

# BONE MANUFACTURING IN THE NEOLITHIC: THE PROBLEMS OF RECONSTRUCTING THE CHAÎNE OPÉRATOIRE AND IDENTIFYING WORKSHOPS

## ÚJKŐKORI CSONTMEGMUNKÁLÁS: A MŰVELETI SOR REKONSTRUKCIÓJÁNAK ÉS A MŰHELYEK AZONOSÍTÁSÁNAK NEHÉZSÉGEI

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### **Abstract**

*Although in recent decades bone industry is not a neglected archaeological topic any more, there are still many open questions. One of the important problems in analysing bone industry is the question of reconstructing the chaîne opératoire and other questions related to the organization of production, workshops and working places, since manufacturing debris often stays unrecognized during excavations, i.e. it is either not collected, or it is stored among faunal remains, awaiting identification and a proper analysis. Also, contextual data are often incomplete, especially when artefacts come from older excavations, when faunal remains were not recognized as important and thus the attention given to them was limited.*

*In this paper a small collection of manufacture debris will be presented, related to the production of decorative items, from the site of Čoka-Kremenjak (Banat, northern Serbia). Although the material originates from excavations carried out one hundred years ago, certain conclusions can be drawn. These objects, along with the material from contemporaneous sites from the south Pannonian plain (Vojvodina region) and central Balkans (Starčevo, Grivac, Anište), helped in reconstructing the chaîne opératoire for making ornamental pieces from bone in Starčevo-Körös-Criş cultural complex and represent indirect evidence for the existence of a workshop within the Čoka settlement. This study raises some important questions for future research, especially those regarding the level of know-how of Neolithic craftspeople and the organization of production.*

### **Kivonat**

*Noha az utóbbi évtizedekben a csonteszközök vizsgálata már nem mellőzött kutatási irány, számos kérdése még nyitott. A csontipar elemzésének egyik legfontosabb feladata a műveleti sor rekonstrukciója valamint az eszközkészítés szervezettségének (műhelyek és munkahelyek) felmérése, mert a megmunkálási hulladékot nem mindig ismerik fel vagy nem gyűjtik az ásatás során. Jobb esetben az állatcsont együttes hulladékai közé keveredve vár megfelelő pontosságú meghatározásra és feldolgozásra. A leletösszefüggések adatai is gyakran hiányosak, ha a megmunkált darabok régebbi ásatásokból származnak, amikor az általános állatcsontanyag fontosságát még nem ismerték fel és nem szenteltek kellő figyelmet a gyűjtésének. Ez a cikk egy kisebb műhelyhulladék-együttes ismertetése, amely a bánáti Čoka-Kremenjak lelőhelyen (Észak-Szerbia) dísz tárgyak készítésekor keletkezett. Annak ellenére, hogy ez az anyag immár egy évszázada került napvilágra, alkalmas bizonyos következtetések levonására. Ezek a darabok a hasonló korú vajdasági, észak- és közép-balkáni lelőhelyek (Starčevo, Grivac, Anište) leleteivel összevetve segítenek a Starčevo-Körös-Criş kulturális komplexum dísz tárgyai műveleti sorának rekonstrukciójában és közvetett bizonyítékkal szolgálnak arra, hogy a Čokai településen csontmegmunkáló hely működhetett. A tanulmány további fontos kérdéseket vet fel a jövő kutatóinak, különösen az újkőkori kézművesek mesterfogásait és a korabeli termelés szervezését illetően.*

KEYWORDS: BONE INDUSTRY, OSSEOUS DECORATIVE ARTEFACTS, CHAÎNE OPÉRATOIRE, NEOLITHIC, STARČEVO-KÖRÖS-CRIŞ CULTURE COMPLEX

KULCSSZAVAK: CSONTIPAR, CSONT JELLEGŰ ANYAGOKBÓL KÉSZÍTETT DÍSZTÁRGYAK, MŰVELETI SOR, ÚJKŐKOR, STARČEVO-KÖRÖS-CRIŞ KULTURÁLIS KOMPLEXUM

