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MICHELA SPATARO, MARTIN FURHOLT

Detecting and explaining

TECHNOLOGICAL INNOVATION IN PREHISTORY

SCALES OF TRANSFORMATION IN PREHISTORIC AND ARCHAIC SOCIETIES | 8

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Preface of the editors

With this book series, the Collaborative Research Centre *Scales of Transformation: Human-Environmental Interaction in Prehistoric and Archaic Societies* (CRC 1266) at Kiel University enables the bundled presentation of current research outcomes of the multiple aspects of socio-environmental transformations in ancient societies. As editors of this publication platform, we are pleased to be able to publish monographs with detailed basic data and comprehensive interpretations from different case studies and landscapes as well as the extensive output from numerous scientific meetings and international workshops.

The book series is dedicated to the fundamental research questions of CRC 1266, dealing with transformations on different temporal, spatial and social scales, here defined as processes leading to a substantial and enduring reorganization of socio-environmental interaction patterns. What are the substantial transformations that describe human development from 15,000 years ago to the beginning of the Common Era? How did interactions between the natural environment and human populations change over time? What role did humans play as cognitive actors trying to deal with changing social and environmental conditions? Which factors triggered the transformations that led to substantial societal and economic inequality?

The understanding of human practices within often intertwined social and environmental contexts is one of the most fundamental aspects of archaeological research. Moreover, in current debates, the dynamics and feedback involved in human-environmental relationships have become a major issue, particularly when looking at the detectable and sometimes devastating consequences of human interference with nature. Archaeology, with its long-term perspective on human societies and landscapes, is in the unique position to trace and link comparable phenomena in the past, to study human involvement with the natural environment, to investigate the impact of humans on nature, and to outline the consequences of environmental change on human societies. Modern interdisciplinary research enables us to reach beyond simplistic monocausal lines of explanation and overcome evolutionary perspectives. Looking at the period from 15,000 to 1 BCE, CRC 1266 takes a diachronic view in order to investigate transformations involved in the development of Late Pleistocene hunter-gatherers, horticulturalists, early agriculturalists, early metallurgists as well as early state societies, thus covering a wide array of societal formations and environmental conditions.

The publication on detecting and explaining technological innovation in prehistory includes interdisciplinary research, with case-studies from Europe, the Indus Valley, Iran, and Mexico. We are very thankful to the editors of the workshop proceedings Michela Spataro and Martin Furholt and to graphic illustrator Carsten

Reckweg for their deep engagement in this publication. We also wish to thank Karsten Wentink, Corné van Woerdekom and Eric van den Bandt from Sidestone Press for their responsive support in realizing this volume and Hermann Gorbahn and Katharina Fuchs for organizing the whole publication process.

Wiebke Kirleis and Johannes Müller

Contents

Technological changes and innovations in the osseous industries in the early and late Neolithic in the Balkans

Selena Vitezović

Abstract

The Neolithic period is marked with numerous and dramatic changes in all aspects of life. Changes in subsistence, namely domestication of plants and animals and introduction of agriculture and animal herding, are the most important, but not the only changes; different mode of subsistence affected different aspects of daily life – shelter making, tool production, technologies, as well as the perception of the environment, and many more.

In this paper, traditions, changes and innovations will be analysed among osseous industries in the south-eastern Europe within the early Neolithic Starčevo and the late Neolithic Vinča culture. Osseous industries went through considerable changes in the Neolithic: introduction of domestic animals brought in modifications in raw material choices and methods of acquiring; changes in economy – new crafts and new activities, which influenced the typological repertoire. Furthermore, we may note some new manufacturing techniques, connected with changes in lithic industries, such as the introduction and wider use of abrasion techniques. Finally, we may observe differences in the cultural attitude towards these raw materials – they are no longer used for the figurines, objects of art, *etc*., although they remain the most important raw materials for personal ornaments.

Keywords: osseous industry, Starčevo-Körös-Criş cultural complex, Vinča culture, south-eastern Europe

Introduction

Osseous raw materials were among the most important raw materials throughout prehistoric times, along with stone and wood. They were used from the lower Palaeolithic, and, especially from the upper Palaeolithic, bone industries constitute an important part of the material culture – osseous raw materials

Institute of Archaeology
Kneza Mihaila street 35/IV
Belgrade, Serbia
s.vitezovic@ai.ac.rs
selenavitezovic@gmail.com

were used for weapons, tools, and ornaments, as well as for making portable art (cf. Schibler 2007 and references therein). Because of their long, continuous presence in almost all prehistoric societies and their frequency, osseous artefacts are important for studying long-term traditions and innovations in technology, and they are also convenient for studying regional diversity.

For a long time, osseous artefacts were neglected in analyses; some researchers perceived them as simply, *ad hoc* used kitchen debris, while the choices regarding selection of the skeletal elements, manufacturing technique and final shape were often interpreted as being determined by environmental factors and following the "easiest", "simplest", "ergonomic" solutions (cf. Vitezović 2016a and references therein). Some of the technological choices within osseous industries are partially dependent on the environment, such as the availability of certain animal species and skeletal elements. However, osseous industry, like other technologies, is also a cultural phenomenon and approach concentrated on its technological aspects and is needed for a complete, comprehensive analysis of its place within a given community (cf. Vitezović 2011a; 2013a).

