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Bone and shell beads from the Bronze Age necropolis at Mokrin (northern Serbia)

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Abstract

The Bronze Age cemetery at the site of Mokrin is situated in the northern Banat region, near the town of Kikinda, in northeast Serbia. Necropolis belonging to the Bronze Age Moriš (Maros) culture was first noted in the nineteenth century, and extensive excavations were carried out in the 1960s revealing over 300 graves. The burials at Mokrin contained rich archaeological material: ceramic vessels, jewelry and clothing accessories made from bronze, gold, osseous and lithic raw materials, copper and stone tools and weapons, and animal bones. The rich data provided by this necropolis, especially the diversity and richness of offerings and/or funerary equipment were used for assessing and analyzing the stratification and social organization of the communities buried at the Mokrin necropolis.

Personal ornaments made from osseous raw materials were recorded at almost one third of the graves, and the most common among them were different beads made from bones and mollusk shells. This paper presents the results of the analyses of technological traits, manufacturing procedure, and use wear traces. Traces of use and their position in graves showed that some beads were used as part of composite jewelry (necklaces, bracelets), but others were part of clothing items, probably attached to belts, head dressings, etc. Also, numerous beads display intensive use wear traces, meaning they were used for a long time, and were probably highly valued.

Keywords: *Bronze Age – Moriš (Maros) culture – Mokrin – personal ornaments – beads – osseous raw materials – burial inventory.*

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Introduction

Beads are one of the most common types of personal adornment. They were produced and widely used since the Paleolithic times until today, in wide geographical regions (cf. Barge 1982; Camps-Fabrer 1991; Taborin 2004; d'Errico et al. 2005; Vanhaeren et al. 2006; Cattelain 2012; Baysal 2014; Bar-Yosef Mayer 2020). They were generally combined into composite jewelry, such as necklaces and bracelets, or they were used to decorate clothing. Despite their morphological uniformity throughout time, they display wide variety of used raw materials, resulting in a variety of manufacturing procedures, but also appearance such as diversity in size, colors, or smoothness of the outer surfaces.

When it comes to the metal ages, decorative items made from metal received more attention from scholars than the ornaments made from other raw materials. The analyses of the production, appearance, and use of personal ornaments from osseous raw materials, however, may provide us with valuable insight into cultural choices and fashion, but also may reveal the presence of long-distance trade and exchange of exotic marine shells, as well as point to the symbolic aspects of ornaments.

Different beads from the Bronze Age necropolis of Mokrin will be analyzed in this paper that were made from bones and mollusk shells – their technological traits, manufacturing procedure and use wear traces, with focus on their possible symbolic meaning and mode of use.

The archaeological background

The Moriš or Maros culture of the Bronze Age was centered around the confluence of the Tisa (Tisza) and Moriš (Maros, Mureş) Rivers in southeast Hungary, northwest Serbia, and southwest Romania (Tasić 1974). Moriš culture sites included settlements, both flat and stratified tell sites, and separate cemeteries. The site of Pecica in Romania can be mentioned as one of the more extensively researched settlements (cf. O'Shea et al. 2005, 2006, and 2011). Cemeteries are better known; several cemeteries were excavated in Hungary: the sites of Szöreg, Pitvaros, Batanya, and others (Tasić 1974; O'Shea 1996). Chronologically, the Moriš culture may be placed in the period from around 2700 to around 1500 cal. BCE (Nicodemus et al. 2015; O'Shea 1992; O'Shea et al. 2019).

In Serbia, the Moriš culture is best known from two necropolises, Mokrin – Lalina Humka and Ostojićevo – Stari Vinogradi. Both sites were extensively excavated and both yielded a relatively large number of burials (Girić 1971; Tasić 1974; Milašinović 2009; Milašinović et al. 2024). The site of Mokrin is situated in in the northern Banat region, in northeast Serbia, 12 km from the town of Kikinda (fig. 1). Excavations were carried out in the 1960s by M. Girić from National Museum in Kikinda and a total of 312 graves were discovered (Girić 1971; Tasić 1974). These burials contained rich archaeological material: ceramic vessels, jewelry and clothing accessories, made from bronze, gold, osseous and lithic raw materials, copper and stone tools and weapons, and animal bones (Girić 1971; Tasić 1974). Since 2020, the National Museum in Kikinda renewed the ex-

