrue des pratiques de chasse pendant la période Gumelnița est particulièrement évidente dans l'exploitation intensive du cerf élaphe (*Cervus elaphus* Linnaeus, 1758), à la fois comme source de nourriture et comme matière première osseuse pour la fabrication d'équipements. Notre étude explore ce phénomène selon deux axes : 1) la valeur économique : l'analyse des restes de cervidés fournit des informations sur les stratégies de chasse, la saisonnalité, les méthodes de collecte des bois à partir du crâne ou les modes de dépeçage des carcasses animales. Les données zooarchéologiques contribuent également à comprendre comment les cervidés étaient intégrés dans l'alimentation et, plus généralement, dans l'économie ; 2) l'utilisation technique : le rôle des cervidés dans la production d'artefacts. Nous étudierons quels éléments anatomiques du squelette ont été utilisés (os, dents, bois) et quels modèles opérationnels leur ont été appliqués pour produire quels types d'objets. Une discussion portera sur le cas des canines de cerfs élaphes qui n'étaient pas utilisées directement, mais reproduites comme ornements dans d'autres matières premières. Des comparaisons seront établies entre les phases A2 et B1 de la culture Gumelnița, et des études de cas illustreront les découvertes provenant d'importants sites archéologiques du Bas-Danube.

MOTS CLÉS
Bas-Danube,
stratégies de chasse,
ressources en viande,
découpe,
matière dure animale,
industrie osseuse,
schéma de
transformation.

INTRODUCTION

The region between the Danube and Carpathians is a key area for prehistoric archaeological research, particularly during the 5th millennium BC. This period was characterized primarily by the evolution of the Kodjadermen-Gumelnița-Karanovo VI technocomplex (*c.* 4600/4500-3900 cal BC) with significant territorial expansion. This technocomplex spread from the Carpathian Mountains (in the north) to the Dniester (in the east) and to the Aegean Sea (in the south). Numerous radiometric data have been published (e.g., Bem 2001; Bréhard & Bălășescu 2012; Reingruber 2015; Popescu *et al.* 2023): at Hârșova, radiocarbon dates indicated the interval of 4336-4057 cal BC and 4369-4235 cal BC (Bréhard & Bălășescu 2012), at Bordușani-Popină between 4490-4263 cal BC (Gillis *et al.* 2013), at Căscioarele between 4450-4264 cal BC (Lazăr *et al.* 2018), at Sultana-Malu Roșu between 4539-4365 cal BC and 4174-3961 cal BC (Lazăr *et al.* 2016), at Gumelnița between 4331-4060 cal BC (Lazăr *et al.* 2020), at Cunești between 4596-4439 cal BC (Mărgărit *et al.* 2013) or at Vitănești, between 4354-4231 cal BC (Ludwig *et al.* 2009; Bréhard & Bălășescu 2012). North of the Danube, the Gumelnița culture is divided into phases A and B, each with two sub-phases, the last one –B2– not being clearly defined. Based on the series of published radiocarbon dates, it is estimated that the Gumelnița A1 phase evolved between 4600/4550-4350 BC, with the A2 phase falling within the interval 4500-3950 BC, and the B1 phase between 4250-3950/3900 BC. Thus, we see that there are overlaps between the phases of the same culture, the transition phenomenon did not unfold uniformly north of the Danube (Bem 2000).

This period was marked by significant changes in human subsistence strategies, social organization, and technological innovations. North of the Danube, stratified tell settlements are characteristic with villages being rebuilt for generations on the same sites. Some tell settlements were occasionally surrounded by defensive structures such as ditches and embankments, while others were enclosed by palisades with dwellings disposed in parallel rows (e.g., Petrescu Dîmboviţa 2001; Lazarovici & Lazarovici 2007; Popovici 2010; Ștefan 2010). Larger, multi-room houses were sometimes constructed with a single story and stone foundations that were aligned in symmetrical arrangements (Lazăr *et al.* 2018). For the Gumelnița culture, houses with simple clay floors are the most common dwelling structure, while those with floors made of logs covered by a layer of plastered clay are rare (Popovici 2010). The social, technological and economic transformations led to changes in the meat component of the diet (e.g., Bréhard & Bălășescu 2012; García Vázquez *et al.* 2023) with a significant share of game or aquatic resources; funerary inventories that seem to reflect social hierarchies (e.g., Slavchev 2010; Windler *et al.* 2013; Lazăr *et al.* 2018; Chapman 2020); the use of copper and gold as raw materials (e.g., Whittle 1996; Thomas 1999; Bailey 2000; Anthony 2010; Lazăr *et al.* 2018; Chapman 2020; Radivojević *et al.* 2021), female figurines made of various materials (clay, bone, gold) (Andreescu 2002, 2009), *Spondylus* ornaments from the Mediterranean world (Mărgărit 2024a) contrasted with numerous beads made of local *Unio* shells (Mărgărit 2019; Mărgărit & Radu 2021).

For the osseous industry, the intense exploitation of red deer (*Cervus elaphus* Linnaeus, 1758) antlers is evident, with some sites showing with an almost equal proportion between bone and antler tools (e.g., Vitănești, B1 level). For domestic animals, the raw materials derive mainly from the ox (*Bos taurus* Linnaeus, 1758) and sheep (*Ovis aries* Linnaeus, 1758) / goat (*Capra hircus* Linnaeus, 1758) species, while other species –pig (*Sus domesticus* Erxleben, 1777) or wild boar (*Sus scrofa* Linnaeus, 1758), dog (*Canis familiaris* Linnaeus, 1758), horse (*Equus ferus* Linnaeus, 1758)– appear sporadically. A special case seems to be that of the *Sus* species, which have significant bone remains in terms of number, but whose canines,

Fig. 1. — Gumelnița tell-settlements mentioned in this study.

especially the lower ones, are very little exploited. Within the archaeological assemblages, the predominant tools are those used in domestic activities, made from bones, antlers, teeth, or shells, followed at a significant distance by various types of hunting or fishing weapons, mainly crafted from antler, and a limited number of ornaments or feminine figurines, mostly made from bone. Among the types of tools identified, bevelled tools and pointed tools predominate, followed by spatulas, flattened astragali, spindle whorls, to which are added the various massive antlers tools such as bevelled tools, hoes and hammers, along with pressure flakers, arrowheads or harpoons. Although rare, *Sus* sp. canines and *Unio* shells were used as scrapers, while tortoise carapaces served as containers. Also, some typological categories, that were present in the previous stages (Early and Middle Neolithic) at the Lower Danube, such as spoons, rings on blank in volume, bone belt elements or *Spondylus* bi/trilobed beads, disappear, while new typological categories appear, such as flat, prismatic or *en violon* bone figurines, triangular bone pendants or dog mandibles used as tools (e.g., Mărgărit & Popovici 2012; Averbouh & Zidarov 2014; Mărgărit *et al.* 2014, 2022; Mihail & Provenzano 2014; Lazăr *et al.* 2016; Mărgărit & Toderaș 2019; Mărgărit 2020, 2023).

Starting from archaeozoological studies and technological analyses of osseous industries, we aim to investigate the importance of the *Cervus elaphus* species in the economy of the Gumelnița communities. Our study explores this phenomenon along two dimensions: 1) Economic value: the analysis of cervid remains provides insights into hunting strategies, seasonality, methods of collecting antlers from the skull or the butchering patterns of animal carcasses. Zooarchaeological data also contribute to understanding how cervids were integrated into the diet and, more generally, into the economy; 2) Technical use: the role of cervids in artifact production. We will investigate which anatomical elements of the skeleton were used, what operational schemes were applied, and what types of tools/weapons were made. We will emphasize less on the share of shed antlers within the osseous industries because it involves a different method of acquisition than hunting, namely expeditions for gathering. Comparisons will be made between phases A2 and B1 of the Gumelnița culture, and case studies will be a series of important tell settlements (Fig. 1) from the Lower Danube.

CERVUS ELAPHUS AS FOOD SOURCE

With the appearance of the first farmers north of the Danube (*c.* 6200 BC) during the Early and Middle Neolithic, the percentage of domestic taxa (mainly ovicaprids and cattle) in the faunal assemblages surpasses 70 % (Bălășescu *et al.* 2005a; Bălășescu & Mărgărit 2014). Later on, during the Gumelnița culture (Table 1; Fig. 2), we note the direct and tight connection between the interest of the populations

Table 1. — Faunal spectrum of some Gumelnița tell-settlements. Abbreviation: **NR**, number.