Technology is a conceptual approach to material culture studies. Derived from the Greek word τέχνη, meaning skill, technology implies all human actions upon a given material (Miller 2007). The concept of technology as a culture-driven phenomenon has become more widely accepted in recent decades, largely influenced by the technological approach from the French anthropological and archaeological school (cf. Lemonnier 1992; Greene 2006). Technologies must be considered in a general anthropological perspective as social productions that are compatible with other social phenomena. All technologies within a given community constitute technological systems, and individual technologies, including osseous, are mutually dependent (Lemonnier 1992).

The features of technologies and technological systems are not simply a result of physical constraints, either those internal to technologies themselves, or constraints arising from the natural environment, and the question of the influence of social choices has to be taken into account. According to P. Lemonnier (1992), there are more subtle informational or symbolic aspects of technological systems that involve arbitrary choices of techniques, physical actions, materials, *etc.*, which are not dictated by their function.

According to B. Hayden (1998), there are different kinds of constraints operating in the development of solutions for each problem and trade-offs between constraints make it unlikely that there will be any single optimal solution to a problem, but rather, a number of more or less equally acceptable solutions. Among the most powerful of these constraints are functional requirements, material properties, availability, and production costs. Once a field of acceptable solutions for a given problem has been identified, the choice of the solution that will be adopted may largely be a matter of cultural tradition, ideological values, style, *etc.* These constraints have an important role in the case of practical technologies. On the other hand, prestigious technologies, used not to perform a practical task, but to solve a social problem, to display wealth, success, and power, have fundamentally different logic and strategy than those used for creating practical artefacts. Prestige technologies employ as much surplus labour as possible to create objects that will appeal to others and attract people to the possessor of those objects due to admiration for his/her economic, aesthetic, technical, or other skills (Hayden 1998).

The analysis of technological choices must include all steps in the manufacturing process, from raw material selection, to episodes of repair, until the final discard. André Leroi-Gourhan proposed the concept of chaîne opératoire (Leroi-Gourhan 1964; 1965; 1971), which aims to describe and understand all the cultural transformations that a specific raw material had to go through and to reconstruct the organization of a technological system. It is a chronological segmentation of the actions and

mental processes required in the manufacturing of an artefact and its maintenance in the technical system of a prehistoric group (Inizan *et al.* 1995, 14; cf. also Sellet 1993).

When it comes to bone technologies analyses, important research questions are why bones were chosen for the production of certain objects in the first place, why specific species and skeletal elements were chosen or avoided, why a specific manufacturing technique was used, and why some bone objects had been used for a long time and often repaired (cf. Choyke 2010; 2013; also Vitezović 2011a; 2013a; 2016a, and references therein).

With the changes that the introduction of the Neolithic way of life brought – namely, domesticated plants and animals, and associated subsistence patterns and other activities, all the technologies changed, including the osseous technology. New animal species and changes in economy affected the raw material choices, changes in other technologies had impact on the manufacturing procedures, and new tasks and new activities influenced the need for some tool types; some disappeared, some new types emerged and the frequency and morphological variations of some types decreased or increased.

In this paper, bone industries from the Neolithic period in the areas of the central Balkans and southern Carpathian basin will be analysed – from the early /middle Neolithic Starčevo culture and from the late Neolithic Vinča culture. Analyses followed the approach and the criteria for typological classification outlined by the French archaeological school (cf. Camps-Fabrer 1966; 1979; Camps-Fabrer ed. 1990; 1991; 1998; Ramseyer ed. 2004), adapted for Balkan prehistoric assemblages (Bačkalov 1979; Beldiman 2007; Vitezović 2011c; 2016a). Analytical criteria for the technological and functional interpretation of manufacture and use wear traces were established upon the previous work and experimental results from different authors (Newcomer 1974; Semenov 1976; Peltier 1986; Campana 1989; Christidou 1999; Maigrot 2003; Christidou, Legrand 2005; Van Gijn 2005; Legrand 2007, *inter al.*). Special focus will be put on the innovations and traditions within the Starčevo culture bone industries (*vs.* Mesolithic bone industry, known in this area only from the Iron Gates region – cf. Bačkalov 1979; Beldiman 2007; Vitezović 2011b; Mărgărit and Boroneanţ 2017) and on the innovations and traditions within the Vinča culture bone industry (*vs.* Starčevo culture).

Archaeological background

The region of the central Balkans and southern Carpathian basin during the Neolithic was marked by the phenomena labelled as Starčevo and Vinča cultures. The Starčevo culture, part of the Starčevo-Körös-Criş cultural complex, was widespread in present-day Serbia, eastern Croatia, Bosnia and Herzegovina, and northern Montenegro. The Vinča culture encompassed more/less the same territory, and also expanded into the territories of Oltenia and Transylvania in present-day Romania (cf. Garašanin 1979; Srejović *ed.* 1989). Absolute dates place the Starčevo culture in the period between 6200 and 5500 BCE (Whittle *et al.* 2002), and the Vinča culture in the period 5400/5300-4500/4450 BCE (Borić 2009; Tasić *et al.* 2015).

The communities of the Starčevo culture represent the earliest agriculturalists in the region. The subsistence of both Starčevo and Vinča communities were based on the cultivation of different plant resources and animal herding, although gathering, fishing and hunting were practiced as well (cf. Bökönyi 1988; Filipović and Obradović 2013; Marinova *et al.* 2013; Greenfield 1986; 2008; Orton 2008; *inter al.*). Domestic animal species included sheep, goats, cattle and pigs, and wild species included red deer, aurochs, wild pigs, roe deer, different fish, birds, *etc.* As a general trend, the predominance of sheep/goats in the Starčevo culture may be noted and the increasing importance of cattle in the Vinča culture. However, there are differences between sites / regions within both Starčevo and Vinča communities regarding the predominant

species, as well as regarding the domestic / wild ratios (for details for specific sites, cf. Bökönyi 1988; Bulatović 2012; 2018; Clason 1982; Greenfield 1986; 2008; Orton 2008).