Figure 1. *Map showing the position of the site of Mokrin in Serbia. Image Credit:* https://sh.wikipedia.org/wiki/Datoteka:Serbia_adm_location_map.svg *and the author.*

cavations and carried out four research campaigns, which uncovered eight new graves (Pendić et al. 2022). Also, new studies and re-evaluations of the excavated archaeological and anthropological material were initiated, focused on biophysical anthropology, DNA analyses, analyses of occupation stress markers, etc. (e.g., Porčić & Stefanović 2009; Krečković Gavrilović 2023). Absolute dates obtained from the necropolis at Mokrin in the twentieth century place it in the period between 2086 and 1807 cal. BCE (O'Shea 1992; Forenbaher 1993), while recent analyses of additional samples provided the range between 2073 and 1822 BC (Krečković-Gavrilović et al. 2025).[1]

One of the characteristics of the Moriš culture are metal artefacts; metal is now more common in comparison with previous periods, and metal artefacts increase in frequencies towards the end of the Early Bronze Age. However, only a relatively small proportion appears to be utilitarian; the majority were weapons and ornaments (Girić 1971; Tasić 1974; O'Shea 1996).

The Moriš culture is the period in which we may note changes in social structures. The rich data provided from the analyses of the necropolises, especially the diversity

[1] Full list of dates obtained from the necropolis at Mokrin are published in Forenbaher 1993, t. 1, 244; O'Shea 1992; 1995, 37 (samples analyzed in the twentieth century), and Krečković-Gavrilović 2025, table 1 (new and previously analyzed samples).

and richness of offerings and/or funerary equipment, also produced data for assessing and analyzing the stratification and social organization of the communities (Soroceanu 1975; Primas 1977). The most comprehensive analysis on the society was carried out by J. O'Shea (1996), who included the evidence from all excavated cemeteries of the Moriš group. 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 the grave inventory, 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. Harding 2004, 386ff).

Beads from osseous raw materials

Materials and methods

As mentioned above, jewelry and clothing accessories were made from diverse materials: metal, kaolin, bone, and stone. Metal ornaments were relatively abundant, and include spiral pendants, rings, bracelets, decorative plaques, etc. (Girić 1971, Tasić 1974). Eighty-five out of a total of 312 graves (ca. 27%) contained ornaments made from osseous raw materials: bones, antler, teeth, and shells (Girić 1971; Vitezović 2017, 2021, and 2022). This is a relatively high ratio, considering that some of the graves contained only ceramic vessels and some graves were devastated, probably robbed.[2] This suggests that osseous raw materials were still valued for production of ornaments, and not simple 'cheap substitute' for metal ones (Vitezović 2017).

Osseous raw materials used for ornaments were both locally available – bone, antler, and animal teeth – or obtained from more distant regions such as mollusk shells. All the osseous ornaments kept today at the National Museum in Kikinda were analyzed by the author from the technological and typological viewpoint, with particular emphasis on the raw material selection, traces of manufacture, and traces of use (cf. Vitezović 2016 and references therein). They were examined with hand lens and Dino-Lite microscope with 5x–50x enlargements, and selected items were examined with the Scanning Electron Microscope (SEM) at the Faculty of Mining and Mineralogy, University of Belgrade. Typological repertoire included pendants, mainly made from perforated teeth, beads, decorative pins, diverse applications (Vitezović 2017 and 2022).

Beads were the most frequent type of ornaments made from osseous raw materials. As beads are classified small artifacts with centrally positioned, usually vertical perforation. Bead typology follows the typological classification offered by the *Fiches typologiques* publication series (Camps-Fabrer 1991), with some modifications. There are also some more elaborate typological classifications for prehistoric beads, created for the

[2] For more details on other funerary equipment, cf. Girić 1971.

assemblages with greater quantities and diversity (e.g., Baysal 2014). At Mokrin, several subtypes may be distinguished: (A) elongated cylindrical or barrel shaped beads, with two variants made from different raw materials (A1 and A2); (B) discoid; and (C) irregular beads (table 1). Criteria for analyses of use wear traces follow mainly those presented by S. Bonnardin (2008 and 2009; see also Camps-Fabrer 1991), as well as other published works (in particular, Cristiani et al. 2020; d'Errico 1993; Guzzo Falci 2015; Guzzo Falci et al. 2018; Mărgărit et al. 2018; Winnicka 2016; inter al.).