	Bordușani GA2		Carcaliu GA2		Hârșova GA2		Luncavița GA2		Căscioarele GB1		Vitănești GA2		Vitănești GB1		Măriuța GB1	
Species	**NR**	**%**	**NR**	**%**	**NR**	**%**	**NR**	**%**	**NR**	**%**	**NR**	**%**	**NR**	**%**	**NR**	**%**
Bos taurus Linnaeus, 1758	1996	21.42	118	24.53	618	11.64	218	23.59	201	7.10	1055	11.6	843	23.02	226	42.97
Ovis aries Linnaeus, 1758	219	2.35	4	0.83	255	4.80	8	0.87	17	0.60	83	0.9	57	1.56	28	5.32
Capra hircus Linnaeus, 1758	73	0.78	2	0.42	77	1.45	9	0.97	3	0.11	30	0.3	27	0.74	14	2.66
Ovis/Capra	1312	14.08	8	1.66	1182	22.26	58	6.28	7	0.25	268	2.9	77	2.10	96	18.25
Sus domesticus Erxleben, 1777	2320	24.90	61	12.68	1009	19.00	122	13.20	57	2.01	1190	13.1	809	22.09	78	14.83
Canis familiaris Linnaeus, 1758	1343	14.41	13	2.70	896	16.87	21	2.27	166	5.87	252	2.8	90	2.46	13	2.47
Total domestic	7263	77.95	206	42.83	4037	76.03	436	47.19	451	15.94	2878	31.7	1903	51.97	455	86.50
Canis lupus Linnaeus, 1758	64	0.69	–	–	26	0.49	6	0.65	3	0.11	72	0.79	18	0.49	–	–
Vulpes vulpes (Linnaeus, 1758)	143	1.53	–	–	14	0.26	4	0.43	1	0.04	61	0.67	19	0.52	3	0.57
Lynx lynx (Linnaeus, 1758)	8	0.09	–	–	6	0.11	1	0.11	–	–	5	0.06	–	–	–	–
Felis silvestris Schreber, 1777	49	0.53	–	–	20	0.38	3	0.32	1	0.04	25	0.28	2	0.05	–	–
Panthera leo (Linnaeus, 1758)	–	–	–	–	–	–	–	–	–	–	3	0.03	–	–	–	–
Meles meles (Linnaeus, 1758)	16	0.17	–	–	15	0.28	6	0.65	4	0.14	208	2.29	33	0.90	–	–
Martes martes (Linnaeus, 1758)	3	0.03	–	–	8	0.15	1	0.11	1	0.04	1	0.01	2	0.05	–	–
Mustela putorius Linnaeus, 1758	2	0.02	–	–	–	–	–	–	–	–	1	0.01	–	–	–	–
Mustela nivalis Linnaeus, 1766	–	–	–	–	1	0.02	–	–	–	–	–	–	–	–	–	–
Lutra lutra (Linnaeus, 1758)	38	0.41	–	–	2	0.04	1	0.11	–	–	11	0.12	–	–	–	–
Ursus arctos Linnaeus, 1758	–	–	–	–	–	–	–	–	1	0.04	21	0.2	1	0.03	–	–
Equus ferus Linnaeus, 1758	35	0.38	2	0.42	20	0.38	4	0.43	245	8.66	773	8.5	220	6.01	10	1.90
Equus sp. (little size)	–	–	–	–	–	–	–	–	–	–	–	–	2	0.05	–	–
Sus scrofa Linnaeus, 1758	757	8.12	72	14.97	890	16.76	131	14.18	550	19.44	1326	14.6	209	5.71	17	3.23
Cervus elaphus Linnaeus, 1758	540	5.80	174	36.17	78	1.47	291	31.49	1193	42.17	1732	19.1	595	16.25	30	5.70
Capreolus capreolus (Linnaeus, 1758)	160	1.72	5	1.04	66	1.24	23	2.49	121	4.28	148	1.6	18	0.49	5	0.95
Alces alces (Linnaeus, 1758)	–	–	–	–	–	–	–	–	–	–	4	0.04	–	–	–	–
Dama dama (Linnaeus, 1758)	1	0.01	1	0.21	–	–	–	–	–	–	–	–	–	–	–	–
Bos primigenius Bojanus, 1827	75	0.80	17	3.53	55	1.04	12	1.30	239	8.45	1368	15.1	515	14.06	6	1.14
Castor fiber Linnaeus, 1758	97	1.04	4	0.83	32	0.60	2	0.22	16	0.57	363	4.0	115	3.14	–	–
Lepus europaeus Pallas, 1778	66	0.71	–	–	40	0.75	3	0.32	3	0.11	89	1.0	10	0.27	–	–
Total wild	2054	22.05	275	57.17	1273	23.97	488	52.81	2378	84.06	6211	68.3	1759	48.03	71	13.50
Total determinated	9317	100.00	481	100.00	5310	100.00	924	100.00	2829	100	9089	100.0	3662	100.00	526	100.00

for hunting, fishing, gathering, and the existence of a rich wild faunal spectrum. For example, at the tell settlement of Gumelnița, stable isotope analyses point to the existence of an agrarian community, with half of the diet consisting of cereals and legumes, supplemented by freshwater resources and hunting. Domestic animals were exploited mostly for by-products and less for meat as shown by García Vázquez *et al.* (2023).

During the development of the Gumelnița culture, the type of economy changes and hunting reaches unexpect-

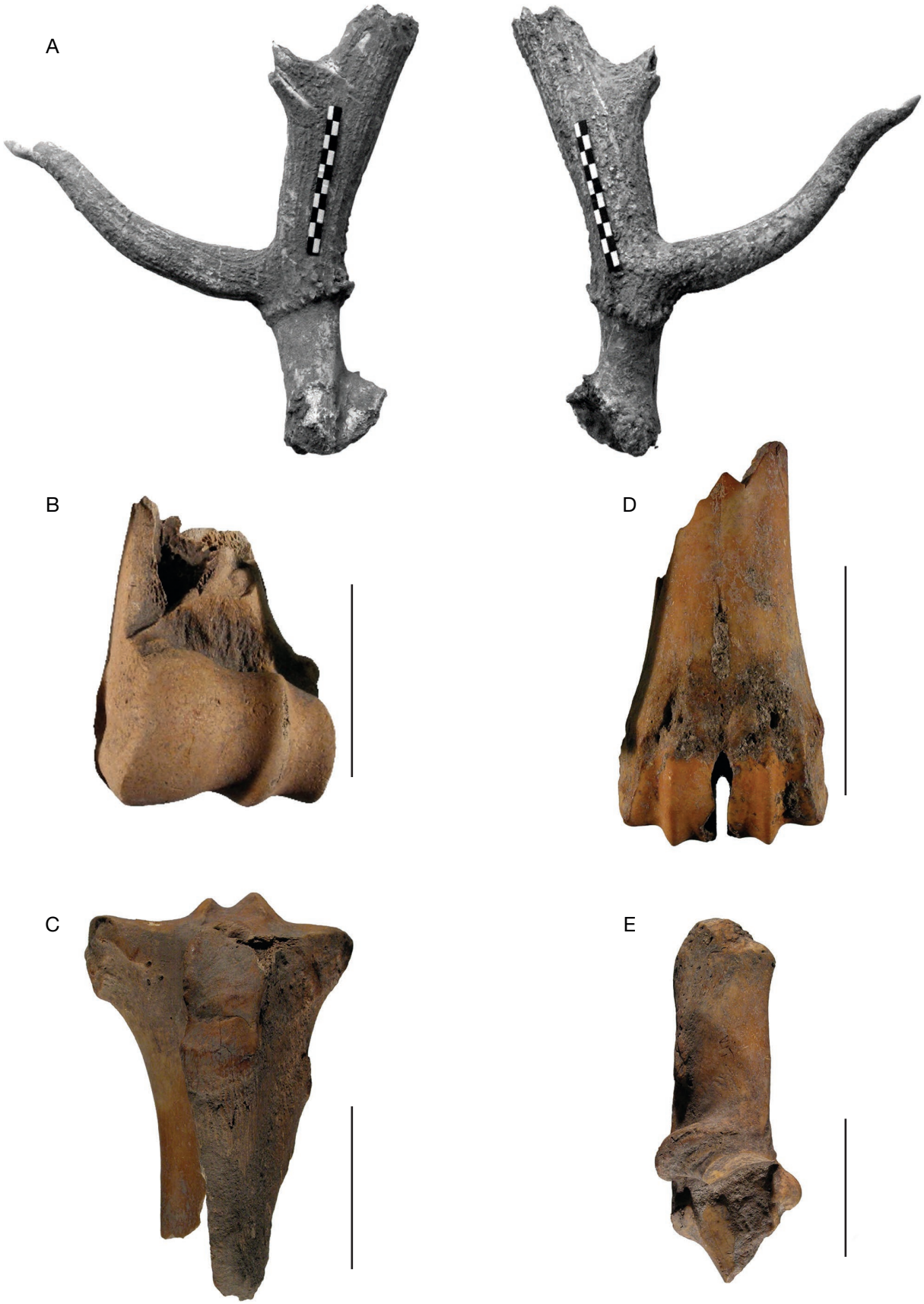

Fig. 2. — Faunal remains of *Cervus elaphus* Linnaeus, 1758: **A**, left neurocranium with antlers (lateral and medial view, Hârșova); **B**, left humerus distally fused (cranial view, Vitănești); **C**, right metacarpus distally fused (dorsal view, Borduşani); **D**, right tibia proximal fused (dorsal view, Luncavița); **E**, left calcaneus fused (medial view, Vitănești). Scale bars: 5 cm. Photos credits: A. Bălășescu.

edly high frequencies in certain places. The animals hunted were mainly red deer, wild boar, aurochs (*Bos primigenius* Bojanus, 1827) and to a lesser extent wild horse (*Equus ferus* Linnaeus, 1758) or carnivores: wolf (*Canis lupus* Linnaeus, 1758), fox (*Vulpes vulpes* Linnaeus, 1758), lynx (*Lynx lynx* Linnaeus, 1758), wild cat (*Felis silvestris* Schreber, 1777), etc. (Bălășescu *et al.* 2005a). There are sites where the remains of wild animals reach and even exceed 50 %. An example is the Vitănești tell settlement, where wild mammals accounted for 68.3 % in Gumelnița A2 level and 48 % in the Gumelnița B1 level (Bălășescu & Radu 2003; Bălășescu *et al.* 2005a, b; Bălășescu 2014). At Căscioarele, B1 level, hunting is attested by the high number of wild mammal remains (Bolomey 1964), reaching 84.1 % (Bălășescu *et al.* 2005a, b) from the faunal assemblage. A. Bolomey (1964, 1968) notes that deer remains make up more than half of the total osteological material, mentioning 1193 fragments from the Gumelnița B1 level. However, the situation seems radically different in the Gumelnița A2 level from this tell settlement. The predominance of domestic animals is attested, the red deer being present with only 84 fragments (Bolomey 1968). There are tell settlements, such as those at Hârşova and Borduşani (Gumelnița A2) where wild mammals account for only a quarter of the total mammal remains. At Tangâru, the percentage of wild mammal remains was only 2.7 % (Bălășescu *et al.* 2005b). These examples reflect varied adaptations of hunting strategies. We can probably see a correlation between the development of deer hunting in certain sites (e.g., Căscioarele, Vitănești) and the diversity of weapons made from bone and antlers (e.g., Mărgărit *et al.* 2022, 2023; Mărgărit 2024b), and, conversely, the limited variety of weapons (e.g., Borduşani, Hârşova) in sites with a marginal role of this type of hunting.

