BONES AT A CROSSROADS

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BONES AT A CROSSROADS

INTEGRATING WORKED BONE RESEARCH WITH ARCHAEOMETRY AND SOCIAL ZOOARCHAEOLOGY

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Osseous artifacts from the Maros-culture necropolis at Ostojićevo (northern Serbia)

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Abstract

The Bronze Age Maros culture, widespread in the southern parts of the Carpathian basin, is characterized by the rich and diverse material culture recovered from settlements and necropoles. Some of the burials of the Maros culture contained rich funerary equipment that encompassed ceramic vessels, bronze weapons, bronze and gold jewellery, as well as ornaments made from osseous raw materials. One of the necropoles that yielded interesting finds of bone ornaments was discovered at the site of Ostojićevo, situated in the Banat region in northeastern Serbia. This necropolis contained graves belonging to the Early and Middle Bronze Age; out of 285 graves, 77 were attributed to the Maros culture. Osseous ornaments recovered from these graves were made from diverse raw materials, bones, teeth, and mollusc shells. The typological repertoire includes pendants, beads, decorative pins, and applications. Their typological and technological traits as well traces of use are analyzed, highlighting their overall importance and symbolic role for Maros culture communities.

Rezime

Bronzanodopska kultura Maroš bila je rasprostranjena u južnim oblastima Karpatskog basena, i karakteriše je bogata i raznovrsna materijalna kultura, otkrivena u naseljima i na nekropolama. Pojedini grobovi maroške kulture sadržali su bogati pogrebni invenar, koji je obuhvatao keramičke posude, bronzano oružje, bronzani i zlatni nakit, kao i ukrase izrađene od koštanih sirovina. Jedna od nekropola sa koje potiču zanimljivi nalazi koštanog nakita otkrivena je na lokalitetu Ostojićevo, koji se nalazi u Banatu u severoistočnoj Srbiji. Na ovoj nekropoli otkriveno je ukupno 285 grobova iz ranog i srednjeg bronzanog doba, od čega 77 grobova pripada nosiocima maroške kulture. Koštani ornamenti pronađeni u ovim grobovima izrađeni su od različitih sirovina – od kostiju, zuba i ljuštura mekušaca. Tipološki repertoar obuhvata priveske, perle, ukrasne igle i aplikacije. Analizirane su njihove tipološke i tehnološke odlike, kao i tragovi upotrebe, koji pokazuju značaj i simboličku ulogu ovih ukrasa u okvrima zajednica maroške kulture.

Keywords: Bronze Age, osseous raw materials, personal ornaments, beads

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The archaeological background: The Bronze Age Maros culture

The Bronze Age culture labelled Maros (Moriš) was a widespread phenomenon in the southern Carpathian basin among the valleys of the Tisza (Tisa) and Maros (Moriš or Mureş) rivers in present-day southeastern Hungary, northwestern Serbia, and southwestern Romania (Tasić 1974; Garašanin 1983; O'Shea 1996). The culture is usually labeled "Maros" or "Moriš," but the terms "Periamos" or "Mokrin culture" may be encountered in the earlier literature (Garašanin 1983, 476).

Research on this culture began over 100 years ago, and numerous sites are known today, including flat and tell settlement sites and necropoles (Garašanin 1983; O'Shea 1996; and references therein). Among them, we may outline the tell settlements of Pecica-Şanţul Mare (O'Shea e*t al.* 2005; O'Shea *et al.* 2006; O'Shea *et al.* 2011) and Perjámos-Sánchalom (Periam) in Romania and Klárafalva-Hajdova in Hungary (O'Shea 1996) as well as the flat settlements Ószentiván-Nagyhalom in Hungary (O'Shea 1996) and Popin Paor in Serbia (Girić 1987). Necropoles have been more extensively researched and include sites such as Szöreg (with 229 burials), Batanya (79), and Pitvaros (42) in Hungary (Tasić 1974; O'Shea 1996), and Mokrin (Girić 1971) and Ostojićevo-Stari Vinogradi in Serbia (Milašinović 2008; 2009). Mokrin, situated 12 km from present-day Kikinda, can be singled out as one of the most important sites. This is the largest Maros culture cemetery, with 312 graves uncovered. It was extensively excavated in the 1960s using then-current recovery techniques and, importantly, thoroughly analyzed and published by the excavator (Girić 1971). The analysis of the excavated archaeological and anthropological remains continues today with the application of novel methodological approaches and techniques (*e.g.,* Žegarac *et al.* 2019).

Absolute dates obtained from the necropolis in Mokrin place it in the period between the 21st and 19th centuries BC, while the site of Klárafalva is dated to the period between the 23rd and 16th centuries BC (Forenbaher 1993; O'Shea 1996, 37; and references therein).[1] In the past few decades, new analyses have been done, and new dates have been obtained for the Bronze Age in the Carpathian basin; therefore the chronology is constantly being revised (see Szabó 2017 for a full discussion of the problem).

The Maros culture communities practiced agriculture and herded domestic animals – cattle (*Bos taurus*), sheep (*Ovis aries*), goats (*Capra hircus*), pigs (*Sus scrofa*), horses (*Equus*), and dogs (*Canis familiaris*)–while wild species had a minor role. Cattle, sheep, and goats were exploited for both primary (for meat, but also for skin and bones) and secondary products (milk, wool, and traction) (Greenfield 2001). Metallurgy played an important role in the economy; metal became more common in comparison with previous periods, and metal artifacts increased in frequency towards the end of the Early Bronze Age. It is interesting, however, that majority were weapons and ornaments, while utilitarian items were less frequent (Garašanin 1983; O'Shea 1996).

The European Bronze Age is generally perceived as the time when important changes in social structures occurred and social stratification emerged (Dani *et al.* 2016, 219). The rich and diverse burial rites and funerary equipment recovered from

1 Uncalibrated (BP) dates obtained from the necropolis at Mokrin are following: 3690 ± 30 (GrN-14179), 3655 ± 30 (GrN-14178), 3650 ± 50 (GrN-7977), 3650 ± 35 (GrN-14180), 3595 ± 35 (GrN-14181) and 3500 ± 35(GrN-8809) (Forenbaher 1993, t. 1, 244; also listed in O'Shea 1996, 37; Szabó 2017, t. 1, 112). Extensive lists of available dates for the Bronze Age in the Carpathian basin are provided in Forenbaher 1993; O'Shea 1996, 37, table 3.1; Szabó 2017 – please see them for further discussion.