Beads were produced from bones and mollusk shells. The skeletal elements, animal species, and the species of the shells were determined by macroscopic analysis and following reference work for actual and archaeological bones and shells (Schmid 1972; Bar-Yosef Mayer 2008; Dance 1992; Taborin 1993, inter al.).[3]

Subtype A

The first and most common subtype are elongated beads, with more or less cylindrical or barrel-like shape. They were made from minimally modified Scaphopoda *(Dentalium)* shells (variant A1), or were cut from bones (variant A2).

Simple beads were made from minimally modified shells of the class Scaphopoda. These shells have an elongated, narrow shell, and are often labeled in literature as *Dentalium*. The ends of the shell may be broken off or cut off in order to use the mesial, widest segment, or already broken shell segments were simply collected and used. Certain weathering that can be noticed on surfaces may be the result of use, but it is more likely that it was caused by taphonomic agents (predating their use). The main criterion for distinguishing fossil shells from those collected fresh at the time when they were modified is the translucent color of fresh shells (cf. Dimitrijević 2014, 35). However, since some of these shells are poorly preserved, their origin cannot be determined with certainty, but it seems that at least some of these beads were made from fresh mollusks. These shells were obtained through trade and exchange, but the details are unknown. There is also possibility that the fossil shells were obtained from the area near the Sava–Danube confluence (cf. Dimitrijević 2014, and references therein).

Dentalium beads from Mokrin can be described as relatively large specimens; their length often exceeds 25 mm, and the diameter is often more than 5 mm (fig. 2). *Dentalium* shells were used in similar manner throughout prehistory, including the Mesolithic and Neolithic, as well as later prehistoric periods (e.g., Taborin 1993 and 2004; Borrello 2004; Dimitrijević 2014).

Usually, just one or a small number of *Dentalium* shells can be found in a single grave (table 1), and often along with other ornamental items, suggesting they were mixed and combined together into different jewelry types.[4] For example, beads from other ma-

[3] Selected items were double checked with Dr. Biljana Mitrović from the Natural History Museum in Belgrade. For details, cf. Ljuština et al. 2019. Also, the website http://www.marinespecies.org/ was consulted.

[4] See also below for *Columbella* beads.

Grave No.	Beads A1	Beads A2	Beads B	Beads C
grave No. 2	1		23	
grave No. 5		5		
grave No. 7			2	9
grave No. 8				11
grave No. 14				5
grave No. 15	1			
grave No. 16		1		
grave No. 27				1
grave No. 38	1			11
grave No. 45				1
grave No. 47	1		1	
grave No. 52	3			
grave No. 53			1	
grave No. 55		2		
grave No. 56	1			
grave No. 69	11	1		
grave No. 74				18
grave No. 90				1
grave No. 97	4	1		
grave No. 104		32		73
grave No. 108	22	1		
grave No. 122		1	1	
grave No. 123			1	1
grave No. 124			8	
grave No. 129				14
grave No. 136	3			3
grave No. 137	15	1		
grave No. 139	2			
grave No. 144	1			
grave No. 161	18			
grave No. 168				6
grave No. 171			6	16

Grave No.	Beads A1	Beads A2	Beads B	Beads C
grave No. 179	14			34
grave No. 180	4			
grave No. 181	1			
grave No. 182	1			
grave No. 187				3
grave No. 194	1			1
grave No. 198			1	
grave No. 199	14			
grave No. 200	23			8
grave No. 215	5			
grave No. 227	5			
grave No. 228	1	11		
grave No. 230		5		
grave No. 235	2	2		3
grave No. 237	4			
grave No. 240				3
grave No. 242				13
grave No. 245	5	15	1	
grave No. 246	5			16
grave No. 247	5			
grave No. 259				12
grave No. 267			1	
grave No. 274	2			
grave No. 283				17
grave No. 286	2	3		
grave No. 287	1			2
grave No. 288	1			
grave No. 300	4			
grave No. 302	13	25		2
grave No. 305				1
Total:	*197*	*106*	*46*	*285*

Table 1. *List of graves with beads.*

terials, including kaolin and metal, were found along with *Dentalium* beads in graves 2, 199, 237, etc. (Girić 1971, 37f, 132f, and 149f). The position of the beads in graves suggests they were most likely used as part of the composite necklaces, or perhaps they were part of the garment (see below).