The red deer is a species that inhabits large ecosystems, often moving over medium to long distances in search of food and water. It prefers forests, as well as the neighbouring biogeocenoses, especially steppes, incursions into such regions being frequent, particularly in seasons when food is scarce. Between 7000 and 3000 BC, studies illustrate the impact of average annual temperatures and increased humidity, which allowed for the widespread development of red deer, highlighted by the expansion of the ecosystems they were part of (Popescu 2008). Even if the restrictive climatic factors of the analyzed period essentially influenced each community to identify its own subsistence strategies that exploited mainly local resources, the literature has shown that high hunting rates could have resulted from the interaction of several factors: the appearance of new husbandry techniques (Bovinae and Suinae), the development of complex socio-economic relations between the sites, or an increased social value attributed to wild mammals (Bréhard & Bălășescu 2012).

The red deer is well represented as number of remains in most of the Gumelnița tell settlements. At Borduşani, Gumelnița and Hârşova, red deer are outnumbered by the wild boar, and by the aurochs at Vlădiceasca and Însurăței. The situation is largely the same with regard to NMI (minimum numbers of individuals) (Bălășescu *et al.* 2005b). At the Teleorman Valley (southern Romania), cervids remains account for 20.7 % in the Gumelnița A2 level and 16.7 % in the Gumelnița B1 level, the red deer being the most hunted animal (Bălășescu & Radu 2003).

The analysis of the metapodial and calcaneal remains of red deer shows that more males than females were hunted which could indicate selective hunting due to their larger size (larger amounts of meat) and the antlers being used in the manufacture of tools and weapons (Bălășescu *et al.* 2005a, b). Hunting was carried out throughout the year, as proven by the discoveries from the Vitănești tell settlement (Teleorman Valley), where the red deer is represented by all anatomical elements, including cranial elements with antlers on the head (at least 10 individuals) (Bălășescu & Mărgărit 2014). Not coincidentally, in this settlement the processing of antlers cut from the skull is attested, even if not in a significant proportion compared to those made from shed antlers (Mărgărit *et al.* 2022). Skulls with antlers on their heads were also found at the tell settlements from Hârşova, Măriuța or Luncavița (Bălășescu *et al.* 2005a).

CERVUS ELAPHUS SUPPLIER AS RAW MATERIAL FOR THE OSSEOUS INDUSTRY

Bone

Gumelnița A2

An astragalus from Hârşova has marks of abrasion on the lateral side, which have led to the attenuation of the anatomical protuberances. Under the microscope, a well-demarcated area with striations is visible, arranged obliquely to the axis of the bone, with an invasive extension.

A mandible (Fig. 3A) fragment from the tell settlement of Cunești, found in the Gumelnița A2 context (Ștefan 2011), was longitudinally broken by percussion without the full arrangement of the debitage edges. Therefore, some of the impact points are visible, with the fractures specific to the use of direct percussion. To create the active end, abrasion (Fig. 3C) was applied distally, only on the inferior side. The abrasion striations are superficial, rare and parallel between, partly overlapped by the use-wear and can be seen especially on the periphery of the active end, being arranged perpendicular to the longitudinal axis of the piece. The use-wear developed on distal end, being characterized by the presence of small superimposed fractures (Fig. 3B). We can assume that it was an intermediate piece, used for indirect percussion, starting from the fracture developed at the proximal level.

At Borduşani-Popină, a radius (Fig. 3D) was found that preserves marks of a segmentation procedure at both ends by percussion without regularizing the debitage edges. The both ends have crushing on the periphery, developing an area that includes the entire circumference of the bone characterized by small superimposed fractures. In addition, the surface has a polish localized on small areas and fine striations arranged parallel to the longitudinal axis of the piece (Fig. 3E, F). Macroscopically, the surface appears rather rough because the small successive fractures maintain this aspect. Compared

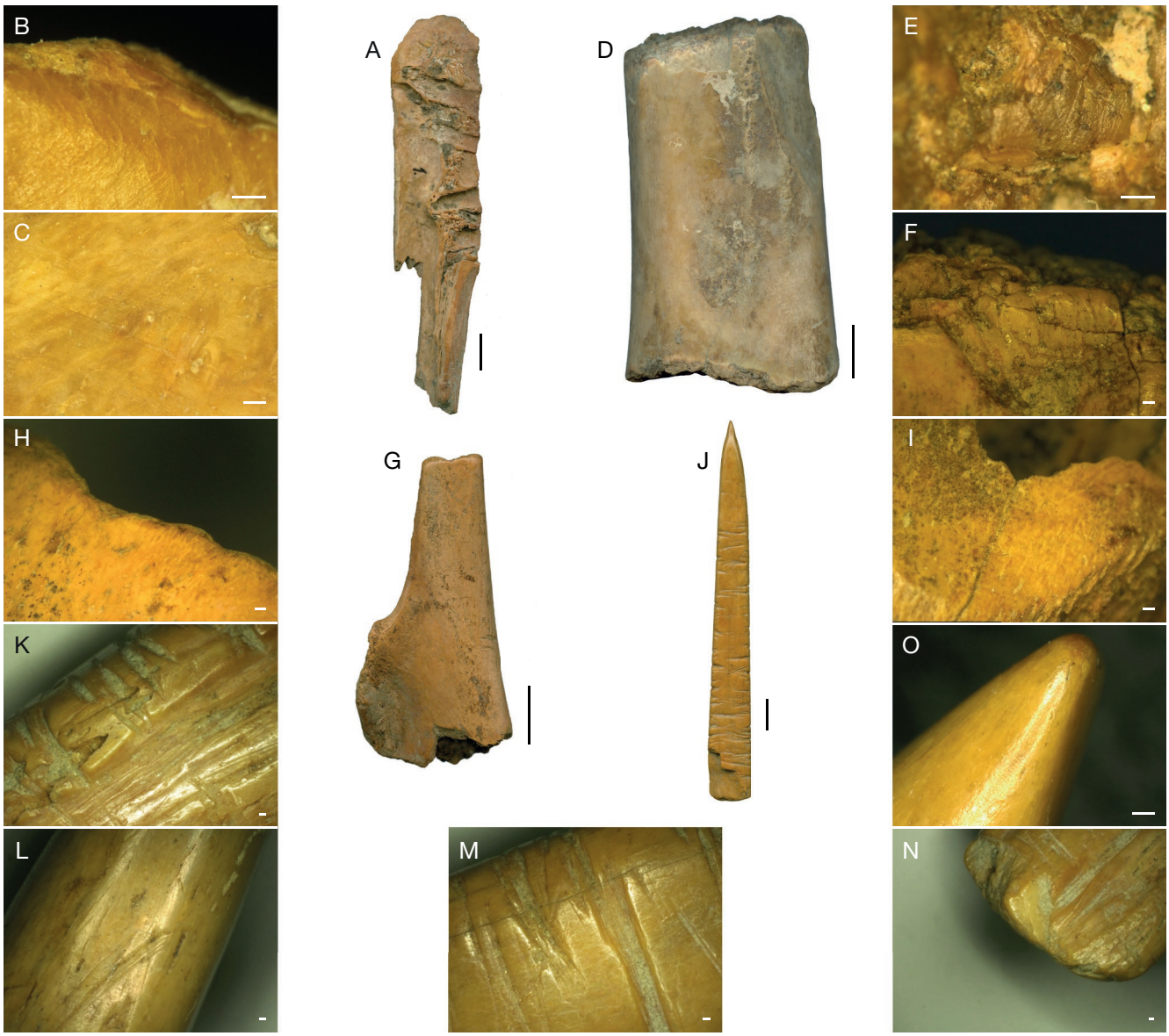

Fig. 3. — Bone artifacts found at the Gumelnița A2 levels: **A**, processed mandible (Cunești); **B**, **E**, **F**, **H**, **O**, distal end details; **C**, **I**, abrasion marks; **D**, hammer (Borduşani); **G**, bevelled tool (Cunești); **J**, pointed tool (Borduşani); **K**, grooving marks: **L**, scraping marks; **M**, incisions detail; **N**, proximal end detail. Scale bars: A, D, G, J, 1 cm; B, C, E, F, H, I, K-O: 250 µm. Photos credits: M. Mărgărit.

with similar pieces published in the literature (Sidéra 2010), we consider that it is a piece used similar to a hammer, in percussion operations.

The *Cervus elaphus* ulna (Fig. 3G) was transformed into bevelled tools, as demonstrated by two pieces found at the Gumelnița tell settlements. For the first item from Cunești, the epiphysis seems to have been removed by direct percussion. The debitage edge was not regularized so that the irregular morphology is visible, as well as the impact points that led to the fracture of the bone wall. At the distal level, an oblique blow was applied with the regularization of the debitage area by abrasion (Fig. 3I). This abrasion was also applied on the superior side. The striations are grouped in an area covering the entire debitage edge, having a morphology parallel to each other, but arranged perpendicular to the bone axis, being dense and superficial in depth. They are more visible at the periphery of the active end. This has small fractures overlapped by use-wear polish which led to the rounding of the *fil du tranchant* and the appearance of a polish and very fine striations, parallel to each other, but also to the axis of the bone (Fig. 3H). This aspect leads us to think that it was an intermediate tool used in indirect percussion. The fracture pattern at both ends and the type of use-wear at the distal level that continued to evolve despite the constant removal of small splinters of raw material by fracturing are indications for assuming this functional hypothesis. The same information is valid for a specimen from Hârșova. At the distal level, despite the fracture, a small area of the active end is preserved, characterized by surface flattening, macroscopic polish and functional striations.