The Starčevo culture brought in an important new technology – ceramic, now used not only for production of cooking, storage and consumption vessels, but also for utilitarian items such as weights or spindle whorls, or non-utilitarian objects such as altars or figurines. The ceramic production in the Vinča culture is even more prominent and certain levels of specialization and standardisation are observed (cf. Vuković 2011). Changes are noted in the lithic industry as well; woodworking tools are more common and more diverse, abrasive stone artefacts, such as querns, whetstones, grindstones, increase in frequency and diversity, and so on (cf. Antonović 2003).

Diversity in technologies, production of goods which are not purely utilitarian and production of goods which are time, labour and skill demanding, as well as a certain level of standardization, show that craft production was diverse, rich and important and that elaborated associated social and economic relations existed. Osseous industries constitute an important part of the material culture in both Starčevo and Vinča cultures. The analyses are connected with numerous methodological problems, though. Some sites were excavated on a limited surface, faunal material was not always carefully collected nor examined by specialists, taphonomic conditions for preservation were not always favourable, and also stratigraphic position on multi-layered sites were not always certain. However, several assemblages analysed in detail from technological viewpoint so far offer interesting results on traditions and innovations in the Neolithic.

Osseous industry in the Starčevo culture

Osseous industry in the Starčevo culture was analysed from the following sites (Fig. 1): Ludaš-Budžak, Nosa-Poroš, Nosa-Biserna Obala, Golokut-Vizić, Obrež-Baštine, Donja Branjevina, Starčevo-Grad, Ušće Kameničkog Potoka, Knjepište, Velesnica, Zmajevac, Divostin, Grivac, Drenovac, Međureč, Anište-Bresnica, Bubanj-Novo Selo and Pavlovac-Kovačke Njive (Vitezović 2007; 2011c; 2011d; 2013b; 2013c; 2017a; in prep; Vuković *et al.* 2016; cf. also Vitezović 2012a; 2014). The quality and quantity of the information obtained from these assemblages differs considerably. At some of these sites, the faunal remains were not carefully collected, and some the preservation was not very good, while some sites were either excavated on a small area or the stratigraphy was mixed. This is why some of these assemblages only consist of several artefacts, while some of the assemblages are rich in both quantity and quality. Numerous excavations carried out in the first half and mid-20th century did not practice careful collection of faunal material, and only selected bone artefacts were collected. In particular, from sites of Ludaš-Budžak, Nosa-Poroš, Nosa-Biserna Obala and Anište-Bresnica only complete objects are stored today in the museums and it is reasonable to assume that there were more bone objects in the excavated area, but were not noticed or considered not worthy of being collected. Problems with the interpretation of the stratigraphy and discerning of Starčevo and Vinča culture layers, caused by inadequate excavation technique of mechanical “spits”, exist at the sites of Divostin, Grivac and Pavlovac, and within these assemblages it is not clear to which period some artefacts belong. The information obtained from these sites are those regarding the presence of certain techniques and artefact types, while the absence of some traits is taken with caution.

Fortunately, some assemblages have sample bias reduced to a minimum. The site of Starčevo-Grad is very important, because it is relatively rich and there are no problems related to the interpretation of the stratigraphic sequence. In this case, it is obvious from the collection itself that faunal material was carefully collected during the excavations in the 1930’s, today in the National museum there are stored not