### **Introduction**

All economic systems consist of three components – production, distribution and consumption (Costin 1991: 1). Their studying is not uniform, however, and some aspects of prehistoric economic systems

received more attention than the others. When it comes to the Neolithic period, the questions probably most explored were those related to trade and exchange, especially in exotic goods (such as marine shell or obsidian – e.g. Sэфériadés 1995, 2010; Dimitrijević & Tripković 2006; Williams-

Thorpe 1995). In recent decades, more attention has been devoted to the technological aspects of craft production, especially to the procurement and management of raw materials (e.g. stone – Antonović 1997, 2003; Perlès 1990; flint – T. Biró 1998, Gurova 2011, osseous raw materials – Schibler 2001, to mention just a few). Analyses concerning the production of everyday goods are less frequent, and also comparative analyses of different industries are relatively rare, although some exceptions should be noted, especially work on the Neolithic in Greece (Perlès & Vitelli 1999, Perlès 2001).

It is often assumed that specialized production is closely tied to cultural complexity, i.e. archaeologists frequently rely on the presence of craft specialization to infer aspects of cultural complexity, or assume that craft specialization could not have existed if the societies were not stratified (cf. Clark & Perry 1990). This view is sometimes overly simplistic, and only too often a production system has been labelled "specialized" without a thorough understanding of the manufacturing processes (cf. Miller 1996: 7). Therefore, there is a need for a more elaborate theoretical framework in studying prehistoric crafts production so as to improve our understanding of past societies and their economy.

But first, more detailed analyses are needed, especially those concerning the process of manufacturing and all of its technological aspects – methods of acquiring and models of managing raw materials, the relations between ad hoc (expedient) and planned artefacts, organization of production, etc. One of the key problems in interpreting the organization of production is the identification of different activity areas, working areas and/or workshops, which are often very difficult to locate during excavations. The reasons range from taphonomic conditions to the methods of excavations.

Bone industry is a relatively less explored topic in comparison with ceramics, flint and ground stone. Therefore the number of open questions is greater. One of the important problems in analysing bone industry is the reconstruction of the chaîne opératoire and other questions related to the organization of production, workshops and working areas, since manufacturing debris often remains unrecognized during excavations, i.e. it is either not collected, or it is stored among faunal remains, awaiting identification and a proper analysis. Furthermore, contextual data are often incomplete, especially when it comes to older excavations, when faunal remains were not recognized as important from the viewpoint of research questions and thus attracted limited attention.

In this paper a small collection of manufacturing debris will be presented related to the production of decorative items at the site of Čoka-Kremenjak.

### *Čoka-Kremenjak: the site and its bone industry*

The site of Čoka Kremenjak is located southwest from the village of Čoka, 4 km from the left bank of the Tisza river, in the Banat region (north-eastern Serbia). The first excavations were carried out at the beginning of the 20th century by F. Móra and the find material was analysed and published by J. Banner almost half a century later (Banner 1960). In 1970, P. Medović researched a small area of the remaining portion of the site, covering approximately 30 m<sup>2</sup>, and noted a ca. 1 m thick culture bearing layer, containing material from the Starčevo-Körös-Criş and Vinča cultures (Медовић 1970).

Today, the portable finds from this site are stored in several museums: in Szeged (Hungary), in the National museum in Zrenjanin and in the National museum in Kikinda (Serbia). The assemblage is very rich and diverse, and includes, amongst others, evidence for a relatively abundant bone industry. The first excavations revealed over one hundred and fifty artefacts: awls made from metapodial bones with both distal and proximal epiphyses preserved as basal parts of the tools, awls from split ribs, diverse polishing tools made from both long and flat bones, biserial harpoons made from antler, as well as peculiar artefacts with serrated or wavy edges (Banner 1960: pl. XLI-XLVII). Several additional artefacts are kept at the National museum in Zrenjanin, such as pointed tools, spatula-chisels, one small haft, etc. (Витезовић 2012: 9-11). Contextual data on these finds are limited. The cultural and chronological attribution to either the Vinča or Starčevo culture can be made on the basis of the technological and typological traits of most (although not all) of these artefacts.