Metapodials were transformed into pointed tools, this being the best-represented typological category in the analyzed assemblages. At the settlements of Luncaviţa Cetăţuia (two pieces) and Carcaliu Vadu Mare (six pieces), several variants of the blank production by partitioning: bipartition, quadripartition and successive partitions, all conducted along the longitudinal axis of the bone block. In the case of bipartition (five specimens), both double grooving and directe percussion were used. In the case of quadripartition (one specimen), we do not know the debitage procedures, and in that of successive partitions (one specimen), percussion was applied. For the shaping operation, scraping and/or abrasion were used (Mihail & Provenzano 2014).

Four pointed tools made from metapodials were identified at the Bordușani tell settlement. The first specimen (Fig. 3J) is fractured at the proximal level (Fig. 3N). The flat blank was obtained by partitioning that involved grooving (Fig. 3K) as we were able to identify a few marks. These are deep, long, parallel striations, creating a U-shaped groove. To arrange the convergence of the edges and the pointed end, a longitudinal scraping (Fig. 3L) seems to have been applied to the distal part. Subsequently, the entire surface of the piece was intensely shaped by abrasion. The end is blunt, rounded, with a very strong macroscopic use-wear polish and transversal functional striations (Fig. 3O). A second item has known the same method of longitudinal debitage by quadripartition in double grooving followed by longitudinal scraping extended over almost the entire surface of the piece, covered distally by abrasion for regularization. The end is fractured. In the case of the other two specimens, the debitage method is identical. Their surface was shaped by abrasion that covered almost the entire surface of the pieces. All pieces have deep transversal incisions (Fig. 3M), irregularly arranged on their surface.

Three specimens from the same typological category come from the tell settlement of Hârșova. The debitage method is the same for all items namely quadripartitioning (rod-type) carried out by double grooving action (two specimens) (Fig. 3B) or by the combination of grooving and percussion (one specimen). For the first piece (Fig. 4A), the entire surface was regularized by abrasion. In addition, at the distal level, in order to create a pointed end, abrasion was applied circularly around the circumference (Fig. 4C). The tip is very rounded, exhibiting polish and transverse striations (Fig. 4D). Also, at the mesial level, the piece presents a strong macroscopic polish (Fig. 4E) with the disappearance of abrasion marks – probably from handling. In the case of the second pointed tool, longitudinal scraping was used to arrange the active end. Deep, irregularly arranged transversal incisions are present on the surface. The end appears strongly blunted, with macroscopic polish being slightly fractured. On the last specimen, starting from the mesial level, transversal abrasion was applied on the edges and on both sides, creating the sharp morphology. The end is slightly functionally fractured.

Three other pointed tools were found at the Căscioarele site. Again, the method of debitage by quadripartition with the application of double grooving action is specific (Fig. 4G). On the first two pieces, at the meso-distal level, scraping can be identified around the entire circumference, to create the sharp end superimposed at the distal level by abrasion. The distal end has changed its initial volume, being blunt with functional striations. On the third piece (Fig. 4F), during the shaping operation, abrasion (Fig. 4H) was applied to various areas. The use-wear of the distal end is intense with functional striations developed longitudinally (Fig. 4I). The piece bears intense use-wear characterized by a macroscopic luster and a flattening of the surface (Fig. 4J).

Two pointed tools from the tell settlement of Vitănești were obtained by quadripartition with direct percussion technique. The debitage edges were rigorously abraded. A third fragment was obtained by quadripartition in double grooving with the shaping of the debitage edges. Towards the distal end, bilateral scraping was applied to arrange the sharp morphology. A small proximal fragment also comes from here, most likely from a pointed end which illustrates a quadripartition procedure by double grooving.

One of the pieces from Vitănești is a needle (Fig. 4K). The technological procedures are identical to those used for processing pointed tools (quadripartition in double grooving – Fig. 4L). The entire surface was regularized by abrasion (Fig. 4M). At the proximal level, a perforation was made by unifacial rotation from the lower side (Fig. 4O). The distal end is rounded with macroscopic luster (Fig. 4N).

The blank for processing a spatula (Fig. 5A) from the same site was obtained by quadripartition through percussion. The debitage edges were left in a raw state. The active end was created by abrasion (Fig. 5C) applied only distally. On various areas, the abrasion was eliminated due to advanced use-wear. Longitudinal functional striations (Fig. 5b), macroscopic luster, and a significant change in the initial volume of the active end are visible.

For one piece, although fractured from Hârșova, we assigned the function of a bevelled tool (Fig. 5D). The bone was cut longitudinally by percussion without shaping the fracture edges. The active end was arranged only at the distal level, from the lower side by abrasion. These marks are preserved only in a small area because the end is fractured. It could have been an intermediate piece used in indirect percussion based on the type of fracturing.

For some fractured pieces, we could not establish the function. Two pieces from the tell settlement of Bordușani are proximal fragments with a fracture of functional origin. They were made from a bone cut longitudinally by grooving over which the shaping of the debitage edges was superimposed. One of the pieces was rigorously shaped at the level of the proximal end as well. Several transversal incisions appear on the superior side. They were, certainly, finished pieces.

At the tell settlement from Hârșova there are two pieces, both meso-proximal fragments. The bone was cut longitudinally by double grooving, the marks of which are very evident. Abrasion was applied to variable areas. On one of the pieces,

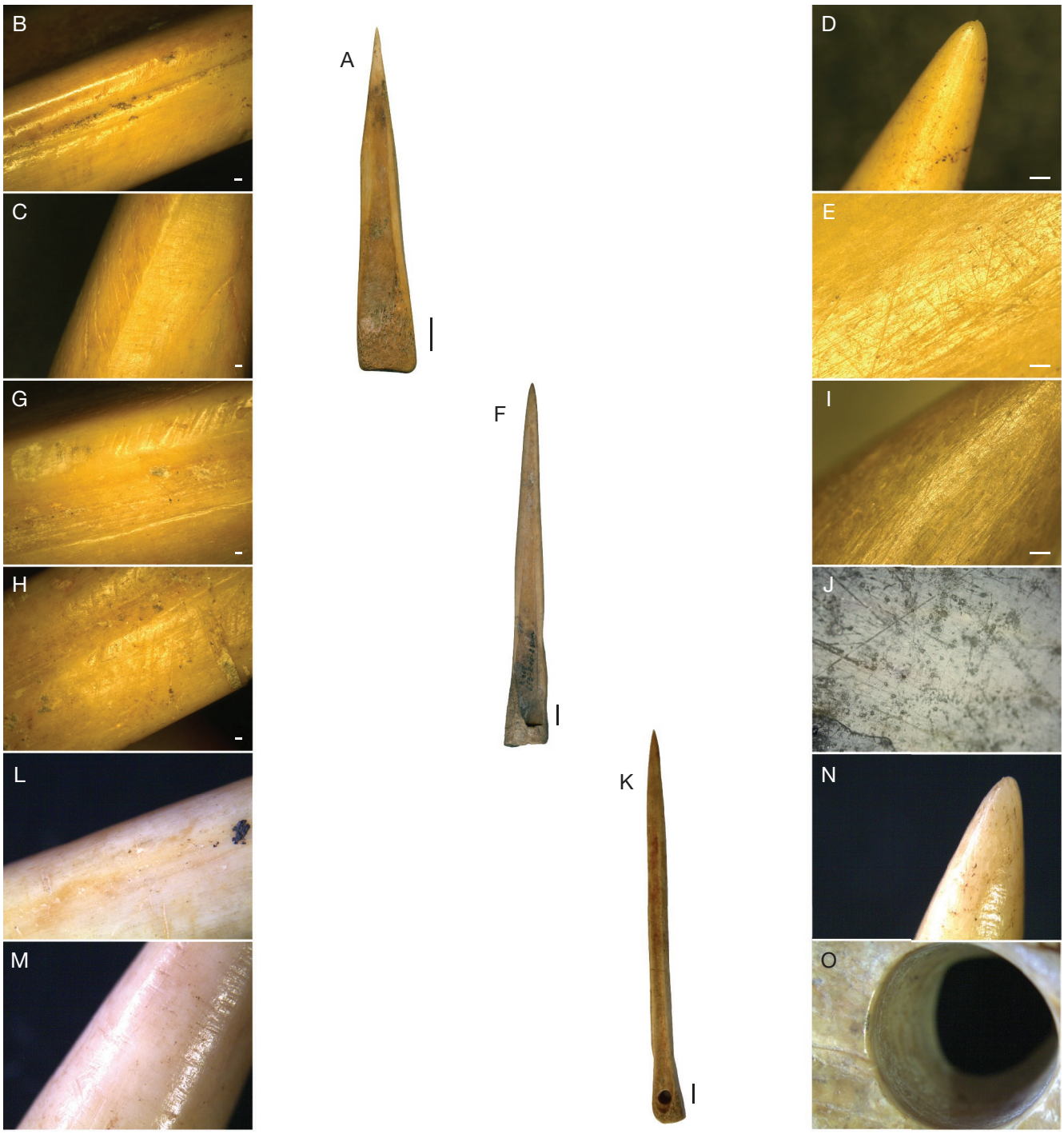

Fig. 4. — Bone artifacts found at the Gumelnița A2 levels: **A**, **F**, pointed tools (A, Hârșova, F, Căscioarele); **B**, **G**, **L**, grooving marks; **C**, **H**, **M**, abrasion marks; **D**, **I**, **N**, distal end details; **E**, **J**, usewear at the mesial area; **K**, needle (Vitănești); **O**, perforation detail. Scale bars: A, F, K, 1 cm; B-E, G-J, L-O: 250 µm. Photos credits: M. Mărgărit.

transversal incisions appear on the surface. The fracture of the pieces is of functional origin.

Pieces undergoing processing are also present. At Hârșova, a bone (Fig. 5E) was longitudinally cut by quadripartition with double grooving (Fig. 5F). No shaping stage followed. The assemblage is completed by two waste fragments. The first (Fig. 5G) illustrates a procedure for removal the epiphysis. The bone seems to have been longitudinally bipartitioned, probably by percussion (we did not identify any grooving marks). Then, the removal of the epiphysis was carried out by sawing (Fig. 5H). The second specimen is a debitage waste that preserves the marks of grooving intended to facilitate the longitudinal bipartition of the bone.