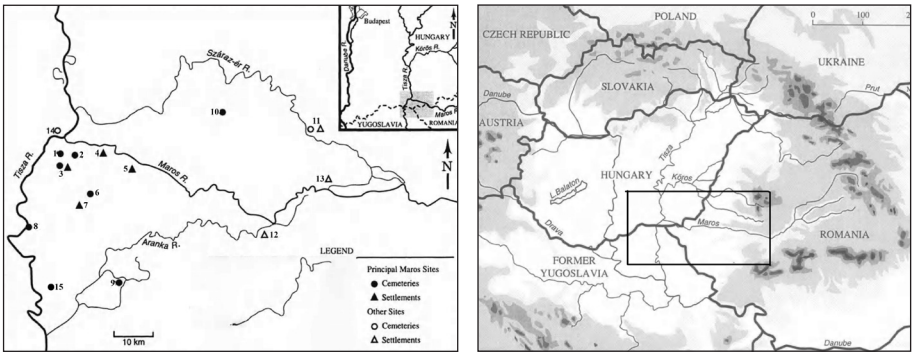

Figure 1. Map of the Maros culture: 1. Szöreg, 2. Deszk A, F, 3. Ósentiván, 4. Klárafalva-Hajdova, 5. Kiszombor-Új Élet, 6. Óbeba, 7. Rabe, 8. Novi Kneževac, 9. Mokrin, 10. Pitvaros, 11. Battonya, 12. Perjámos, 13. Pécska, 14. Tápé, and 15. Ostojićevo (adapted after O'Shea 1996; Milašinović 2009).

Maros culture cemeteries were the basis for the studies of social stratification in this period in the southern Carpathian basin. Numerous researchers were interested in this topic (*e.g.*, Soroceanu 1975; Primas 1977). The most comprehensive analysis of the society was carried out by J. O'Shea (O'Shea 1996), and later studies relied on his methodological and theoretical framework (Milašinović 2008; 2009). O'Shea included the data from all the studies of cemeteries of the Maros group available at the time – Mokrin, Szöreg, Deszk A, Deszk F, Ószentiván, and Óbéba. He distinguished a "normative" burial mode (flexed inhumation, facing east), which represents the standard form that a community member could expect on death, and a series of differentiated modes. He argued that some of them, such as weapons and certain head ornaments, may be signs of hereditary social office, while other items, notably body ornaments, are seen as representing "associative" wealth, that is, wealth derived from membership of a particular household by the person possessing it (O'Shea 1996; cf. also Harding 2004).

The site of Ostojićevo-Stari Vinogradi

The site of Ostojićevo-Stari Vinogradi is situated in the Banat region in northeastern Serbia, 24 km northwest of present-day Kikinda (Figure 1). The site itself is located on the left bank of a now-dry meander of the Tisza river. Along with the nearby Mokrin, it is one of the largest Bronze Age cemeteries discovered in Serbia, and one of the most important cemeteries of the Maros culture. The site was first noted in 1954 and excavated in the period between 1981 and 1991 by the National Museum of Kikinda (Girić 1959; Milašinović 2008; 2009). The excavated area exposed 3886 m^2 in 136 trenches, where 285 graves dating to the Early and Middle Bronze Age were discovered. Seventy-seven graves were attributed to the Maros culture; it was possible to clearly discern these burials by differences in depth and a clear hiatus in the stratigraphy (Milašinović 2009). Unlike Mokrin, the examination of archaeological and anthropological remains from this site was only partially completed (Milašinović 2008; Vučetić 2018), and further analyses are to ensue.

Ornaments from osseous raw materials from Ostojićevo

A rich funerary inventory is one of the hallmarks of the Maros culture, and the attention of researchers often focused on analyzing archaeological evidence obtained from the cemeteries. As mentioned above, studies have mainly been concentrated on social relations and social hierarchy, as evidenced by the differences in burial rites and funerary equipment; metal objects especially have received more attention. However, personal ornaments made from osseous raw materials also provide some insight into social relations and symbolic worldviews of the Maros-culture communities.

Ornaments made from osseous raw materials were discovered in 20 of the 77 graves from the necropolis at Ostojićevo attributed to the Maros culture (Table 1). These ornaments were analyzed from technological and typological viewpoints. They were examined with a hand lens and a microscope with magnification up to 60x. Analytical criteria for the technological and functional interpretation of manufacture and usewear traces were established based on the previous work of numerous authors (Bonnardin 2008; 2009; Christidou 2008; d'Errico 1993; Legrand and Sidéra 2006; Newcomer 1974; Peltier 1986; Semenov 1976).

Raw materials

The osseous raw materials used include bones, teeth, and mollusc shells.

The bones were mainly those of medium or small mammals, predominantly sheep/goats, followed by cattle and pigs. The teeth were predominantly canines from domestic dogs, with occasional use of the canines of red deer (*Cervus elaphus*), cattle incisors, and teeth from pigs; one specimen was a horse tooth. Almost exclusively, skeletal elements from domestic animals were used; they were most likely obtained locally. Ornaments made from antler were not noted at Ostojićevo, although red deer antlers were otherwise used for everyday tools at the Maros-culture settlement of Pecica-Şanţul Mare (Nicodemus, Lemke 2016).

The mollusc shells include valves of *Glycymeris*, shells of *Dentalium*, *Columbella*, and fragments of shells that could not be identified, mainly due to heavy erosion of the surfaces and fragmentation. At least some of them were obtained via some sort of exchange; there is a possibility, though, that some of them were in fact fossil shells obtained almost locally (directly or through a local exchange network).[2]

Typological repertoire

Artifacts were classified following the typological scheme outlined by H. Camps-Fabrer and colleagues in *Fiches typologiques* (Camps-Fabrer 1991) and the scheme proposed by S. Bonnardin (Bonnardin 2008; 2009, 57-67) adapted to the particular assemblage of the Maros culture.[3] Such classification includes the following main types: pendants, beads, decorative pins, and applications. Subtypes and variants were defined using the morphological criteria and raw material.