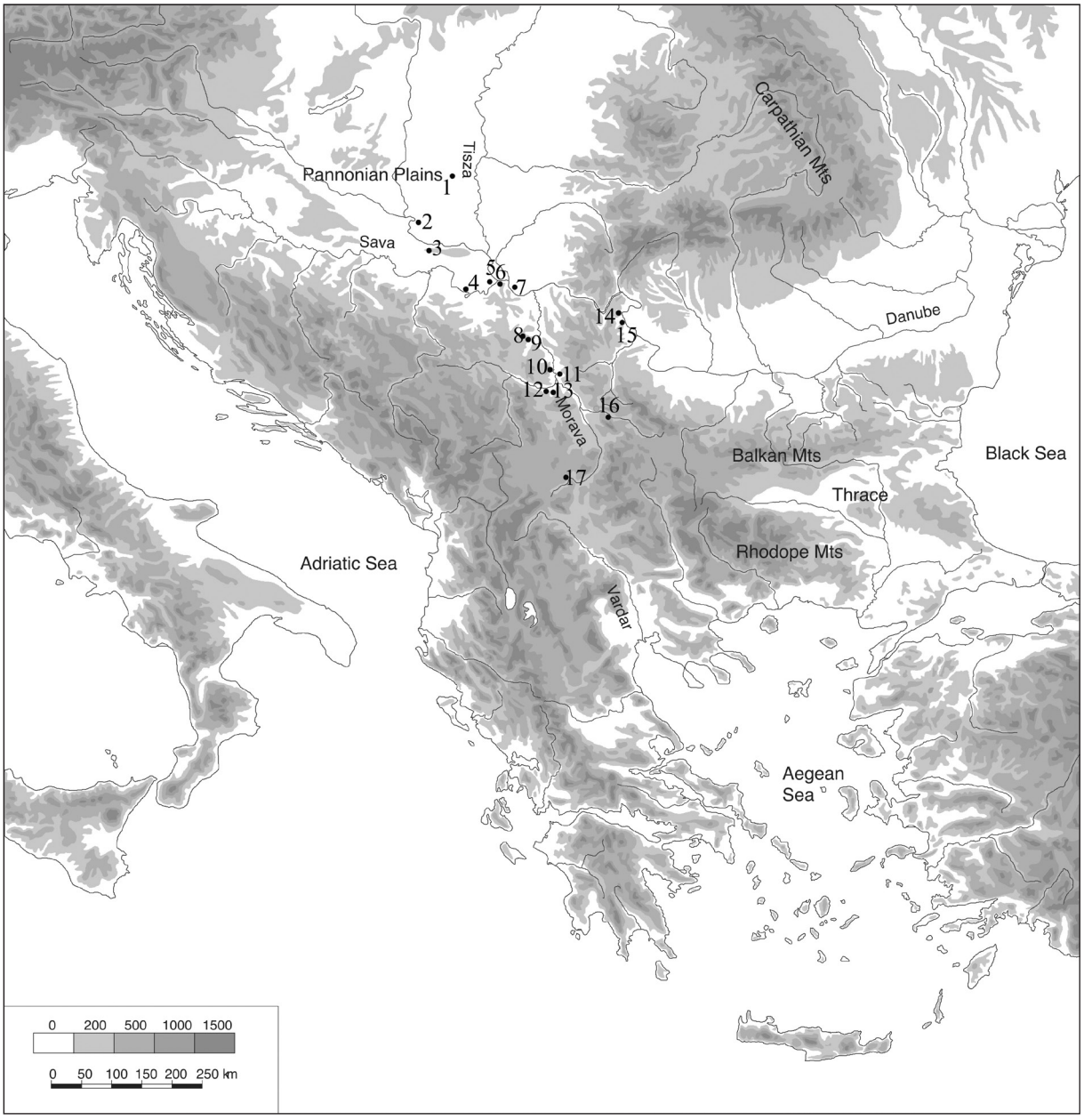

Figure 1. The most important Starčevo and Vinča culture sites mentioned in the text: 1. Ludaš-Budžak, 2. Donja Branjevina, 3. Golokut-Vizić, 4. Obrež-Baštine, 5. Jakovo-Kormadin, 6. Vinča-Belo Brdo, 7. Starčevo-Grad, 8. Grivac, 9. Divostin, 10. Međureč, 11. Drenovac and Slatina-Motel, 12. Stragari, 13, Vitkovo, 14. Velesnica, 15. Ušće Kameničkog Potoka and Knjepište, 16. Bubanj, 17. Pavlovac-Kovačke Njive.

only complete objects, but also fragments, manufacture debris, unworked faunal remains, *etc.* Furthermore, excavations carried out in the 21st century yielded collection with same technological and typological traits. Also, assemblages from sites of Međureč, Knjepište, Velesnica, Ušće Kameničkog Potoka were recovered and collected following the modern standards of archaeological excavations, and recent excavations at sites of Bubanj and Drenovac provided representative assemblages, with sample bias reduced to a minimum (see references for each of the sites for more details on the history of excavations, stratigraphy, preservation, *etc.*).

Osseous raw materials were used for producing a variety of objects: everyday tools (awls, needles, heavy points, scrapers, burnishers, chisels, wedges, hammers, small percussion tools, retouching tools, *etc.*), diverse utilitarian objects (such as handles or hafts), weapons (projectile points) and ornaments (beads, pendants, buckles, bracelets).

In the osseous technology of the Starčevo culture some traits may be noted that can be linked with the Mesolithic traditions, but also numerous innovations, linked

with changes in subsistence, economy, and other technologies, as well as with culture-driven changes. Some of these innovations are shared with other early Neolithic communities in Anatolia and south-eastern Europe, and they are usually considered to be the result of the Near-Eastern influences (cf. Sidéra 1998), however, they were not simply transmitted, but modified through the process of adoption (cf. Vitezović 2011c for more details on the Starčevo culture bone industry and Vitezović 2016b for a more detailed discussion on innovations and Near-Eastern influences).

Raw material management and selection

Osseous raw materials could be acquired from animals killed for food or could be collected (for example, shed antlers or mollusc shells) (cf. Vitezović 2016a and references therein). They could be obtained directly and locally, or acquired through trade and exchange (for example, mollusc shells from distant regions). In prehistoric communities, locally and directly acquired osseous raw materials usually prevail. However, this does not imply that all the available skeletal elements were used unselectively – certain choices among available raw materials were made, directed by their physical and mechanical traits as well as by cultural preferences (cf. Isaakidou 2003; Choyke 2010; 2013).

In the Starčevo culture, a strict selection of both skeletal elements and species was present. The main raw materials were sheep/goat and cattle long bones (mainly metapodial bones, tibiae) and ribs, followed by red deer antlers (Vitezović 2011c; 2014). Other skeletal elements were used only occasionally and in small quantities – such as roe deer antlers, boar tusks, other teeth and mollusc shells. Some skeletal elements were almost never used, such as cranial bones or pig bones. Reasons for such a choice are only partially technological – ungulate metapodial bones are very convenient for tool production because of their straight shaft and thick walls, and therefore widely used in prehistory (cf. Schibler 2013); however, the presence of pig bones in other cultures / periods shows their properties can be well exploited. We can also note that certain techno-types have a strict, exclusive choice of skeletal element and species, partially linked with their physical and mechanical properties (for example, use of antlers for percussion tools – cf. Vitezović 2014 and references therein).