Waste fragments were also identified at Borduşani. These are bone fragments that show the marks of longitudinal debitage by grooving on one/two of the edges.

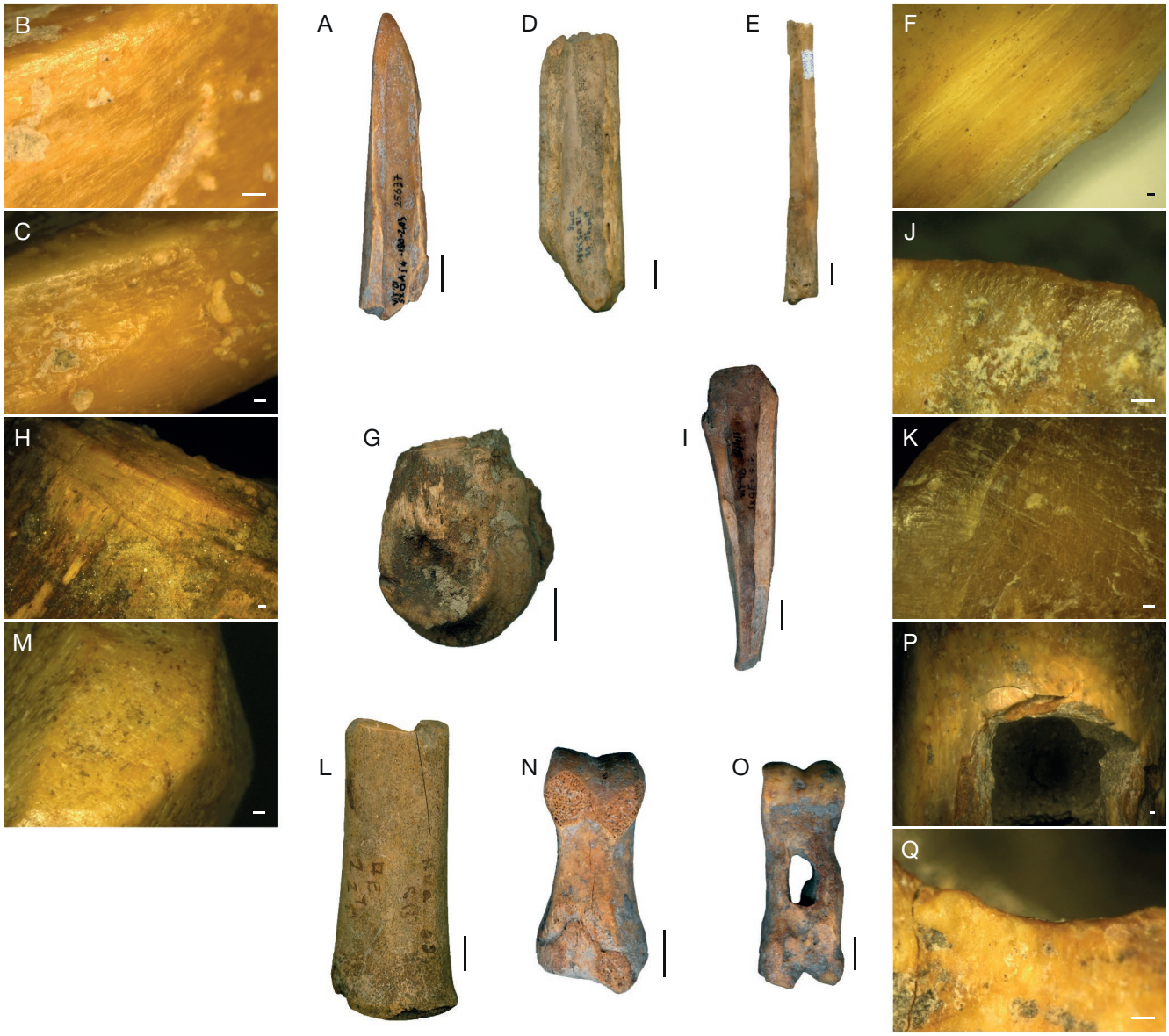

Fig. 5. — Bone artifacts found at the Gumelnița A2 levels: **A**, spatula (Vitănești); **B**, **J**, usewear at the distal end; **C**, **K**, **M**, abrasion marks; **D**, **I**, bevelled tool (D, Hârșova; I, Vitănești); **E**, blank (Hârșova); **F**, grooving marks; **G**, waste (Hârșova); **H**, sawing marks; **L**, handle (Hârșova); **N**, flattened phalanx (Vitănești); **O**, perforated phalanx (Vitănești); **P**, perforation detail: **Q**, usewear at the level perforation. Scale bars: A, D, E, G, I, L, N, O: 1 cm; B, C, F, H, J, K, M, P, Q: 250 µm. Photos credits: M. Mărgărit.

A femur from Hârșova was segmented transversely at both ends by percussion. One of the debitage edges presents a flattened appearance with small fractures and macroscopic polish. We did not identify any marks of shaping, which may mean that the blunting occurred due to use. We attribute its function to that of a hammer, similar to that of a radius described above.

A bevelled tool (Fig. 5I) found at Vitănești was made from a tibia. The blank is flat, obtained by successive percussions without shaping the debitage edges. To arrange the proximal part, another blow was applied to one side, ensuring their convergence. At the distal level, bifacial abrasion (Fig. 5K) was applied to create the active end. At the distal end, the abrasion marks were destroyed by use-wear, characterized by polish and deep, rare striations, perpendicular to the end (Fig. 5J). A handle (Fig. 5L) was obtained at Hârșova by transversal segmentation of a tibia at both ends by percussion. At the distal end, the debitage edges were regularized by abrasion (Fig. 5M), with visible marks. At the proximal level, a perforation was made by rotation through the spongy tissue, while at the opposite end, the natural medullary canal was used.

A processed metatarsus from Hârșova is a blank. The bone was bipartitioned longitudinally by double grooving. There are no other interventions on the bone. A metatarsus fragment from Bordușani is only a waste, illustrating a quadripartition by double grooving.

The phalanges were technologically transformed at Vitănești. One phalanx (Fig. 5O) was perforated by per-

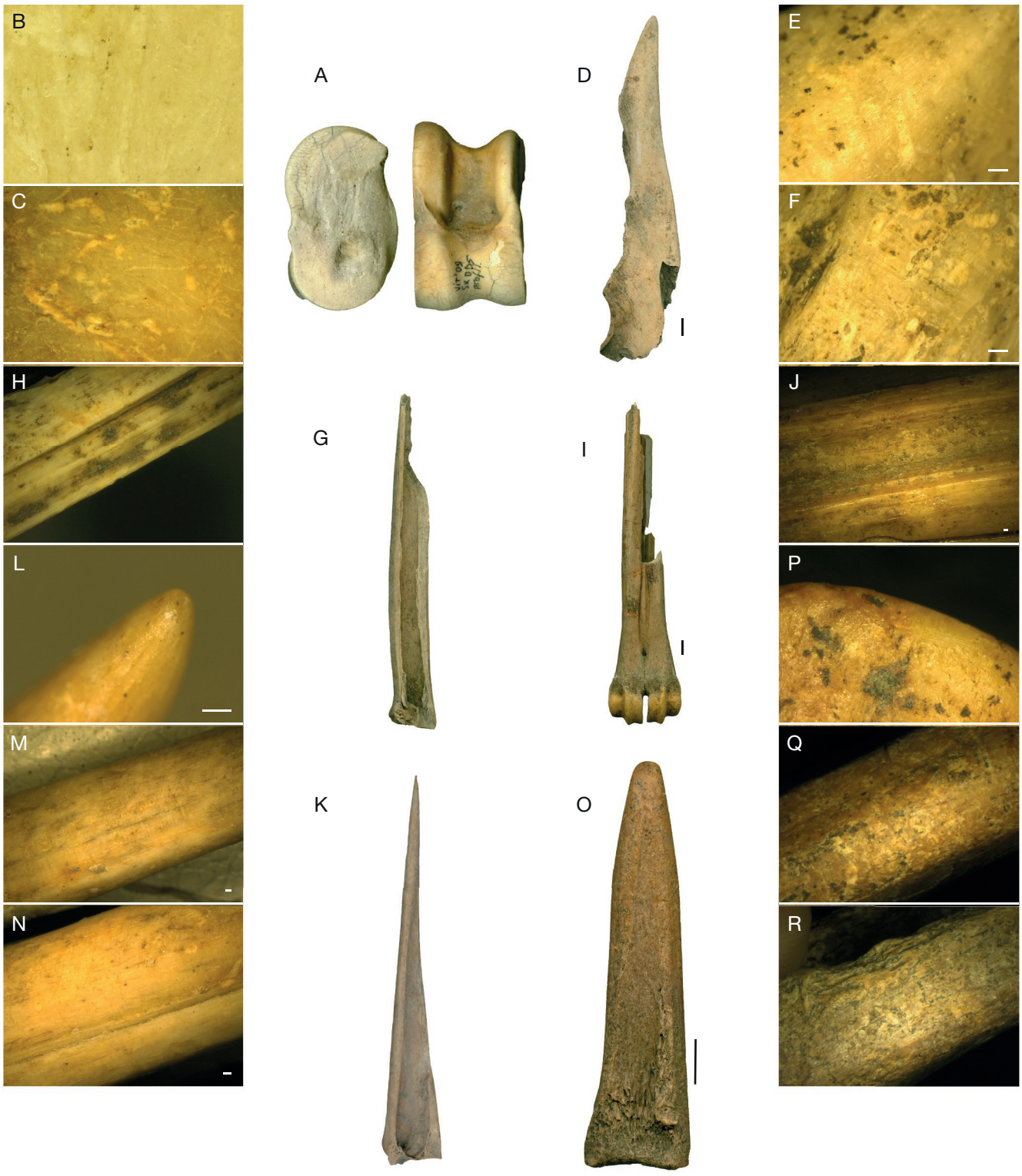

FIG. 6. — Bone artifacts found at the Gumelnița B1 levels: **A**, flatenned astragalus (Vitănești); **B**, **C**, **F**, **M**, **R**, abrasion marks; **D**, knife (Vitănești); **E**, **L**, **P**, distal end details; **G**, blank (Vitănești); **H**, **J**, **N**, **S**, grooving marks; **I**, waste (Vitănești); **K**, pointed tool (Căscioarele); o. bevelled tool (Vitănești). Scale bars: A, D, G, I, K, O: 1 cm; B, C, E, F, H, J, L-N, P-R: 250 µm. Photos credits: M. Mărgărit.

cussion (Fig. 5P) applied bifacially. The use-wear of the perforation level (Fig. 5Q) had begun to form. On another phalanx (Fig. 5N), a procedure for flattening one of the faces by abrasion was applied.