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2 The criteria for distinguishing fossil from fresh molluscs follow Dimitrijević, Tripković 2006; cf. also Dimitrijević *et al.* 2010 and Dimitrijević 2014 for the availability of fossil *Dentalium* shells in the Danube valley. However, the small sample size and poor preservation at Ostojićevo do not allow firm conclusions regarding the origins of the molluscs.

3 See the typological scheme proposed for Mokrin in Vitezović 2017 and the more detailed beads only in Vitezović *in press.*

Grave no.	Osseous artifacts
35	Perforated teeth of *Canis familiaris* (n=1)
79	Perforated teeth of *Canis familiaris* (n=26) Decorative pins (n=2)
107	Triangular application (n=1) Beads made from long bones (n=6) Perforated teeth (total=28) of *Canis familiaris* (n=20) of *Bos* (n=4) of *Cervus elaphus* (n=3) of *Equus* (n=1)
114	Beads made from *Dentalium* (n=3) Beads made from long bones (n=2)
120	Beads made from *Dentalium* (n=5) Beads made from long bones (n=28) Beads made from other molluscs (n=2) Applications made from *Bivalvia, Glycymeris,* and undetermined (n=5)
126	Decorative pins (n=2)
128	Beads made from long bones (n=5) Perforated teeth (total=9) of *Canis familiaris* (n=3) of *Bos* (n=4) of *Sus scrofa* (n=2)
141	Decorative pins (n=2) Semi-globular application (n=1)
147	Triangular application (n=1) Discoid application (n=1) Fragmented tooth of *Sus scrofa*, unidentified artifact (n=1)
166	Decorative needle (n=1)
184	Decorative pins (n=2)
186	Beads made from *Dentalium* (n=2)
190	Elongated pendant (n=1) Discoid application (n=1)
226	Bead made from *Dentalium* (n=1)
227	Fragmented tooth of *Sus scrofa,* unidentified artifact (n=1)
229	Perforated tooth of *Canis familiaris* (n=1)
230	Beads made from *Dentalium* (n=3) Beads made from *Columbella* (n=2) Applications made from *Bivalvia, Glycymeris,* and undetermined (n=3)
250	Beads made from *Dentalium* (n=3) Fragment of *Unio* shell (it is not certain whether it is an artifact)
280	Beads made from *Columbella* (n=7)
283	Beads made from *Columbella* (n=1)

Table 1. List of Maros culture graves from Ostojićevo and osseous ornaments discovered within them.

Pendants

Pendants are decorative objects that are suspended or attached by their upper part while their lower part is free; they have at one end (in the upper part) a perforation or, rarely, a groove used for suspension (Taborin 1991).

Two subtypes of pendants can be distinguished in the material from Ostojićevo, A (perforated animal teeth) and B (shell valves with perforations) (type A is after Bonnardin 2009 – *coquillage et dents simplement percées*); additionally, one unique pendant from bone was discovered.