There are some regional differences in the ratio of certain skeletal elements; especially when it comes to the usage of antlers, which are very frequent at some sites (especially Divostin and sites in the Iron Gates region, but also Starčevo-Grad), while almost completely missing at others – at Međureč, for example, not a single antler object was found (cf. Vitezović 2014). Antlers were not widely used in the early Neolithic in the region; they were rare or almost non-existent in the Körös culture (cf. Tóth 2013) or among early Neolithic communities in Greece (Perlès 2001). Somewhat more frequent use of antlers on Starčevo and Criş sites (cf. Vitezović 2014 and Beldiman 2007 respectively) could be a reflection of Mesolithic traditions, – namely, antler industry was important and diverse among the Mesolithic communities in the Iron Gates (Bačkalov 1979; Beldiman 2007; Vitezović 2011b). Antlers were mainly shed and so obtained by collecting, and this shows that Starčevo communities possessed the necessary knowledge about the environment, as the red deer tend to shed their antlers at the same place every year (cf. Clutton-Brock 1984).

Mollusc shells used for artefacts were only marine shells, mainly acquired fresh, although there is a possibility that some of the *Dentalium* shells were fossilised ones (cf. Dimitrijević 2014). Deliberate modification of freshwater *Unio* shells is not confirmed thus far. The quantities of mollusc shells encountered on different sites varies, in fact, they are quite rare and found in small numbers at only a few sites. Few shell ornaments come from Divostin, Međureč and Drenovac, while only at Starčevo-Grad the assemblage is somewhat richer and includes several *Spondylus* bracelets and three *Dentalium* beads (cf. Vitezović

2016c). These are only exotic, marine shells, acquired through some sort of exchange, and valued as prestige goods (cf. Vitezović 2012a).

The predominance of cattle and sheep/goat bones shows that the skeletal elements of domestic animals were already fully accepted as adequate raw material, and also that their physical and mechanical properties were well known. The study of raw material choices in the Natufian, PPNA (Pre-Pottery Neolithic A) and PPNB (Pre-Pottery Neolithic B) assemblages from Levant showed that a certain time is needed for domestic animals to be fully adopted and included into all segments of life and into diverse aspects of consumption (Le Dosseur 2010). During the Natufian and PPNA, gazelle bones were predominant both in faunal record and as a raw material. Caprinae increased in the fauna during the middle PPNB and even predominate, but the gazelle were still the preferred raw material choice. Goat and especially sheep bones became the main raw material choice during the late PPNB. This suggests that the frequency and easy access are not the determining reasons for the choice of species, and this shift in preferred raw materials from gazelle to sheep/goats also included changes in attitude towards the newly introduced animals.

Manufacturing techniques

Most of the manufacturing techniques encountered within the Starčevo culture have much in common with techniques practiced throughout prehistoric Europe, although some technological traits are more culture- and chronologically specific.

One of the most prominent innovations of Neolithic osseous technology was the widespread use of abrasion, directly linked with the introduction and widespread use of stone abrasive tools (cf. Antonović 2003; Antonović and Vitezović 2014). Abrasive stone tools became particularly abundant and diverse and include querns, static and portable whetstones and grindstones, *etc.* Their function was usually related to food processing, but some of these artefacts were used in the later stages of shaping objects from osseous raw materials, for repairing / re-sharpening cutting edges, pointed ends, as well as for more decorative polishing of mesial and basal surfaces.

A particularly interesting method of shaping concerns the production of pointed tools from small ruminant metapodials. This tool type was widespread in Europe throughout the Neolithic period (*e.g.* Bačkalov 1979; Beldiman 2007; Camps-Fabrer ed. 1990; Makkay 1990; Sidéra 2005; Stratouli 1998). Three distinctive manufacturing methods were recognised: (i) manufacture using abrasion only; (ii) manufacture by first sawing the metapodia in half and then abrading them; and (iii) manufacture by first abrading and then by sawing (cf. Murray 1979, Sidéra 2005). In the first and the third method, metapodial bone was first ground with an abrasive stone from both sides (dorsal and ventral) until it became flat. It may have been further shaped then by abrasion only, or by a combination of cutting with a flint tool and abrasion. The result are very thin, fine points. The distal epiphysis, preserved at the base, is often reduced to a very small, almost flat knob or simply ground from all sides, thus obtaining a more or less regular square shape. This method allowed more precise shaping, but restricted the number of artefacts which could have been fashioned from a single piece of raw material (Fig. 2).

The second method could enable the maximum of four tools from a single bone and, also, the results were not so fine, but more resilient, stronger awls. All three techniques for shaping were used within the Starčevo-Körös-Criş culture and the early and middle Neolithic in the region (cf. Beldiman 2007; Beldiman and Sztancs 2011; Makkay 1990; Stratouli 1998; Tóth 2012). In later periods, methods that included abrasion as the first step disappeared, and the second technique became predominant (cf. Bačkalov 1979; Russell 1990; Vitezović 2007; also see below). Unfortunately, at this moment it is not clear whether the abrasion-only technique existed