Gumelnița B1

An astragalus (Fig. 6A) from the tell settlement of Vitănești was abraded on the lateral and medial sides acquiring a rectilinear morphology (Fig. 6B, C).

In the same site, an ulna (Fig. 6D) was transformed to function as a knife or scraper in the sense that the active end evolves laterally, showing use-wear (Fig. 6E). The natural shape of the ulna was used with the distal end regularized by bifacial abrasion (Fig. 6F). Due to the shape of the bone, it could be easily held in the hand.

Some bones were under processing, such as several metacarpals from the Vitănești tell settlement. Two bones (Fig. 6G) were bipartitioned by double grooving (Fig. 6H) with visible marks. Two other fragments illustrate a bipartition procedure by double grooving, more pronounced on one side with penetration of the bone wall. The bipartition procedure was not completed, so the bones have been preserved and could have been further processed. Finally, a bone fragment (Fig. 6I) with technological marks can be considered waste because it can no longer be transformed into a finished piece. On one of the sides are visible the marks of a bipartition procedure by grooving (Fig. 6J).

The metapodials were used to make four pointed tools (Fig. 6K) at the Căscioarele tell settlement. To obtain the flat blank, a longitudinal debitage method was applied by quadripartition in double grooving (Fig. 6N) or by a combination of grooving and percussion. At the meso-distal level, abrasion (Fig. 6M) or longitudinal scraping was applied around the entire circumference to create a sharp end. This is blunt, having undergone significant modifications to its initial volume and presents an extended luster on the surface (Fig. 6L). A specimen from Vitănești is a splinter from the diaphyseal wall, obtained by successive partitions through percussion. The shaping operation targeted only the proximal area, which was regularized by abrasion. Also, the arrangement of the active end was done only at the distal level through faceted transversal abrasion around the entire circumference. The distal end is considerably blunted, becoming rectilinear, and the technological marks have been removed by use-wear.

At Vitănești tell settlement, the metapodials were also transformed into bevelled tools (Fig. 6O). For the first specimen, the longitudinal bipartition was achieved by double grooving (Fig. 6S), which is still visible, because the abrasion was applied only towards the distal end (Fig. 6Q) on both sides to create the active end. It is intensely blunt, with a luster more extended on the lower side (Fig. 6P). The second bevelled tool is fractured proximally and longitudinally, so we do not have all the technological data. It was made from a flat blank, without the integral arrangement by abrasion of the preserved edge. The abrasion was applied to the lower side at the distal level. At the functional end, the piece displays small superimposed fractures hence the conclusion that it was used as an intermediate tool for indirect percussion.

A needle was found at the Căscioarele site and another one at the Mărițua site (Fig. 7A). The blank was obtained by the same double grooving (Fig. 7C) procedures as most pointed tools. To achieve the convergence of the edges towards the end, longitudinal scraping was applied. The entire surface was shaped by abrasion (Fig. 7B). The perforation was created by bifacial rotation (Fig. 7E). For the first item, the sharp end shows a functional fracture. In the case of the second needle, the functional end is very blunt, with transversal striations and macroscopic luster (Fig. 7E).

Another metapodial from Vitănești can be considered debitage waste. It is an abandoned fragment that illustrates the longitudinal bipartition through grooving combined with percussion.

The metatarsals were transformed into pointed tools. At Vitănești, such a bone (Fig. 7F) was cut longitudinally by quadripartition. The grooving (Fig. 7H) shows signs of use-wear, being very difficult to identify because the debitage edges and both sides at the meso-distal level were rigorously abraded. Also, short transversal incisions appear randomly arranged on the surface. The piece is heavily worn, with most of the technological marks fading due to hand rubbing. The sharp end is blunt and slightly fractured (Fig. 7G).

At Mărițua, two pointed tools were obtained from metatarsals cut longitudinally by quadripartition in double grooving (Fig. 7K). For the first specimen, the convergence of the edges and the sharp end were obtained by longitudinal scraping. Both the grooving and the scraping marks were difficult to identify because the surface of the piece has been abraded. On the upper side, especially at the distal level, there are a series of transversal incisions, randomly arranged, made by the repeated passage of a flint tool with an irregular V-profile, probably intended to increase friction. The end is functionally broken. In the case of the second item (Fig. 7I), the fracture edges have been fully regularized, by abrasion, as have the two sides at the meso-distal level. The distal end is slightly fractured but presents intense use-wear, spread across the surface (Fig. 7J).

There are also blanks at the Vitănești settlement. The first item (Fig. 7L) was obtained by the classical method: quadripartition by double grooving (Fig. 7M). Another piece (Fig. 7N) was bipartitioned through longitudinal percussion, after which a new bipartition by grooving was initiated. An attempt was made to deepen the groove on both the upper and lower sides. The action was not finished. We complete the Vitănești assemblage with a piece that can be considered waste (Fig. 7O). The epiphysis is preserved, illustrating a procedure of bipartition by double grooving (Fig. 7P). The bone was fractured, which was probably the reason for its abandonment.

Antler

Gumelnița A2

Hammers were made from antlers cut from the skull, such as this illustrated specimen (Fig. 8A) found at the Bordușani site. The detachment was carried out by percussion (Fig. 8D), preserving a fragment of the skull. The active end was arranged at the level of the outer burr through percussion. It preserves specific marks: heavy use-wear with cuts caused by impact, loss of raw material and microscopic luster (Fig. 8B, C). At Căscioarele, six hammers (Fig. 8E) made from the basal area of some antlers detached from the skull were discovered. The detachment from the skull was carried out in all cases by percussion. The pieces have per-

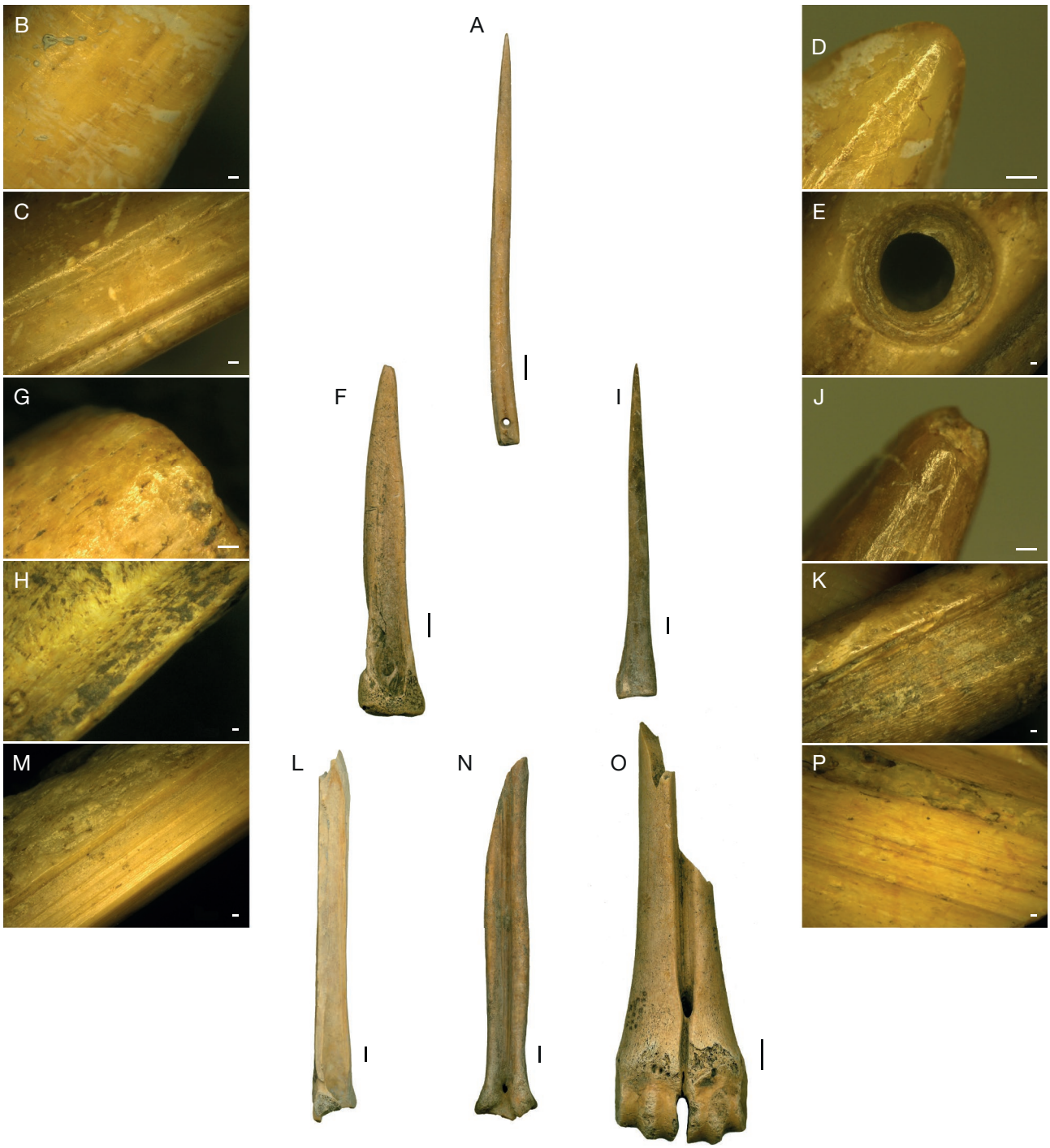

Fig. 7. — Bone artifacts found at the Gumelnița B1 levels: **A**, needle (Mărițua); **B**, abrasion marks; **C**, **H**, **K**, **M**, **P**, grooving marks; **D**, **G**, **J**, distal end details; **E**, perforation detail; **F**, **I**, pointed tools (F, Vitănești; I, Mărițua); **L**, **N**, blanks (Vitănești); **O**, waste (Vitănești). Scale bars: A, F, I, L, N, O: 1 cm; B-E, G, H, J, K, M, P: 250 µm. Photos credits: M. Mărgărit.

forations made at the mesial level by percussion, completed at some specimens by rotation (Fig. 8H). The segmentation was carried out by percussion followed by shaping (Fig. 8J) to create a regular convex morphology at the level of the active end. The used area became deformed and acquired a concave morphology. Cuts, luster and depressions (as a result of the loss of raw material) are added (Fig. 8F, G, L, M). One of the pieces (Fig. 8I) was perforated through bifacial percussion applied alternatively. The piece fractured at the perforation level, and a new perforation was created through percussion (Fig. 8K).