Smaller long bones were also used to produce beads (variant A2; figs. 3 and 4). They were mainly or perhaps even exclusively made from tibiae and metapodial bones of smaller ungulates (mainly or even exclusively *Ovis/Capra*). They were produced by transversal division of the bone diaphysis; after the removal of epiphyses, a transversal groove was made with the aid of a wet abrasive fiber. After that, the bone was cut through by sawing and sometimes we may notice the traces of the sawing near the edge. Finally, the bone was either completely cut through, or a small portion was broken/snapped off. The surfaces of these beads are rarely well preserved due to unfavorable taphonomic conditions. Insufficient preservation and use wear traces do not allow determining with certainty the tools which were used, but it seems that these were chipped stone and not metal tools.[5]

These beads were usually cylindrical or slightly barrel shaped, i.e., their outer surface was straight or slightly biconical, depending on the portion of the bone that was used. There is no clear border between cylinder or barrel shaped beads; the differences are more gradual than sharp and this is the reason why they were grouped together. Not only this difference is barely noticeable, and it is difficult to assign them to one or either shape, but also it is not meaningful, since they share other technological traits and this final variations in shape were not intentional.

Sometimes, the transversal groove for dividing the bone was only initiated, but the bone was not cut completely, and thus the groove was retained as some sort of a decoration. This variant of beads may be relatively short and resembles the shape of figure 8, but rarely are quite elongated and resemble preforms. One unique, quite large segment of bone (66 mm long) with initiated grooves – practically, a preform used as a final object – was recorded in the grave 245 along with other, smaller beads (fig. 4).

The dimensions of these beads vary, suggesting there was no predetermined template for them. Their average length is 15–20 mm, and this means that several beads could have been produced from a single metapodial bone. The quantities of these beads also vary; for example, grave 104 contained 32 beads of this type, grave 245 yielded fourteen, in grave 228 there were eleven, etc.

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. These beads could have been arranged on a string and be a part of a composite necklace, bracelet, sawn to clothes (dress, cloak, belt...), etc. Their locations in the graves with respect to the skeleton vary, but they seem to have been mainly used for decoration on clothes. For example, in grave 245 these beads were found in the waist area, along with other ornamental pieces (Girić 1971, 154f), so they

[5] Criteria for distinguishing chipped stone from metal tool marks follow Christidou 2008.

Figure 2. *Beads made from* Dentalium *shells (subtype A, variant A1). Image Credit: the author.*

Figure 3. *Bead made from long bone (subtype A, variant A2), with traces of manufacture. Image Credit: the author.*

Figure 4. *Various bone beads (subtype A) from grave 245. Image Credit: the author.*

may have been part of the belt or simply sawn to the clothes (fig. 4). Similar is the case of grave 228; a horizontal row of eleven such beads was uncovered in the waist area of the skeleton, along with one *Dentalium* bead and a clay object in the shape of a biconical spindle whorl (Girić 1971, 145).

These beads were relatively frequent at the necropolis of Ostojićevo (Vitezović 2021 and 2022). Morphologically, similar beads, elongated, cylindrical, or barrel shaped, sometimes with groove in the central part, were also discovered at other Bronze Age sites across Europe. Closely resembling beads were discovered in one of the graves at the site of Mačkovac situated in the Sava River basin in eastern Croatia, belonging to the Late Bronze Age group of Barice-Gređani (Kalafatić et al. 2016). The Early Bronze Age site of Kichary Nowe in southeast Poland, belonging to the Mierzanowice culture, yielded similar beads made from bones (Winnicka 2016).

Subtype B

The second subtype of beads are discoid in shape, relatively flat (i.e., their height is insufficient to be classified as cylindrical beads). They were made from shells or bone and were less frequent than other subtypes (table 1). However, it should be noted that they were produced from other raw materials as well, such as white stones – perhaps deliberately chosen to resemble shells.

Discoid beads from Mokrin are rather small, often less than 10 mm in diameter (fig. 5). The bad preservation of surfaces makes difficult to tell anything more on the manufacture or use wear. Bone discoid beads were probably made in the same manner as the cylindrical ones (see above), simply the cut segment was much smaller. Shell beads were made from smaller segments of shell valve, and they have central perforation made by drilling from both sides. However, they were found in small number and their surfaces are eroded, therefore, it is difficult to reconstruct the manufacturing procedure in detail, but it is possible that the blanks were obtained by breaking the shells, and even that the broken ornaments were recycled into small beads. Burnishing

Figure 5. *Discoid bead made from shell (subtype B). Image Credit: the author.*

was applied to obtain their final shape, and it is possible that it was used in earlier stages of production as well. Poor preservation as well as extensive modification also prevent the precise identification of shell species; Bivalvia shells were used, most likely Spondylus sp.