Special attention should be paid to the presence of manufacture debris. Several circular pieces as well as numerous long bone segments with unfinished perforations are kept in the National museum in Zrenjanin (Витезовић 2012: 9-11).

Artefact inv. 3040 (**Fig. 1.**), was made from the flat segment of a large long bone from a large ungulate. Circular incisions from initiated perforations may be observed on the inner (medullary cavity) surface. On one imprint fine traces are visible, the second imprint overlaps with the first one, and the third is partially visible in the place where the bone is now broken. Artefact inv. 3641 (**Fig. 2.**) is also a broken piece of a large long bone from a large ungulate, and negatives from two circular pieces are visible on its broken edge.



**Fig. 1.:** Artefact inv. 3040 (above) and inv. 3641 (below), with details of manufacture traces, Čoka-Kremenjak. Photo Ž. Utvar.

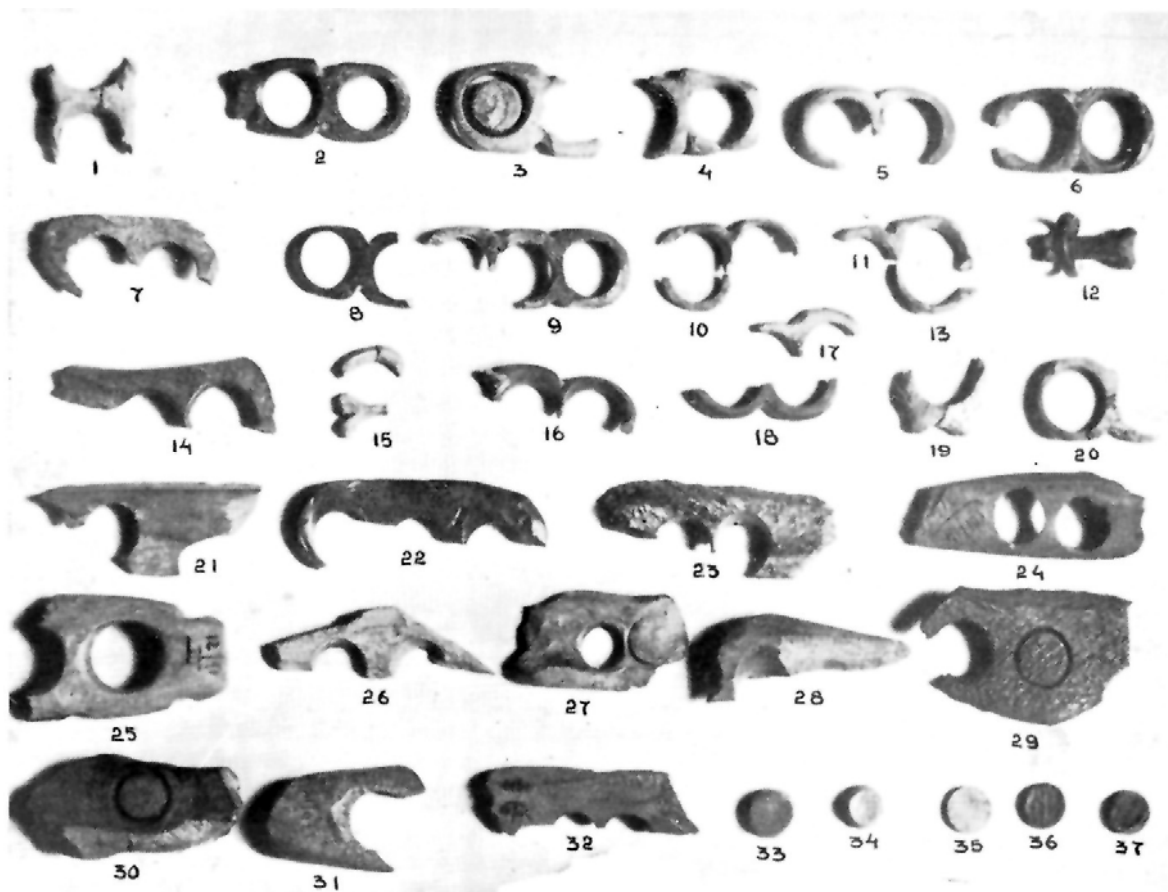
**1. ábra:** Csóka-Kremenyák, megmunkált csontok. Fent: ltsz. 3040, lent ltsz. 3641. A felvételeket készítette: Ž. Utvar.