The site of Bordușani also preserves a waste (Fig. 8N), namely the base of an antler cut from the skull by direct percussion, while at the other end it was segmented by bending.

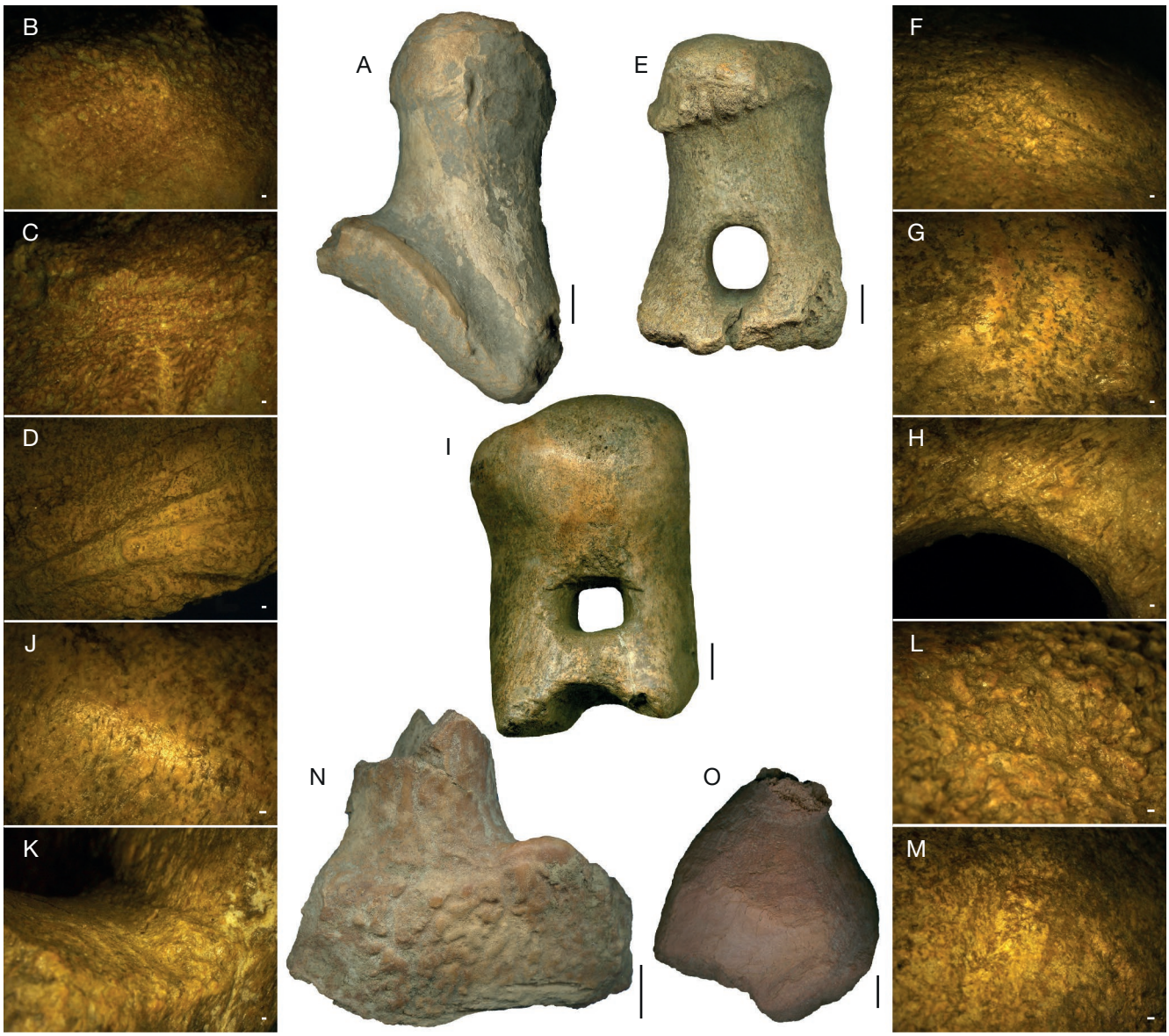

Fig. 8. — Antler artifacts found at the Gumelnița A2 levels: **A**, **E**, **I**, hammers (A, Borduşani; E, I, Căscioarele); **B**, **C**, **F**, **G**, **L**, **M**, details of the active area; **D**, percussion marks; **H**, **K**, perforation details; **J**, abrasion marks; **N**, **O**, debitage waste (N, Borduşani; O, Hârşova). Scale bars: A, E, I, N, O: 1 cm; B-D, F-H, J-M: 250 µm. Photos credits: M. Mărgărit.

Two fragments were identified at Hârșova tell settlement, both of which can be considered debitage waste pieces. They come from the area under the outer burr, which was detached from the skull by percussion. For the first example (Fig. 8O), at the opposite end, segmentation was also achieved by percussion applied around the entire circumference, the final detachment being by bending. For the second piece, above the outer burr, a segmentation procedure by percussion can be identified, while the outer burr began to be removed by percussion.

Gumelnița B1

The antler was transformed into a hammer at the Gumelnița B1 level. A piece from Vitănești (Fig. 9A) was detached from the skull by percussion, followed by abrasion of the debitage edge. Also, the entire surface was decorticated by detaching the pearling through percussion, leaving visible marks. A perforation was made mesially by percussion (Fig. 9D) and bifacial rotation. The basal tine was segmented by percussion with regularization of the debitage edge by abrasion. A small fragment of the proximal end is also preserved, obtained through beam segmentation, without knowing the technique because the debitage edge was rigorously abraded. The active end seems to have been used in a percussion action – presenting a strongly smoothed area, with loss of material, and cutting marks superimposed by use-wear (Fig. 9B, C).

Two pieces from the Căscioarele tell settlement are bevelled tools. In both cases, the detachment from the skull was achieved by percussion. For the first specimen (Fig. 9E), at the mesial level, the area to be perforated was previously prepared by percussion. The perforation has a rectangular morphology obtained through alternative bilateral cutting. The piece is

Fig. 9. — Antler artifacts found at the Gumelnița B1 levels: **A**, hammer (Vitănești); **B**, **C**, details of the active area; **D**, percussion marks; **E**, bevelled tool (Căscioarele); **F**, preform (Căscioarele); **G**, undeterminated object (Căscioarele). Scale bars: A, E-G: 1 cm; B-D: 250 µm. Photos credits: M. Mărgărit.

broken at the level of an active front but still preserves a small area prepared by percussion. In the case of the second piece, above the outer burr, a perforation with rectangular morphology was made by percussion. The bevelled active end, now fractured, was prepared by unifacial percussion.

Two preforms were found at the same site. These include the area between the skull and the outer burr segmented at both ends by percussion. In the first case, a perforation with a rectangular morphology was arranged by percussion. It would have ensured a transversal handling. The elimination of the outer burr began by percussion. The procedure was not completed, and the piece was not used. For the second specimen (Fig. 9F), the outer burr was eliminated by percussion. The entire surface of the piece was regularized by percussion to eliminate the pearling. A perforation was initially arranged by rotation, applied alternatively bifacially, without the process being completed.

Four other pieces from Căscioarele are indeterminable in terms of functionality. They were certainly finished pieces. They are made, as in the case of other specimens, from the area under the outer burr. All fragments preserve a rectangular perforation made by bifacial percussion (Fig. 9G).

DISCUSSION

The study was conducted on 89 artifacts made of bone (n = 70) and antler from hunted animals (n = 19). Regarding the two phases compared, in A2 levels, 57 pieces could be identified, and in B1 levels, 32 artifacts. However, it should be noted that the number of Gumelnița B1 assemblages published is smaller and new studies are needed, so we cannot generalize the data.

For A2 levels (n = 47), the analysis of the assemblages showed, in terms of bone processing, a predominance of flat blanks (n = 39), in comparison with those preserving the anatomical shape (n = 8). The principle of segmentation debitage was retained to produce these blanks in volume with two practical options: one implementing a sectioning procedure by direct percussion, the other by sawing. Partioning *débitage* method was applied with variants that allowed the production of a variable number of blanks: bipartition (two blanks), quadripartition (four blanks), and successive partitions (a variable number of blanks depending on the way the bone was broken). This blank production by partioning

was achieved in most cases by double grooving, much less often by percussion or by a combination of percussion and grooving. A transformation scheme by direct shaping can be added, identified in the case of the processed astragalus and phalanx. For surface modification, abrasion was the most used technique. It is characterized by a flattened area on which fine, dense striations develop, parallel to each other, with a longitudinal or circular arrangement, depending on the direction of the friction process. It is seconded by scraping, sometimes both techniques being used. In this case, the specific traces are long, deep striations, parallel to each other, arranged parallel to the longitudinal axis of the artifact.