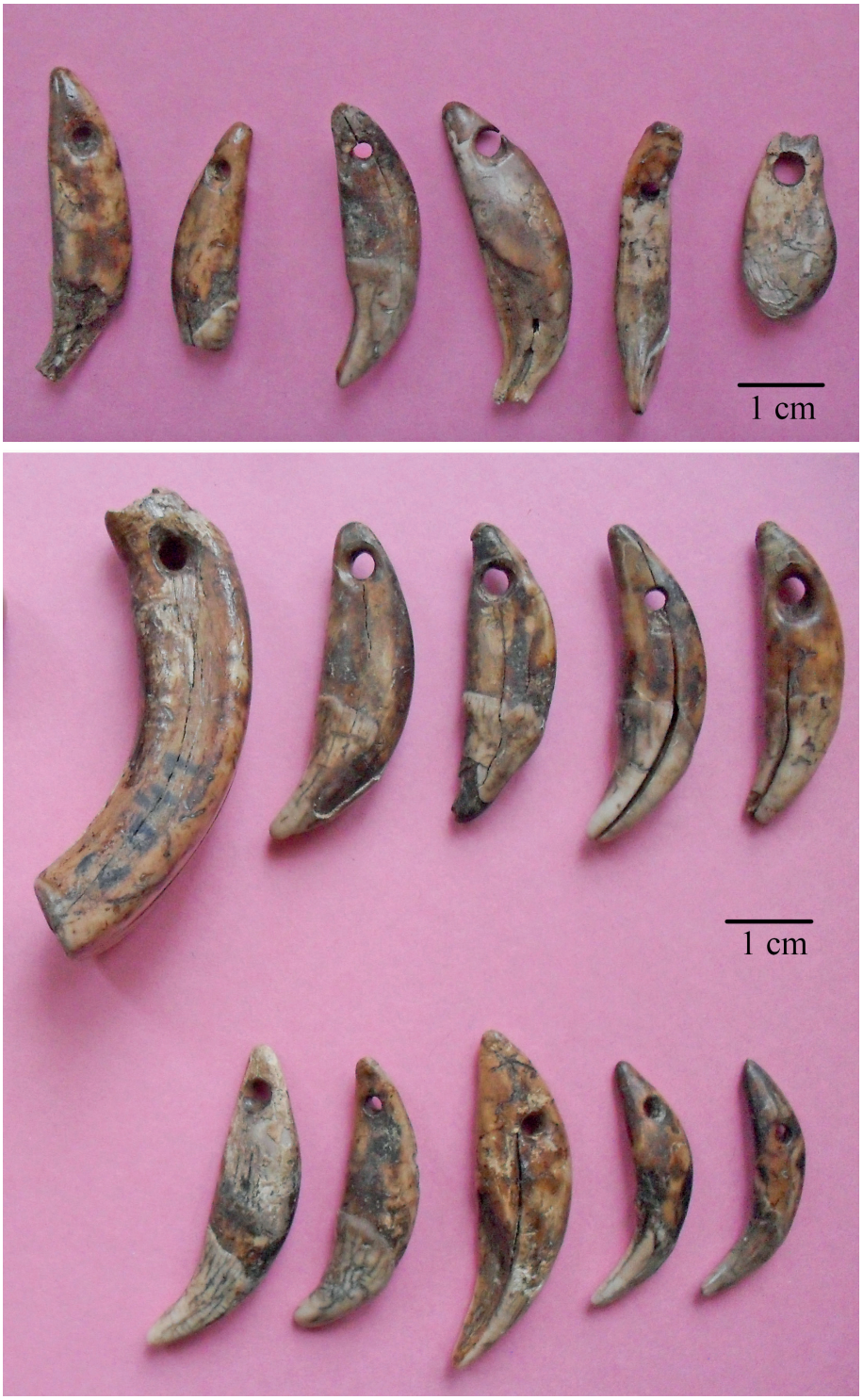

Figure 2. Some of the perforated teeth from grave no. 107, including red deer teeth (upper row, last one) and an *Equus* tooth (second row, first to the left).

Perforated animal teeth are the most common ornament among the osseous raw materials at Ostojićevo (Figure 2). They were produced simply by drilling a perforation at the root, usually from both sides. Regular concentric lines from drilling are still visible inside some of them. On some of the teeth, the surface was slightly scraped before drilling was initiated. The diameter of these perforations is 2-3 mm. The quantities of perforated teeth vary considerably (Table 1); while some burials contain just one perforated tooth (for example, grave no. 35), in others they are quite numerous: 26 teeth were recovered from grave no. 79 and 20 from grave no. 107 (Figure 2).

The traces of use on the perforated teeth from Ostojićevo consist of intensive polish and wear in the area of the perforation; usually, the upper part of the perforation has more prominent polish and wear, which is consistent with suspension (Figure 3). Occasionally, the perforations are deformed from use or even broken. It is interesting to note that the intensity of usewear differs considerably on the different specimens, even those from the same burial. While some of the pendants are completely worn down, others were barely used. This shows that these ornaments were worn during the life of the buried individual and at the same time implies something else: that the composite ornaments containing these teeth were enriched and/or repaired over time by adding new pieces and/or replacing the broken ones. It is possible that some were even inherited.

Canine teeth from *Canidae* were prevalent and probably all from dogs. Teeth from other species are rare. In addition to dog teeth, grave no. 107 contained four cattle teeth, two red deer teeth, and one horse tooth (Figure 2). Among nine teeth found in grave no. 128, three were from dogs, four from cattle, and two from pigs. It is not clear, however, whether the various species had different meanings or simply a substitute for the otherwise preferred dog teeth. Perforated teeth were also frequent at Mokrin, and there the predominant species was also dog (Vitezović 2017, 70). One perforated dog tooth was found at the Maros culture settlement at Pecica-Şanţul Mare (Nicodemus and Lemke 2016).

Perforated animal teeth are generally a common and widespread type of personal ornament and have been widely used since the Palaeolithic (Cattelain 2012). They remained in use in the metal ages and are commonly encountered at other Bronze Age sites in the region. Diverse species are represented, but the relatively frequent presence of dog teeth is conspicuous, suggesting that a certain symbolic meaning attributed to dog teeth was common for many Bronze Age communities. For example, at the Monteoru culture site of Năeni-Zănoaga Cetatea 2 in Romania, perforated canines from domestic dogs were noted together with a cattle incisor and a red deer canine (Mărgărit *et al.* 2011, 17-18; Figure 4). Pendants from dog and wild boar (*Sus scrofa*) teeth were discovered at the Early and early Middle Bronze Age site of Tiszaug-Kéménytető in Hungary (Choyke and Bartosiewicz 2000; Figure 4), while at the Middle Bronze Age site of Jászdózsa-Kápolnahalom, perforated teeth from domestic dogs, pigs, horses and different wild animals were found (Choyke and Bartosiewicz 2009).

The second subtype of pendants are single valves of *Bivalvia* shells with a perforation at the apex (Figure 4). Only the *Glycymeris* shells were identified with certainty (some of the shells were too fragmented). They were not frequent; five were discovered in grave no. 120 and three in grave no. 230 (Table 1). These shells are generally poorly preserved, with eroded surfaces, and fragmented; furthermore, the perforations have intensive traces of wear. Therefore, it is not possible to reconstruct with certainty the method of