**Fig. 2.:** Artefact inv. 3641 and 3686B (left), inv. 3686 A, B, C, D (right), Čoka Kremenjak. Photos Ž. Utvar, S. Vitezović.

**2. ábra:** Csóka-Kremenyák, megmunkált csontok. Balra: ltsz. 3641 és 3686B, jobbra ltsz. 3686 A, B, C, D. A felvételeket készítette: Ž. Utvar és S. Vitezović.





**Fig. 3.:** Manufacture debris from Čoka-Kremenjak, after Banner 1960: pl. 45.

**3. ábra:** Csóka-Kremenyák, műhelyhulladék. Banner 1960, 45 tábla nyomán

The third artefact, inv. 3587, is a smaller bone fragment from which a circular piece was cut out, showing traces of cutting on the edge.

Besides these, four circular pieces from cutting such perforations are also stored in the National museum in Zrenjanin (inv. 3686 A, B, C, D; **Fig. 2.**). They were all cut out from segments of larger long bones of probably large animals, judging from the bone wall thickness. The debris inv. 3686A is not fully cut, and shows traces of manufacturing visible along the edge. The debris segments inv. 3686 B, C and D, although damaged, were completely cut out. They have a regular circular shape, with diameters from 1 to 1.3 cm, and traces of manufacture clearly visible on their lateral edges. The piece inv. 3686 B fits into the hole in object inv. 3641 (**Fig. 2.**, left).

Among the material published by J. Banner there are similar circular pieces of debris as well (Banner 1960: pl. XLV/33-37): long bone fragments with negatives of circular segments removed (pl. XLV/22, 23, 26, 28, 31, 32), along with objects with unfinished perforations (pl. XLV/29, 30) (cf. **Fig. 3.**).

### *Decorative items: reconstructing the chaîne opératoire*

The concept of operational chain (*chaîne opératoire*), created by A. Leroi-Gourhan (1964, 1965, 1971) is an analytic technique that explores the ways in which one artefact was made, used and discarded – starting with the obtaining of the raw material, through manufacturing technique, final shape, use (which includes thesaurising, breakage, repair, sequences of re-use), until it is discarded, passing through all the stages of manufacture and use of different components. The concept makes it possible to structure man's use of materials by placing each artefact in a technical context, and offers a methodological framework for each level of interpretation (from manufacture to the use and discard); its aim is to reconstruct the organization of a technological system and also to describe and understand all the cultural transformations that a specific raw material had to go through (Inizan et al. 1995: 14, cf. also Sellet 1993).



**Fig. 4.:** Manufacture debris, Starčevo-Grad. Photos Ž. Utvar, S. Vitezović.

**4. ábra:** Starčevo-Grad, műhelyhulladék. A felvételeket készítette: Ž. Utvar és S. Vitezović.

These pieces of manufacturing debris enabled us to reconstruct the chaîne opératoire in detail. As the main raw material, large, relatively flat, thick segments of diaphyses of long bones from large ungulates were selected. Blanks were not cut, but simply broken. Bone is scraped and burnished first, usually just on the inner (medullary cavity) surface, or, rarely, on both the outer and inner surfaces. Circular pieces were cut out by drilling, however, they were not made by gradual widening of a small perforation, but by a tubular, hollow tool instead (perhaps some sort of a reed tube or something similar), with an abrasive substance added (e. g. sand). The final perforation had a diameter between 1 and 1.5 cm, therefore the tool itself must have been approximately 1 cm wide. Drilling always started from the inner surface, progressing through the bone, and when the tool almost reaches the outer surface (when the bone was almost cut through), the debris is just broken off or snapped. The bone with such a hole (or holes) was further shaped into its final form mainly by burnishing and polishing. (The technique of gradual drilling that creates rather small perforations, up to 0.5 cm in diameter was also used in the Starčevo bone industry – cf. Vitezović 2011: 267-268.)