Usually, these beads were discovered near the neck area of the skeletons (Girić 1971), suggesting they were most likely combined into necklaces or perhaps sawn to the clothes.

Discoid beads from diverse materials were widespread in prehistory (e.g., Barge 1982; Baysal 2014; see also Camps-Fabrer 1991).

Subtype C

The third subtype includes irregular beads produced from almost entire shells of *Columbella* snails. *Columbellae*, mainly and probably exclusively *Columbella rustica*, were used minimally modified (see also Ljuština et al. 2019). The top part of the shells was removed and left open. In the central part of the shell, they have a perforation, usually of irregular circular shape, made by piercing. Most of them were intensively used; beside worn perforations, surfaces also display polish and weathering, with prominent parts sometimes abraded (figs. 6 and 7).

Columbella beads may be encountered in graves that are considered rich, i.e., that contained metal ornaments – for example, one *Columbella* bead was discovered in grave 123, along with several ornamental items made from gold (Girić 1971, 100).

Columbella beads were used combined with other ornamental items into composite jewelry such as necklaces (fig. 8); for example, a perforated animal tooth, three *Dentalium* beads, and three *Columbella* beads were discovered in the neck area of the skeleton in grave 136, along with 13 kaolin beads (Girić 1971, 106f). In grave 129, they were recorded behind the skull, so they could have been either part of the necklace or head garment.

Some of these *Columbella* shells were decorations on clothes, as suggested by the finds from graves 74 and 90, where they were discovered behind the back of the skeleton,

Figure 6. *Beads made from* Columbella *shells (subtype C). Image Credit: the author.*

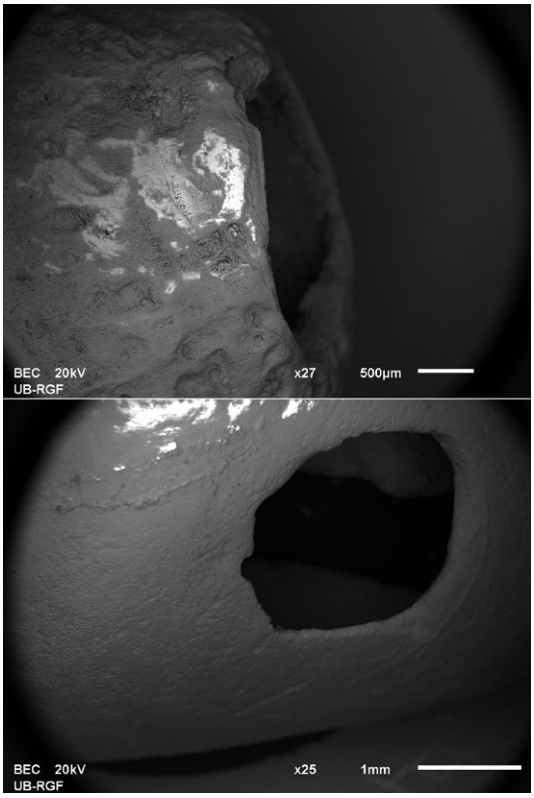

Figure 7. *SEM images of* Columbella *shells beads. Above: detail of the top part of the shell. Below: detail of the perforation. Image Credit: the author.*

along with bronze buttons (figs. 9 and 10; Girić 1971, 76 and 84). Remains of a belt, probably made from leather, were discovered in grave 242, with copper applications and buttons on it (fig. 11). Some buttons were scattered around, along with 13 *Columbella* beads that were most likely part of the same belt (Girić 1971, 152f).

The richest finding of *Columbella* beads comes from grave 104; 73 shells were discovered in the waist area, along with several hundred kaolin beads, over 70 perforated teeth, 32 bone beads, and ten salteleons made from copper, again, probably decoration on a belt or other clothing item (Girić 1971, 91).

This is also the type of ornaments that was widespread across Europe in prehistoric times, (e.g., Borrello 2004), and they are also encountered in the Bronze Age of the Carpathian basin. It should be noted that one such bead was discovered at the settlement site of Pecica-Şanțul Mare in Romania (Nicodemus & Lemke 2016, fig. 2b), showing that these items were worn daily and were not restricted to funeral equipment.