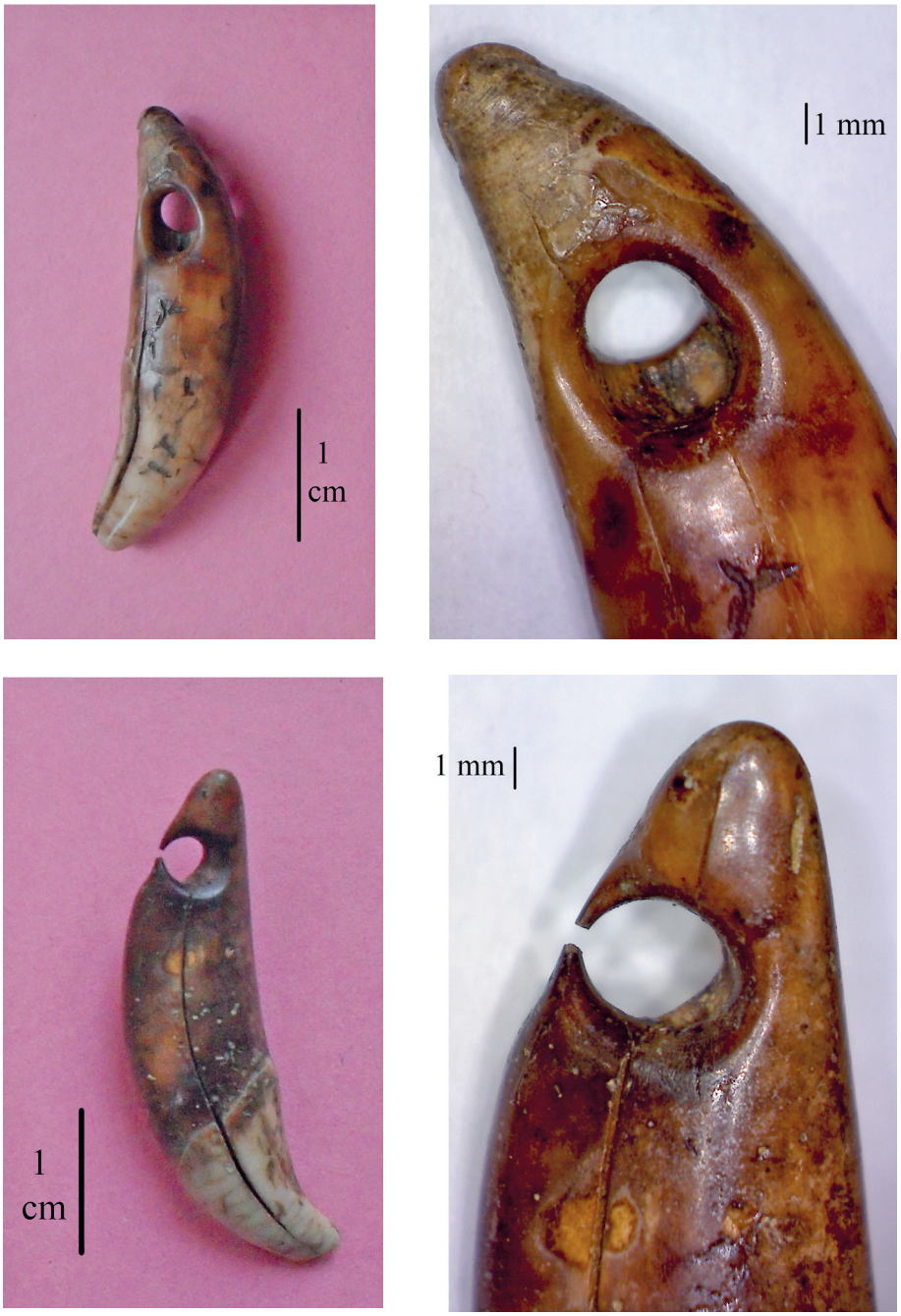

Figure 3. Perforated teeth from grave no. 107: upper row – anterior side of one of the teeth and details of the traces of manufacture and use on the perforation; lower row – posterior side of the tooth with the perforation broken from use and details of the traces of manufacture and use.

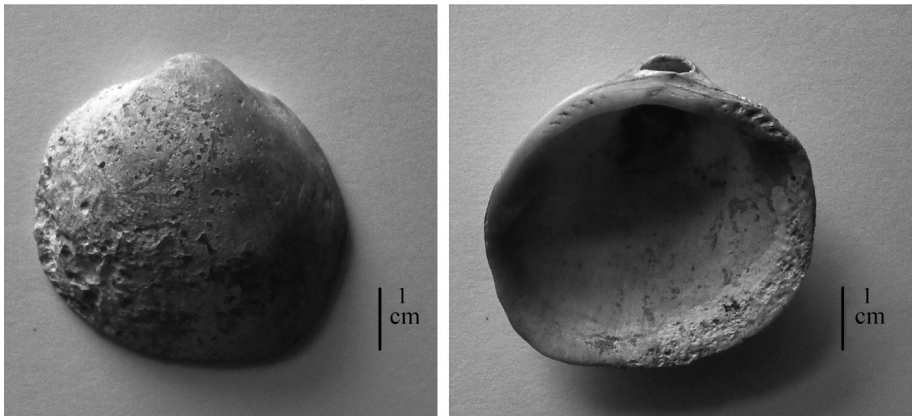

Figure 4. Pendant made from *Glycymeris* shell, grave no. 120, anterior and posterior sides.

manufacture. It is possible that the shell surface was first abraded and then pierced. The usewear consists of polish, and sometimes the perforation is not regular but deformed.

One quite unusual pendant made from a complete lateral metatarsal bone of *Sus scrofa* was discovered in grave no. 190. It was not modified except for a perforation on the upper part, made by drilling, and worn and polished from use. Exact analogies for such an object are unknown at present. It is interesting to note, however, the presence of drilled hare and dog metapodial bones at the Middle Bronze Age site of Százhalombatta-Földvár in Hungary (Choyke *et al.* 2003).

Beads

Smaller objects of different shapes and sizes, with central, usually vertical perforations positioned in such a way that they could be lined up on a string, are classified as beads (Barge-Mahieu 1991). Three subtypes of beads were distinguished at the necropolis at Mokrin (Vitezović *in press*), and two of these subtypes are present at Ostojićevo: A, elongated cylindrical or barrel shaped beads, and C, irregular beads, while the remaining subtype (B, discoid beads), was not noted.[4]

The most common subtype consists of elongated tubular beads (*perle tubulaire*, type B2 after Bonnardin 2009) (Figure 5). These are cylindrical or barrel-shaped, and two variants, made from different raw materials, may be distinguished: beads from minimally modified *Dentalium* shells (variant A1) and beads produced from bones (variant A2).

Dentalium beads were quite simple, produced from minimally modified shells – the ends of the shell were just broken or cut off in order to use the widest, mesial segment, or perhaps already broken shell segments were simply collected and used. Their outer surfaces are often weathered and eroded, hence it is not possible to determine whether they were fossil or fresh.[5] They are up to 25 mm long and usually 7 mm wide. *Dentalium* beads were not frequent at Ostojićevo; for example, in burial no. 120, five such beads

4 Discoid beads were labelled as subtype B beads in the Mokrin assemblage (Vitezović *in press);* that is why subtypes A and C are listed here.

5 For the availability of fossil *Dentalium* shells in the Danube valley in Serbia and their use by Neolithic communities, see Dimitrijević *et al.* 2010 and Dimitrijević 2014.

Figure 5. Elongated cylindrical beads made from bone, grave no. 120.

were discovered, and in burial no. 186, only two were found (Table 1). *Dentalium* beads were found at the Mokrin necropolis as well (Vitezović 2017, 67; *in press*), and this type of ornament was present throughout prehistory, in the Mesolithic, the Neolithic, and the metal ages (*e.g.*, Taborin 2004; Dimitrijević 2014).