**Fig. 5.:** Decorative appliqués inv. Grv 07 (left) and Grv 01 (right), Grivac. Photo S. Vitezović.

**5. ábra:** Plasztikus díszítések a csonton, Grivac, Balra: ltsz. Grv 07, jobbra ltsz. Grv. 01. A felvételeket készítette: S. Vitezović.

The same circular pieces were also discovered at two more sites of the Starčevo culture: on the eponymous Starčevo-Grad and Vizić-Golokut, both in the Vojvodina region (Serbian part of the Pannonian plain) (Vitezović 2011). Specimens from Starčevo have diameters of approximately 1.4 cm, and it may be perceived on them how the bone was drilled starting from the inner (medullary cavity) side, with the outer edge slightly ragged, as the remains were broken off when the drilling was almost completed (Fig. 4.). Some pieces carry traces of burnishing, carried out prior to drilling (Vitezović 2011: 124).

The same type of manufacturing debris was also discovered at one Körös culture site, Ecsefalva 23B, located some 175 km north of Čoka in Hungary. It consisted of a long bone fragment with the negative of a circular piece removed and several circular debris segments, labelled “plugs” (Choyke 2007: 656-657, figs. 29.20 and 29.21). The absence of such finds from other Starčevo-Körös-Criş sites is probably due to sampling bias – such small pieces were either not recognized or not collected at all. The “plugs” from Ecsefalva 23B were discovered within the same excavation unit, and it was suggested that a small workshop area was situated nearby (Choyke 2007: 656-657).

Another long bone fragment with the negative of a circular piece removed, classified as (fragmented) disc (Scheibe), was discovered at Körös culture site of Endröd (Makkay 1990: abb. 16.5, see also Tóth 2012: 175).

For the Ecsefalva specimens, it was assumed that they represent a debris from ring-making (Choyke 2007). The final form of the artefacts created in this way may be seen in finds originating from other sites, mainly those from Grivac and from Anište-Bresnica (Vitezović 2011).

Several artefacts in the shape of discs originate from the site of Grivac, as well as rectangular plates with large perforations (diameter 1-1.5 cm) in the middle (Fig. 5.). The best preserved such object is

inv. Grv 007 (**Fig. 5.**, left), of a rectangular shape with rounded corners, finely polished on the entire surface, measuring 4 by 4 cm (Vitezović 2011: 162). The perforations are smoothed by use, however, their mode of manufacture is the same as in the case of the Čoka-Kremenjak specimens, i.e. the same circular pieces of debris would correspond to them. Manufacturing traces on the inner (medullary cavity) sides of the perforation are the same as within the circular impressions from Čoka.

The circular debris (“plugs”) were not discovered at the Grivac settlement, however, one large piece of a long bone with the trace of an initiated perforation may represent manufacture debris of the same artefact-type.

From the site Anište-Bresnica only one, unique decorative artefact was discovered in the shape of number eight (8), i.e. a double ring (**Fig. 6.**). The diameter of the closed ring is 1.5 cm, and of the open one 0.8 cm. This object is completely preserved, i.e. the open ring was not broken, but was deliberately made into this shape. The entire object was very carefully made and traces of manufacture are partially preserved. The shape was cut out using a fine flint tool and the final shape was achieved by polishing. Some polish caused by use is also visible (Vitezović 2011: 148). This particular object is not made following the exact same technique, but there is a possibility that similar ornaments were made by this large-hole drilling technique, judging from other segments of debris from Čoka-Kremenjak (cf. **Fig. 3.** and Banner 1960: pl. XLV/2-20). The debris from Čoka-Kremenjak, therefore, suggests that both these types and variants were made using this technique – 8-shaped and rounded/ rectangular plates. They were most likely used as some sort of buckles or worn attached to clothes as appliqué (cf. Vitezović 2011: 336-338).