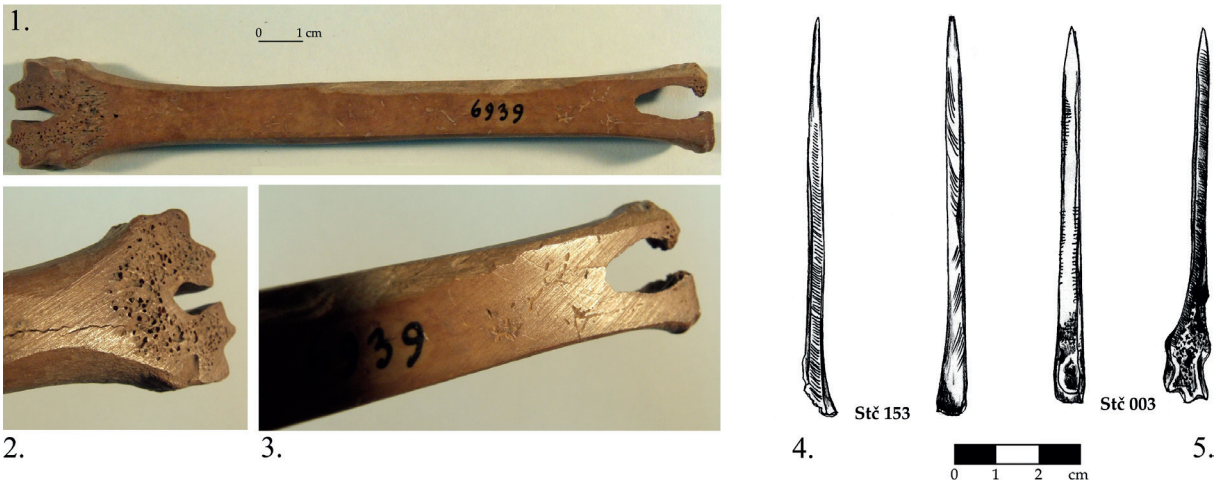

Figure 2. Method of manufacture of pointed artefacts by abrasion only: 1. manufacture debris – abraded metapodial bone, 2. and 3. details, 4. and 5. final products – awls, all from Starčevo-Grad.

in the early phases of the Vinča culture or if it disappeared with the final periods of the Starčevo culture, since the stratigraphy is uncertain for some of the finds.

The usage of technique for transversal division of long bones can also be considered as specific for the Starčevo culture. It is easier to divide large, thick long bones from large mammals into segments longitudinally than transversally due to the anisotropic traits of the long bones (Christensen 2004). In order to obtain segments that have full circumference and original width of the bone, a groove was made along the circumference of bone with a chipped stone tool and/or with abrasive fibre and the bone was either completely cut through or the final millimetre or so of the bone was just snapped or broken off. This method enabled obtaining blanks with predetermined dimensions, of regular shape and more or less straight edges, which was not possible with breaking or chopping.

A similar method of transversal division, grooving with a chipped stone tool and use of wet abrasive fibre, was also applied on antlers. Again, antlers, especially when fresh, are very resilient, and this technique, labelled *débitage by segmentation* (*débitage par tronçonnage*) or *cut-and-break technique*, enabled obtaining regular blanks (cf. Averbouh 2000, 186; Averbouh and Pétillon 2011, 41). Another technique was used for extracting elongated, flat blanks from beam segments, called *débitage by extraction* (*débitage par extraction*) or *groove-and-splinter technique* (cf. Averbouh 2000, 186; Averbouh and Pétillon 2011, 41). Usually, two parallel grooves were incised longitudinally and then a blank was extracted with a wedge (cf. Averbouh 2000; Averbouh and Pétillon 2011; Rigaud 2004).

Within the Starčevo culture, three distinct methods for making perforations on bones were noted. The most widespread method of making perforations was by drilling with a perforated chipped stone tool (with sand added), used to obtain smaller holes – usually 5-8 mm in diameter and circular in shape. This technique is generally applied to ornaments; perforated tools are very rare. The second method, scraping out the bone, which produced elongated, more oval perforations, was noted on a single example, on one bone needle from Pavlovac-Kovačke Njive (Vuković *et al.* 2016, t. VI/2).

The third technique was used to make larger holes, 1-1.5 cm in diameter and circular in shape. They were made with a hollow tool (perhaps some sort of a reed tube or something similar), with an abrasive substance added (*e.g.* sand) and are encountered on decorative items. These large perforations leave distinctive debris, in the shape of small circles, discovered at several sites so far, including a large amount at the site of Kremenjak-Čoka (cf. Vitezović 2013e). This technique is characteristic for the Starčevo-Körös-Criş cultural complex (cf. Beldiman and Sztancs 2011; Makkay 1990; Tóth 2012; see also Vitezović 2013e and references therein).

Typological repertoire

Some of the Neolithic osseous tools are not culturally or chronologically specific; they have simple shapes, which follow the natural shape of bones and were widespread across Europe – *e.g.*, awls from long bone splinters, scrapers from ribs, *etc.* Most of the characteristic techno-types actually display certain Near-Eastern influences. According to I. Sidéra (1998), Anatolian influences visible in the osseous industries in south-eastern Europe included the presence of some or all of the following techno-types: pointed tools with a cutting edge from small ruminant tibiae, antler sickles, elaborated fishhooks, needles with perforation made by incising, buckles, crude axes, spoons, and beads from bird bones.

These techno-types were not simply taken over by the Starčevo communities, but were modified through the process of adoption (Near-Eastern influences are discussed in more detail elsewhere – cf. Vitezović 2016b). The presence and quantity of these techno-types vary; some were not identified thus far (such as beads from bird bones or crude axes), some were found in small numbers (such as elaborated fish hooks or antler sickles), while some techno-types are relatively frequent. The types that are more common are spatula-chisels from caprinae tibiae, spatula-spoons from large ungulate metapodials and buckles and ring-shaped ornaments from large long bone segments.