The second variant consists of beads made from smaller long bones, probably all metapodial bones from smaller ungulates (mainly or even exclusively sheep/goats) (Figure 5). They were produced by transverse division of the bone diaphysis: after the epiphyses were removed, a transversal groove was made. After that, the bone was cut through by sawing, and sometimes we may notice traces of the sawing near the edge. Finally, either the bone was completely cut through or a small portion was broken or snapped off. The cross-section of the cut is therefore either completely smooth and straight, or somewhat irregular or ragged, or has a small piece of excess bone (from the piece from which it was cut off). Manufacturing traces are not well preserved due to taphonomic weathering and usewear traces; therefore, it is not possible to determine which tools were used, but it seems that chipped stone tools, not metal ones, were used.[6]

Depending on the part of the bone that was used, the shape of these beads was more or less cylindrical or slightly barrel-shaped, *i.e.*, the outer surface was straight or slightly biconical. There is no clear border between cylindrical- and barrel-shaped beads; the differences are gradual rather than sharp, and this is why they were grouped together. This difference is not only barely noticeable, which makes it difficult to assign them to either shape, but also has no significance, since the beads share other technological traits and these final variations in shape were not intentional.

6 The criteria for distinguishing chipped stone from metal tool marks follow Christidou 2008 and Semenov 1976.

One bead, from grave no. 120, stands out. It has a groove in its mesial part, which makes its shape resemble the number 8 (Figure 5). It was produced in the same manner as the remaining beads; this groove is simply the trace of an unfinished groove for transverse cutting. A similar method of making a decoration on beads, by marking a groove on the mesial part, has also been noted at Mokrin (Vitezović *in press*).

The dimensions of these beads vary slightly, suggesting there was no pre-determined template for them. Their length ranges from 8 mm to 13 mm, which means that from a single metapodial bone, several beads could have been produced. The traces of use that can be observed on these beads are polish and shine, the result of contact with soft materials, such as clothes.[7] These beads could have been arranged on a string as part of a composite necklace or bracelet, sewn to clothes (dress, cloak, belt, …), *etc*.

Bone beads were more frequent in Ostojićevo burials than those made from mollusc shells. The richest grave was no. 120, where 28 beads were recovered. These beads are in every aspect similar to those recovered from Mokrin; the only exception is that at Mokrin, a few more of the beads with grooves were found (Vitezović *in press*). Similar beads have been encountered at other Bronze Age necropoles in the southern Carpathian basin and in central Europe, *e.g.,* at the Early Bronze Age site of Kichary Nowe in southeastern Poland (Winnicka 2016), at the Middle Bronze Age site of Jászdózsa-Kápolnahalom in Hungary (Csányi and Tárnoki 1992, 194, cat. 264), or the Late Bronze Age site of Mačkovac in eastern Croatia (Kalafatić *et al.* 2016).

Other beads found at Ostojićevo belong to the subtype of irregular beads produced from almost entire shells of *Columbella* snails. *Columbellae*, mainly and probably exclusively *Columbella rustica*, were used with minimal modification. In the central part of the shell they have perforations, usually of irregular circular shape, made by piercing. The perforated surface is often worn from use.

Columbella beads were rare – they were noted in only three graves; seven beads in grave no. 208, two in grave no. 230, and just one in grave no. 283 (Table 1). Graves containing *Columbella* beads at Mokrin also contained other objects considered luxurious – for example, in grave no. 12, one *Columbella* bead was discovered along with several ornamental items made from gold (Girić 1971, 100; Vitezović *in press*).

Columbella shells were used for producing beads throughout prehistory (*e.g.,* Taborin 2004). It is interesting to note that one such bead was discovered at the Maros culture settlement of Pecica-Şanţul Mare in Romania (Nicodemus, Lemke 2016, Figure 2b), showing these items were worn daily and were not restricted to funeral equipment.

A few more objects made from shell segments may be classified as irregular beads. One is made from an unidentified *Gastropoda* shell with heavily eroded surfaces, and the remaining two are from irregular segments of shells (one being the innermost segment of *Gastropoda*). These were probably recycled ornaments from broken pieces of other shell ornaments.

7 Criteria for analyses of usewear traces follow Bonnardin 2008 and 2009; also d'Errico 1993 and Semenov 1976.

Figure 6. Decorative pins with perforations from grave no. 184.

Decorative pins

Decorative pins are elongated objects with elaborated heads on the basal part and pointed distal ends (Camps-Fabrer 1991).

The pins recovered at Ostojićevo were made from metapodial bones of small ruminants (*Ovis/Capra*), except for one, which was made from a pig fibula (Figure 6). The metapodial bones were longitudinally split, and the proximal segments, with a very small portion of the epiphysis retained at the basal part, were modified into pointed objects. Their cross-section is smaller than semi-circular, *i.e.,* a segment that was less than one longitudinal half of the bone was used. On some of them, traces from scraping with a chipped stone tool are preserved along the side edges and sometimes on both ventral and dorsal surfaces. Handling polish is preserved on some of them. Their overall preservation, however, is not very good, and some are fragmented.

These pins usually have small perforation, with diameter 2-3 mm, made near the base (only those from grave no. 126 are not perforated). They were probably perforated with the same tool used for drilling teeth. These perforations are often polished and slightly deformed from use. Typologically and technologically they are identical to those recovered from the necropolis at Mokrin (Vitezović 2017, 72-73). The only exception is the pointed object made from fibula of *Sus scrofa*, from grave no. 166. Its basal part is fragmented, and it has a fine, pointed end, but the concretions on its surface cover any possible traces of manufacture or use.

The pins at Ostojićevo were generally found in pairs,[8] although this is not a strict rule for all of the Maros culture necropoles (O'Shea 1996, 190). These pins were most likely used for fastening clothes. They were almost exclusively found in female graves, and they are considered markers of the high social status of the buried individual (O'Shea 1996, 189; Milašinović 2009, 67).