This large-hole drilling technique is a specific technological procedure for making such relatively simple, but meanwhile culture-specific decorative items.



**Fig. 6.:** Decorative 8-shaped item, Anište-Bresnica. Photo and drawing Ž. Utvar.

**6. ábra:** Anište-Bresnica, 8-as formájú csonttárgy. A rajzot és a felvételt készítette: Ž. Utvar.

The technique itself was not encountered so far within the Vinča culture, and neither was this type of decorative items (cf. Срејовић & Јовановић 1959, Bačkalov 1979, Vitezović 2007); therefore, they may be considered a specific technological trait of the Starčevo-Körös-Criş culture complex. Within the Vinča culture, perforations were made by progressive drilling and widening of the original hole, using thin, sharp tools; this technique would not leave any particular debris (cf. Vitezović 2007).

### Discussion

The full interpretation of manufacturing debris from Čoka Kremenjak cannot be completed due to the lack of contextual data. It is not clear whether all the debris came from a single context or not, therefore, although it is clear that the production of decorative items was carried out at the settlement for a long period of time / in repeated sequences, the workshop or working area cannot be spatially identified. The questions remain open whether the production was carried out at one or several places, was it occasional and repeated or a continuous activity. It is also impossible to correlate any other tools (bone or flint) or possible debris from other activities with this working place.

The presence of the same type of debris at several sites suggests that the production of these artefacts was not limited to one site only. It is conspicuous that the distribution of debris is within a larger region (all the sites are in the Pannonian plain), but this may be related to the problem of sampling bias (most Starčevo culture bone industry assemblages originate from either old excavations, when animal bones were collected selectively, or from sites where excavations were carried out in a limited area – cf. Vitezović 2011).

In terms of the level of technological knowledge and skill, it is impossible to determine whether such a relatively high ratio of “mistaken” and unfinished/abandoned pieces represent a novice i.e. an inexperienced craftsman, since it is unknown how many successful final items were produced per “mistake”. The time span of production remains likewise unknown; furthermore, the find itself may represent a selected deposition of objects designated as “garbage”. In comparison with the find of a “workshop” of cockle shell beads in Greece (cf. Miller 1996), but keeping in mind the relatively high technological uniformity between both debris and final products from all those sites, it can be concluded that these decorative items were produced by relatively skilful craftsmen, probably partially specialized (in terms that these artefacts were not produced by any member of the community). At the same time, however, making such bone artefacts was most likely an occasional activity.

The importance of these finds, however, is that the full sequence of chaîne opératoire for a specific type of decorative items can be reconstructed. At the same time it was confirmed that they were produced within sites of the Starčevo-Körös-Criș cultural complex. Furthermore, some interesting technological characteristics may be observed – the same initial procedure was used for obtaining two different types (8-shaped and circular/rectangular appliqués). Therefore, we have the presence of manufacturing continuity and morphological discontinuity (cf. Sidéra 2005) on the one hand, and on the other, the presence of manufacturing discontinuity and morphological continuity (two methods for creating perforations in bones). Such a diversity in manufacturing techniques was already noted for the production of some other artefacts in the Starčevo-Körös-Criș bone industry (cf. Vitezović 2011: 352-3). This testifies to both the creativity and the high level of technological know-how of the Starčevo-Körös-Criș bone craftspersons.

### Concluding remarks

Although the material under discussion originates from excavations carried out a century ago, some preliminary conclusions can be made. These objects, along with the material from contemporaneous sites from south Pannonian plain and the central Balkans, enabled the reconstruction of the chaîne opératoire for making ornamental pieces from bone in the Starčevo-Körös-Criș cultural complex. At the same time, they represent indirect evidence for the existence of a workshop within the Čoka settlement. This study raises some important questions for future research, especially those regarding the level of know-how of Neolithic craftspersons and the organization of production.

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