Spatulae-chisels from caprinae tibiae were produced from almost the entire tibia bone; the proximal epiphysis is removed and bone obliquely ground to obtain a working edge. Sometimes, basal parts are additionally smoothed (Fig. 3). They were discovered at sites such as Grivac, Divostin, Rudnik near Srbica and Pavlovac-Kovačke Njive (Vitezović 2011c; Vuković *et al.* 2016). Their frequency varies and they are generally not as important as, for example, in the Bulgarian Karanovo I-II culture (cf. Lang 2005; Zidarov 2014). Also, in the eastern Balkans, tibia tools are still produced in the late Neolithic, while in the central Balkan area the usage of entire tibia bones disappears in later stages.

Spatula-spoons take a very special place in several Anatolian (*e.g.* Dekker 2014; Özdoğan 2011; Russell 2006; 2016) and south-eastern European osseous industries, including the Starčevo-Körös-Criş cultural complex (cf. Beldiman 2007; Beldiman and Sztancs 2011; Makkay 1990; Nandris 1972; Tóth 2012; Vitezović 2011c; 2011d; 2013b; 2016d) and the Karanovo I-II culture (cf. Lang 2004; Zidarov 2014). They are considered by M. Özdoğan (2011) as part of the "Neolithic package", while J. Nandris (1972) singled them out as the key bone artefact for the "First Temperate Neolithic".

Spatulae-spoons were made almost exclusively from large ungulate metapodial bones. Although it was suggested by Nandris (1972) that only bones of wild *Bos primigenius* were in use, *Bos taurus* metapodials prevail or were even exclusively used in the Starčevo culture. Spatula-spoons are particularly meticulously made, with very high skill, time and labour investment. According to the experimental results, approximately 25 hours of work were needed for one spoon (Sidéra 2011). They were produced from an entire metapodial bone through several stages of cutting, scraping, burnishing and polishing. They have elongated handles of cylindrical or oval cross-sections, straight or gently curved, and a bowl (spoon-part) at the distal end, usually completely flat or slightly concave. Bowl shapes vary – they may be elongated, leaf-shaped, or shorter, triangular, or, rarely, oval (Fig. 4). Zoomorphic handles, known from Anatolian sites (Mellaart 1961, pl. 4/c; 1965) and occasionally encountered in Bulgaria, have not been discovered thus far (cf. Vitezović 2016d and references therein). However, it should be noted that one projectile-shaped artefact from Donja Branjevina, probably a re-worked spoon, had a zoomorphic base (Vitezović 2011d, 31). Also from Donja Branjevina, one fragmented piece has a peculiar base – decorated with two rows of incisions (Vitezović

Figure 3. Spatula-chisels from caprine tibiae, 1. Divostin and 2. Pavlovac-Kovačke Njive.

2011d, 37, Fig. 18/2), and one example from Tečić may be mentioned with incisions on both sides at basal part of the bowl (Vitezović 2016d, 192, Fig. 3).

Very intensive, long use is another important feature of these artefacts. High polish and shine from use, worn bone tissue is visible on all of them; sometimes they have broken or damaged edges, and we may observe how they continued to be in use even after the breakage. Their function is still enigmatic; the intensive use-wear, especially damages, was interpreted as being related to contact with either clay or stone (cf. Georgiev 1967; Nandris 1972). They may have been used on special occasions, and their original purpose may have been related to the processing of different plants, perhaps "special" plants, such as medicines or spices. They might have served as cosmetic tools as well (cf. also Dekker 2014; Russell 2006; 2012). In the Starčevo culture, they were used for long periods of time and often repaired; therefore, it may be assumed that their original function was rather important (Vitezović 2011c). Their final function was probably as some sort of burnishers, as suggested by the presence of a high level of polish and shine, consistent with the prolonged contact with soft, organic materials, such as leather, hide and plant fibres (cf. Peltier 1986; Maigrot 2003; Legrand 2007; also cf. observations by Tóth 2012, 175). Perhaps one of their functions included processing pigments (for a more detailed analysis of spatula-spoons in the Starčevo culture, cf. Vitezović 2016d).

All these traits, their relative frequency (over forty examples were discovered at sites such as Donja Branjevina or Starčevo – cf. Vitezović 2011d; 2016d), important skill and labour investment in their production and long use often with repairs show that this techno-type was an important segment of the Starčevo material culture.

Another culture-specific bone item should be mentioned, namely one subtype of projectile points. Projectile points made from bones were relatively frequent in the Starčevo culture (unlike chipped stone projectiles) (Vitezović 2012b; 2018a). They were presumably used for hunting and fishing, and they were carefully made, suggesting that they were valued objects. Three subtypes were noted, and one of them is made from metapodial bones by using the very same manufacturing procedure as for spatula-spoons, furthermore, some are actually modified handles of broken spatula-spoons. So far, they have been discovered within Körös (Makkay 1990), Criş (Beldiman) and Starčevo culture sites (cf. Vitezović 2012b; 2018a).