8 The only exception is grave no. 166, but this pin differs from the others by its raw material.

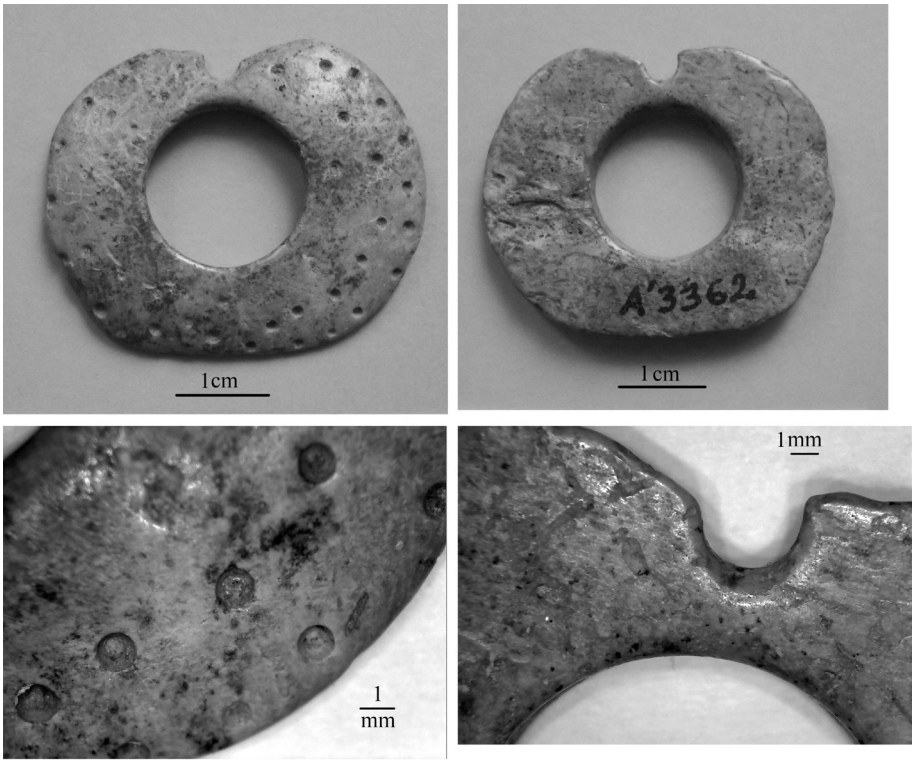

Figure 7. Discoid application from grave no. 147: Anterior and posterior sides and details of the dotted decoration and broken perforation.

Perforated pointed artifacts made from long bones were common at other Bronze Age sites in the Carpathian basin, although it is possible that they had other functions as well. They are noted at the sites of Jászdózsa-Kápolnahalom (Csányi and Tárnoki 1992, 195, cat. 283), Túrkeve-Terehalom (Csányi and Tárnoki 1992, 195, cat. 284), and Tiszaug-Kéménytető in Hungary (Choyke and Bartosiewicz 2000, Figure 4/1), as well as at Năeni-Zănoaga Cetatea 2 in Romania (Mărgărit *et al.* 2011).

Applications

This type of ornament encompasses diverse forms of items used as some sort of application, most likely attached to clothes. They are rather unique in shape and not as numerous as, for example, the beads or the pendants. Two applications have more-or-less triangular shapes, two have discoid shapes, and one possible application is semi-globular in shape.

Triangular applications were found in graves no. 107 and 147. Both are made from hyoid bones of *Bos*. The one from grave no. 147 has lateral ends cut off. At the apex of the triangle, there is one broken perforation with another immediately below it, worn from use, that was probably made after the first one broke. This new perforation, with R=3 mm, is also worn from use, and the traces of usewear polish are visible all over the artifact. The other application, from grave no. 107, is fragmented, but we may assume it resembled the first one.

The discoid applications, discovered in graves nos. 147 (Figure 7) and 190, were produced from segments of large long bones from a large mammal. The blanks were cut from the

diaphysis and then modified into discoid shape with central large perforations. Traces of manufacture are not preserved, but they were probably finalized by abrasion. The edges are polished and worn from use. They have relatively large perforations in the center.

The application from grave no. 147 is also ornamented. It has small dots on its outer side made by superficial drilling. They run around the circumference of the application, organized into two rows. This application also had one smaller perforation at the side that was made by drilling, broken from use, and intensively polished. The entire artifact has intensive traces of polish from manipulation and contact with soft organic materials.

Morphologically similar to those is one discoid-shaped application made from red deer antler from Mokrin, grave no. 245 (Vitezović 2017, 74).

Another osseous artifact that may have been used as application was discovered in the grave no. 141. It was more-or-less semi-globular in shape and made from the head of the femur of a large mammal. This bone segment was transversally divided in two; the used half was also cut on the outer side to make both surfaces flat, *i.e.,* it has a truncated semi-globular shape. Handling polish can be noted on it. It is possible, however, that it was a functional object (a spindle whorl) and not an ornament.

Discussion

Although the Maros culture is known for its developed metallurgy and rich bronze and gold jewellery, osseous raw materials were still widely in use for the production of personal ornaments. In fact, they kept their importance, aesthetic, and symbolic role. Some of the symbolic value lies in the raw material itself – in its origin and/or physical and mechanical properties.

In case of perforated teeth, we may note the careful selection of species and type of teeth (predominantly canines, teeth that usually stand out by their shape), as well as the prolonged use and instances of repair of these pendants. Perforated teeth were mainly found in female graves, and perhaps their symbolic meaning included display of status and/or belonging to a group. A preference for dog teeth is apparent, perhaps because their elongated, slightly crescent-like shape was aesthetically attractive, but this may also be linked with a meaning attributed to them (a display of prestige, status, and/or symbolic value attributed to dogs). Whether dogs as a species had specific symbolic meaning is difficult to say at this point, although the preference for dog teeth not only among Maros culture communities but also within some other Bronze Age cultures[9] suggests the possibility that indeed a certain symbolic meaning and value was attributed to dogs.[10]

Antler was not noted in the assemblage from Ostojićevo, and at Mokrin it occurs rarely (Vitezović 2017). In contrast, it was frequent in the assemblage from the settlement of Pecica-Şanţul Mare (Nicodemus and Lemke 2016); it is difficult to assess whether it was considered inadequate for ornaments or more valuable for production of tools.