Another arrangement technique was perforation by rotation or percussion. In the first case, the perforation has a circular morphology, with concentric striations resulting from the rotation procedure; in the second situation, at the periphery of the perforation, small overlapping material removals resulting from the impact with the hammer are evident. In the case of the B1 levels, the information is extremely similar. Of the 23 bone pieces, only two preserve the anatomical volume. There are bones under processing that preserve technical stigmatas of so that these would also have ended up, eventually, as flat blanks. Also, the segmentation transformation scheme is identical with the same predominance of double grooving. Only in the case of transversal debitage, we did not identify the use of sawing. In the case of perforations, the only technical option was rotation. We can affirm that the productivity of the assemblages was high because the transformation schemes based on quadripartition or bipartition allow obtaining two/four similar blanks that can be transformed into finished objects.

In the case of pieces made of antler, there are fewer variables at the technical level. Regardless of the level from which they come, all blanks preserve the anatomical volume. In the context of a transverse exploitation of the bone block relative to its longitudinal axis, the only debitage method used was segmentation, which, moreover, has only one practical variant: sectioning by percussion. For surface modification, percussion was applied, especially to eliminate the pearling and, to a lesser extent, abrasion. Volume modification was achieved only through perforations, recording the following variants: percussion and the combination of percussion and rotation, at Gumelnița A2 contexts and rotation or percussion, at Gumelnița B1 contexts. As in the case of bone, we can say that the differences, at a technological or typological level, between the two phases of the Gumelnița culture are minimal. Antler blanks in volume were preferred because the tools were to be used for percussion actions (hammers and bevelled tools) and there was a need for robust, hard blanks that could withstand shocks. We can also invoke mechanical values more suitable for these types of tools, because antler is more elastic than bone, and according to this it is better adapted for the manufacture of various tools specific to prehistoric periods (e.g., Billamboz 1977; Michels & Zurbruchen 1991; Averbouh 2000; Riedel *et al.* 2004; Vercoutère *et al.* 2007). It absorbs shock and impact, due to the important proportion of organic matter in its structure (MacGregor 1985).

We must say that this analysis cannot give us a complete picture of the technological exploitation of red deer bones. This is primarily because in each archaeological assemblage, a large part of the pieces cannot be determined as raw material. For example, it can be seen that the *Cervus elaphus* ribs are either missing or that they were technologically transformed because they offer a special, wide and flat blank (Table 2). However, in all cases, it was only possible to establish that they come from species of the *Bos taurus* / *Cervus elaphus*, without a precise attribution. A second example is that of the metapodials. The radical transformation of the bone through technological interventions, again, makes it impossible to determine the species. We can take as an example level B1 from the Vitănești tell settlement. Here, 307 bone artifacts were inventoried, of which only 16 items could be attributed with certainty to the *Cervus elaphus* species. To these are added 20 bones belonging either to the species *Bos taurus* or to *Cervus elaphus* (Mărgărit *et al.* 2023). We see that, even if we take into account the bones that we can say come from large mammals, their number remains low within the assemblages. We would have expected a much higher number of pieces made from metapodials because we are talking about bones with a straight morphology, from which a high number of blanks with regular shapes could have been obtained through the quadripartition method present at all of the analyzed sites. Another example would be the site from Căscioarele, where the difference between the two levels (A2 and B1) is not significant in terms of number of pieces, although, as we have shown above, there are significant differences in the weight of osteological remains belonging to the *Cervus elaphus* species. We can continue with a comparison between the sites of Hârșova and Borduși, where the osteological remains belonging to wild animals do not exceed a quarter of the total remains, but where the artifacts that are the subject of this study are in comparable proportion or exceed the number of those from sites where hunting has a greater proportion (Tables 2, 3). For the site of Căscioarele, more interesting are the statistics related to the antlers from hunted red deer. Starting from the archaeozoological studies, we would have expected that such antlers would be much less numerous in the A2 level. Or, out of 14 antlers from hunted animals, eight come from the B1 level and six come from the A2 level. Furthermore, all items from the A2 level are hammers, while these hammers are absent in the B1 level.

The observation regarding the reduced weight within the assemblages remains valid also for the antlers from a hunted animal (*bois de massacre*) (Table. 2). There is a significant discrepancy between the number of antlers from a hunted animal and those that were shed. For example, at the Vitănești site, B1 level, 258 pieces made of antler were counted, of which only one piece was made of antler from a hunted animal, preserving a fragment of the skull next to the basilar area of the antler (Mărgărit *et al.* 2022). The shed antler is more suitable for processing because it no longer requires hunting the animal that bore it, thereby involving less effort. An antler from a hunted animal that has completed its structural and morphometric development possesses the same physical

TABLE 2. — Numerical distribution of artifacts according to typological category.

Raw material	Typological category	Bordușani	Carcaliu	Cunești	Hârșova	Luncavița	Căscioarele		Vitănești		Măriuța	TOTAL
Archaeological level		*A2*	*A2*	*A2*	*A2*	*A2*	*A2*	*B1*	*A2*	*B1*	*B1*	
Bone	Pointed tool	4	6	–	3	2	3	4	3	2	2	29
	Bevelled tool	–	–	2	2	–	–	–	1	2	–	7
	Needle	–	–	–	–	–	–	1	1	–	1	3
	Handle	–	–	–	2	–	–	–	–	–	–	2
	Processed phalanx	–	–	–	–	–	–	–	2	–	–	2
	Flattened astragalus	–	–	–	1	–	–	–	–	1	–	2
	Knife	–	–	–	–	–	–	–	–	1	–	1
	Spatula	–	–	–	–	–	–	–	1	–	–	1
	Hammer	1	–	–	–	–	–	–	–	–	–	1
	Undeterminated object	2	–	–	2	–	–	–	1	–	–	5
	Blank	–	–	–	2	–	–	–	–	6	–	8
	Waste	4	–	–	2	–	–	–	–	3	–	9
Antler	Hammer	1	–	–	–	–	6	–	–	1	–	8
	Bevelled tool	–	–	–	–	–	–	2	–	–	–	2
	Preform	–	–	–	–	–	–	2	–	–	–	2
	Undeterminated object	–	–	–	–	–	–	4	–	–	–	4
	Waste	1	–	–	2	–	–	–	–	–	–	3

TABLE 3. — Numerical distribution of artifacts according to raw material. *****, archaeological assemblages directly studied by the authors.

Skeleton elements	Bordușani*	Carcaliu	Cunești*	Hârșova*	Luncavița	Căscioarele*		Vitănești*		Măriuța*
Archaeological level	*A2*	*A2*	*A2*	*A2*	*A2*	*A2*	*B1*	*A2*	*B1*	*B1*
Antler	2	–	–	2	–	6	8	–	1	–
Astragalus	–	–	–	1	–	–	–	–	1	–
Mandible	–	–	1	–	–	–	–	–	–	–
Radius	1	–	–	–	–	–	–	–	–	–
Ulna	–	–	1	1	–	–	–	–	1	–
Metacarpus	–	–	–	–	–	–	–	–	5	–
Metapodialus	9	6	–	9	2	3	5	6	4	1
Femur	–	–	–	1	–	–	–	–	–	–
Tibia	–	–	–	1	–	–	–	1	–	–
Metatarsus	1	–	–	1	–	–	–	–	4	2
Phalanx	–	–	–	–	–	–	–	2	–	–
TOTAL	13	6	2	16	2	9	13	9	16	3

properties as a shed antler, both of which are fully developed. This provides valuable insights into the desired properties (sometimes, partially developed antlers are used, and obviously, the same properties are not functionally sought) as well as indications of the harvest season, in addition to the information provided by taphonomic changes observed in archaeological antlers (Averbouh 2000). In this case, we think it is about a good knowledge of the mechanical properties of the raw materials.

CONCLUSIONS

We can state that there are no significant differences between the two phases of the Gumelnița culture, neither at the level of selected bone types, nor at the typological or technological level, a valid observation especially when we have the possibility to compare sites that contain remains from both phases (e.g., Vitănești and Căscioarele tell settlements). What is valid for all the analyzed sites, however, is the fact that the number of artifacts made from *Cervus elaphus* bones remains constantly reduced within the osseous industries, even if it was the main game in some sites. The selection of blocks also depended on other factors besides the economic ones. And here, we also reach the cultural determinant often mentioned in literature. The two determinants (economic *versus* cultural) seem to complement one another, meaning that the knowledge concerning which parts of the animal skeleton may be used, materialized in the collective memory (Averbouh 2003; Choyke & Daróczi-Szabó 2010). It was observed that the changes in the selection of raw materials suffered insignificant modifications during long periods of time, although modifications of the species availability took place (Choyke *et al.* 2004; Luik 2009, 2011). To support this observation, we can mention the case of *Cervus elaphus* canines. At the settlement of Cunești, a *Bos taurus* molar were processed and used as pendant. The surface was, thus, modifying the natural shape, in order to imitate a red deer canine. At the Gumelnița tell settlement, a red deer canine was imitated in limestone. To date, there were no perforated red deer canines from this period, while teeth turned into pendants were *quasi*-absent (Mărgărit 2019). This was probably a cultural choice, although red deer was abundantly hunted by the Gumelnița communities as already detailed. Instead,

these teeth were remembered through imitations so that the symbolism of this tooth became special. This option reflects the ways in which the animal materialized as a symbol in the context of human behavior. We can conclude that although our approach was initiated to identify the economic significance of the red deer within the Gumelnița communities, it was ultimately proven that its exploitation was also subject to cultural determinants. This suggests that the cultural values, symbolic meanings, and social distinctions associated with red deer and other animal remains played a decisive role in shaping their selection and treatment, highlighting the importance of symbolic and ritual considerations over mere economic or practical factors in these communities.

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