Discussion and concluding remarks

The beads discovered at the necropolis of Mokrin show diversity in the use of raw materials. We may note the occurrence of skeuomorphism – interchangeable raw materials, the occurrence of one variant made in different raw materials. For example, white

Figure 8. *M. Girić's reconstruction of an ornament from grave 8, including* Columbella *shells and a tooth pendant. Image Credit: the author.*

stones were sometimes used, mainly for small discoid beads – perhaps as a replacement for white shells, which must have been obtained through exchange (and therefore more difficult to obtain), or perhaps the white color was important.[6] Also, beads made from shell and bone may have the same or similar shape, as in case of the two variants of subtype A, elongated cylindrical beads.

The raw materials were obtained from diverse sources; bones were most likely obtained locally, while shells were obtained by trade and exchange. Bone beads were most likely produced locally, and discoid shell beads were also most likely local product. *Dentalium* and *Columbella* shells, on the other hand, may have been obtained through trade and exchange routes both unworked and already modified (Vitezović 2017 and 2022).

Use wear traces are not well preserved on these ornaments. Traces of intensive use are best preserved on beads from *Columbella* shells; their perforations are heavily worn and often deformed. On other beads, when the use wear traces are preserved, we may note

[6] The importance of white color was already suggested for some other ornaments in prehistory (e.g., Luik 2007; Vitezović 2012; Antonović et al. 2017).