As for the distribution of the certain types of raw material in different graves, some patterns emerge, but are inconclusive (Tables 2 and 3). Some graves (*e.g.,* nos. 107, 120, and 128) are richer and have larger quantities and greater diversity of ornaments. Graves

9 As mentioned above, dog teeth are encountered at, among others, at the Monteoru culture site of Năeni-Zănoaga Cetatea 2 in Romania (Mărgărit *et al.* 2011, 17-18), at the Early and early Middle Bronze Age site of Tiszaug-Kéménytető in Hungary (Choyke and Bartosiewicz 2000, fig. 4), and at the Middle Bronze Age site of Jászdózsa-Kápolnahalom (Choyke and Bartosiewicz 2009).

10 Although the value and meaning may not be identical among all these communities.

Type of ornament	Grave no.
Perforated teeth	35, 79, 107, 128, 229
Pins	79, 126, 141 , 166, 184
Bone beads	107, 114, 120, 128
Dentalium beads	114, 120, 186, 226, 230, 250
Columbella beads	230, 280, 283
Glycymeris and other shell ornaments	120, 230
Bone applications and pendants of various shapes	107, 141, 147, 190

Table 2. Distribution of groups of ornaments within the Maros culture graves from Ostojićevo.

no. 107 and 120 particularly stand out. Grave no. 107 contained one triangular application, six bone beads, and 28 perforated teeth from different species, including the only red deer and horse teeth in the Ostojićevo necropolis. Grave 120 contained beads from diverse raw materials: bone, *Dentalium*, undetermined molluscs, and applications from molluscs. Thus, it is the richest grave with mollusc ornaments (a total of five *Dentalium* beads and seven other mollusc beads and applications).

Certain groups of ornaments can be singled out. In some graves, perforated teeth are the only or the predominant type of ornament (graves no. 35, 79, 107, and 128). Either pins are the only type of osseous ornament placed in the grave (graves no. 126, 166, and 184) or the other ornaments are not particularly rich or diverse (graves no. 79 and 141). Mollusc shells are the only or the predominant raw material for ornaments in some of the graves (graves no. 120, 186, 226, 230, 250, 280, and 283). Mollusc shells generally seem to have been more valued as raw materials; the majority of these ornaments also show prolonged use and instances of repair, even recycling. Furthermore, they occur in smaller quantities than, for example, bone beads. Additionally, it seems (judging from data obtained from the Mokrin necropolis, see Vitezović 2017 for details and references therein) that beads from *Columbellae* may be related to richer graves, which raises the possibility that ornaments made from mollusc shells may be related to the display of wealth and/or prestige.

Further analyses of other findings from graves, as well as comparative analyses of the age, sex, health status, *etc.* of the individuals will provide information regarding the symbolic meaning of this distribution.

It is interesting to note the occurrence of skeuomorphism or interchangeable raw materials, that is, the occurrence of one variant made from different raw materials. Beads were also produced from white or whitish stones, and a few pendants were made from whitish stones that resembled perforated teeth in shape. Furthermore, beads made from shell and bone may have the same or a similar shape, as in the case of the two variants of subtype A, elongated cylindrical beads. It is possible that this was a replacement for the more highly valued mollusc shells, or perhaps the white color was important. The importance of white color has already been suggested for other ornaments in prehistory (cf. Luik 2007; Antonović *et al.* 2017), and it is possible that the physical and mechanical properties of osseous materials, such as white color, overall shine, and smooth surfaces and durability, contributed to the value of these ornaments.

Long use of these ornaments and instances of recycling suggests another thing – the possibility that some of them were inherited. This would imply that osseous ornaments were used to display not only prestigious status but also belonging to a certain group (family or other).

Grave no.	Perforated teeth	Pins	Bone beads	*Dentalium* beads	*Columbella* beads	*Glycymeris* and other shell ornaments	Bone applications of various shapes
35	x						
79	x	x					
107	x		x				x
114			x	x			
120			x	x		x	
126		x					
128	x		x				
141		x					x
147							x
166		x					
184		x					
186				x			
190							x
226				x			
227							x
229	x						
230				x	x	x	
250				x			
280					x		
283					x		

Table 3. Presence of certain groups of ornaments within the Maros culture graves at Ostojićevo. The fragmented tooth from grave no. 227 and the *Unio* shell from grave no. 250 are not included in Tables 2 and 3 since these artifacts are fragmented and their type cannot be determined.

Further bioarchaeological analyses of the individuals buried with osseous decorative items at Ostojićevo may shed some more light on the possible meaning and value of these ornaments.

The majority of these ornaments (all types of bead, perforated teeth, and *Glycymeris* applications) do not differ in raw material selection or other techno-typological traits from those recovered at Mokrin (Vitezović 2017, *in press*) and have strong parallels at other Maros culture necropoles (O'Shea 1996 and references therein), suggesting that these ornaments had some common fashion and/or common symbolic meaning and value among Maros culture communities.

Ornaments made from locally available raw materials were most probably also produced locally. Osseous industries at Maros culture sites are known only from the settlement site of Pecica-Şanţul Mare in Romania (Nicodemus and Lemke 2016), and although the comparison between the assemblages from the necropolis and the settlement poses numerous obstacles, some common traits may be recognized. One concerns technology of production – the use of chipped stone tools such as burins, drills, *etc*., and the other concerns the presence of the same or similar techno-types – *Columbella* beads, perforated valves of *Bivalvia* shell (in case of Pecica, *Cardium*), and perforated dog teeth.

Conclusion

Ornaments made from animal hard tissue remained in use even after the introduction and spread of metals. In fact, although they are often considered "cheaper substitutes," they did not lose their value. Osseous raw materials, probably valued for their origin (from living animals) and physical and mechanical properties (hardness, color, and surface smoothness) throughout prehistory, were used for a long time as personal ornaments and remained in use for these purposes in the Bronze Age as well. These ornaments were valued by the members of communities of the Maros culture; they had certain symbolic roles and were used to display status and/or prestige.

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