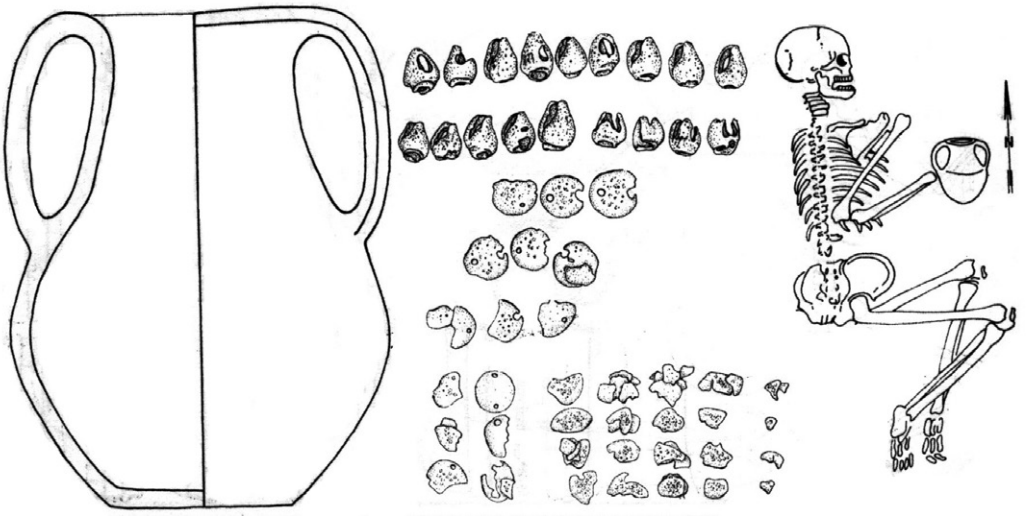

Figure 9. *Grave 74, skeleton and grave goods. Image Credit: Girić 1971.*

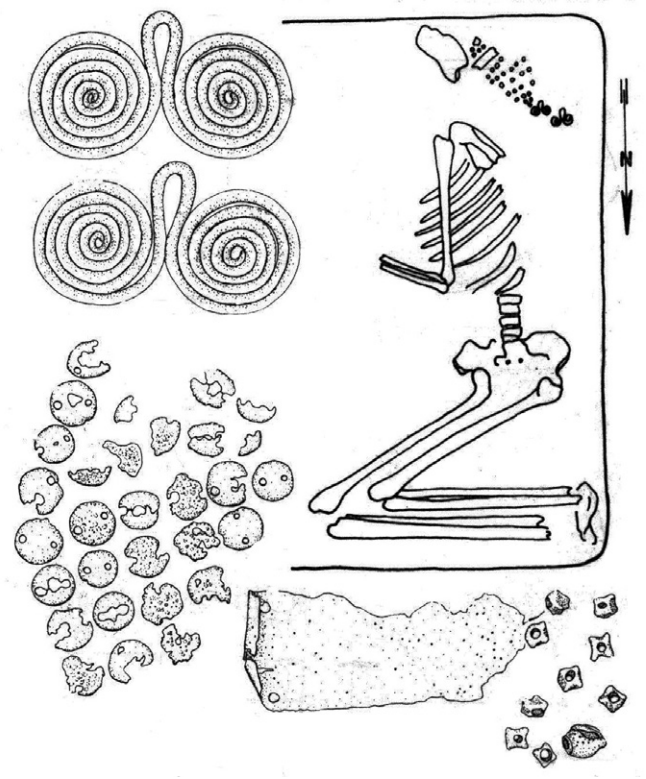

Figure 10. *Grave 90, skeleton and grave goods. Image Credit: Girić 1971.*

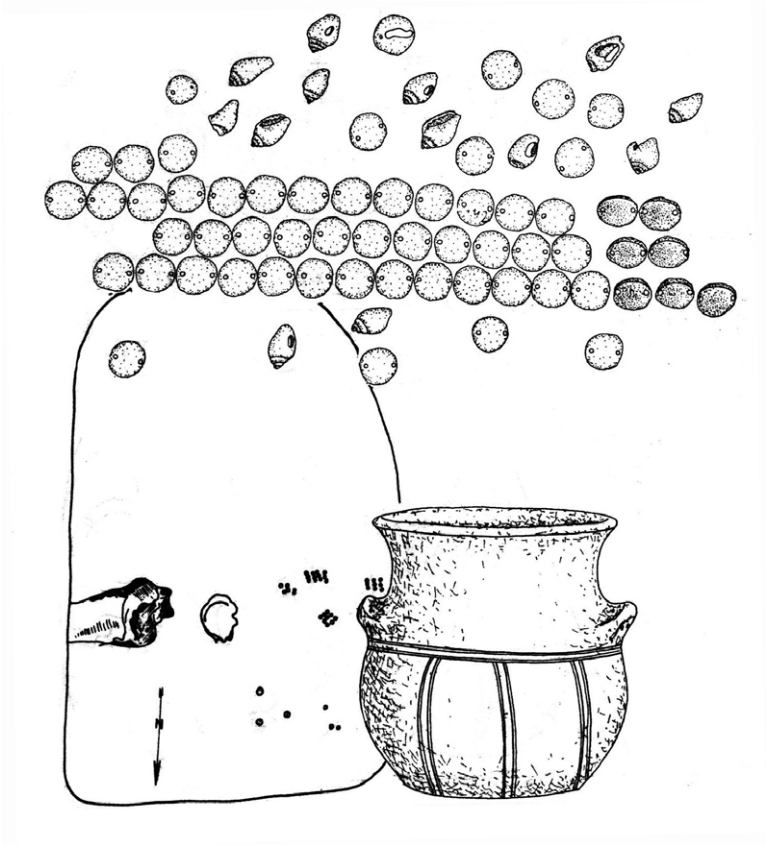

Figure 11. *Grave 242, skeleton and grave goods. Image Credit: Girić 1971.*

polished, worn surfaces. This suggests that the jewelry that contained these beads was not made for burial purposes only, but was used during life, and this is supported by the finds from settlements, such as a shell from the site of Pecica-Şanțul Mare (Nicodemus & Lemke 2016). Long use suggests that beads from osseous raw materials were valued. There is also a possibility that some of the ornaments were inherited, since some of the beads were found in graves of younger individuals. Personal ornaments may have been included in the burial as some sort of gift, offering, or sacrifice, and their symbolic value may involve display of status, wealth, and prestige, but their function might have also been apotropaic and prophylactic (these meanings are not mutually exclusive; on possible meanings of ornaments in burial contexts, cf. Härke 2014; Vitezović 2024, and references therein). Their presence in graves with richer funerary equipment, including gold jewelry (for example, grave 123) may suggest they were also used to display status and wealth.

These beads do not differ in raw material selection or other techno-typological traits from the beads discovered at the Moriš culture necropolis of Ostojićevo (Vitezović

2021), suggesting there was some common fashion and/or common symbolical meaning and value of these ornaments among the Moriš culture communities.

Beads are often interpreted as being used to create composite jewelry such as necklaces or bracelets. However, the evidence from the Mokrin necropolis shows that beads were used to decorate garments as well. In fact, we may note that elongated bone beads were often found in the waist area, suggesting that they were part of the ornament on clothing items, most likely belts, and at least some of the beads made from *Columbella* shells were worn in the same manner.

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