New artefact types also include several decorative items. One of them being buckles in the shape of an open bracelet, all made from long bones of considerable

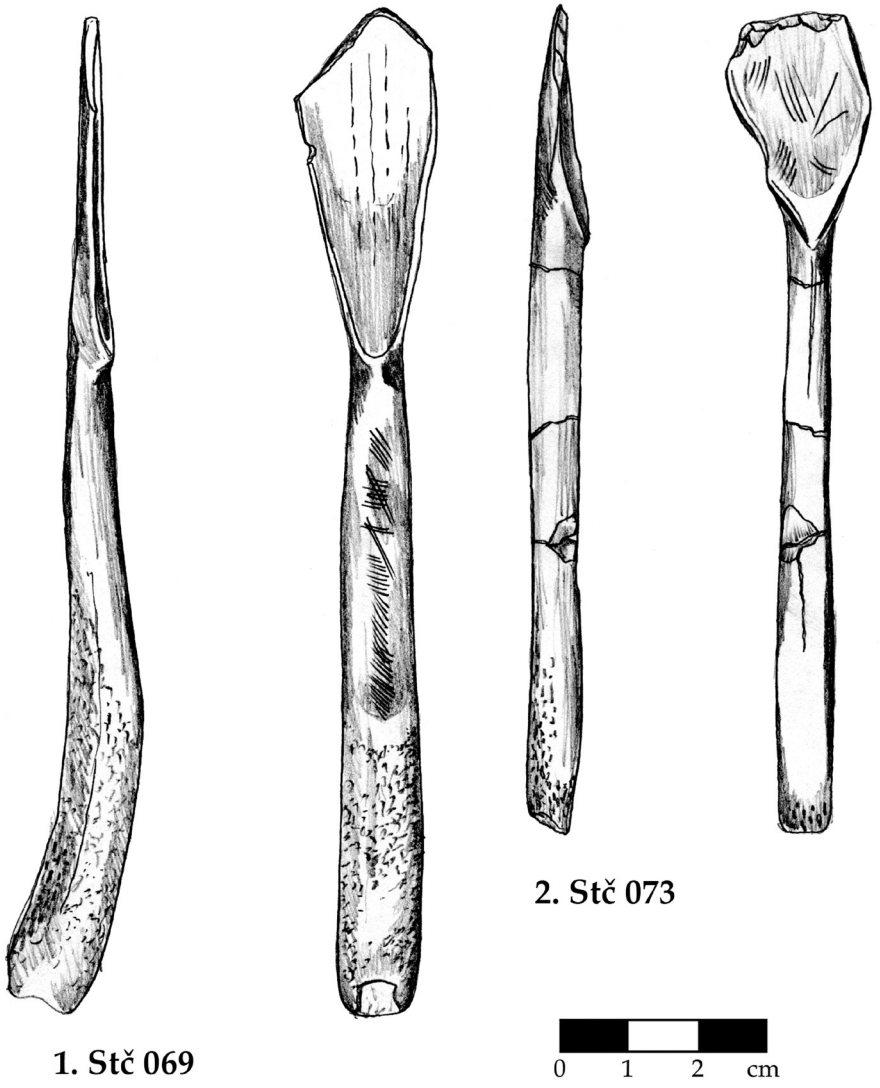

Figure 4. Spatula-spoons made from Bos metapodial bones, Starčevo-Grad.

size, from large ungulates, probably *Bos.* Bones were cut transversally by making a groove with abrasive fibre; and then by cutting the bone with a flint tool. All these objects have carefully shaped heads, made by cutting with a flint tool, and all the surfaces were carefully polished with some fine-grained stone. However, their original shape is unknown – whether they were in the shape of a half-circle or almost full circle, as they are all broken in the middle. This breakage is probably due to use – these peculiar artefacts may have been used as some sort of belt buckle or clasp for clothing pieces (Vitezović 2012a).

Among the region and culture specific decorative items, rings, disks and rectangular plates with large holes may also be included, all of similar morphology with slight variations. They were obtained by using the above-mentioned specific techniques, either by transversal cutting of large long bones (ring-shaped pieces), or from diverse flat pieces of bones, mainly from diaphyses of large long bones, by cutting, burnishing and polishing and by making large holes with a hollow tool (disks and rectangular perforated plates) (Vitezović 2012b; 2013e).

Osseous industry in the Vinča culture

The study of technological changes is based on assemblages from the following sites, partially or completely analysed by the author: Jakovo-Kormadin (Vitezović 2010; Krištofić 2016; 2017), Vinča-Belo Brdo (Srejović and Jovanović 1959; Bačkalov 1979; Cristiani *et al.* 2016; unpublished work by the author), Drenovac, Slatina-Motel (Vitezović 2007), Vitkovo (Vitezović 2011e), Stragari (Vitezović 2007; 2009; 2011f), Belovode, Pločnik (Vitezović in press a; in press b), Grivac and Divostin (Vitezović 2013c; 2013d) (cf. also Vitezović and Bulatović 2013; Vitezović 2017b) (Fig. 1). Also, the osseous industry from the site of Selevac is extensively published (Russell 1990). Again, sample bias is present, thus making it difficult to measure and quantify some of the observed features; for example, over 300 objects were discovered at Drenovac within a single trench, while a rescue excavation campaign at Slatina-Motel yielded only approximately 60 artefacts (cf. Vitezović 2007). On the other hand, some of these assemblages are quite abundant, in fact, providing more detailed information on variations within assemblages, but also creating distorted images for underrepresentation of some raw materials or techno-types on other sites. This especially refers to the site of Vinča-Belo Brdo, where excavations first started in 1908 and, with some pauses, are still on-going. At this site an impressive 9m-thick cultural layer was discovered and a substantial quantity of portable finds also comes from the large area that was investigated, including osseous artefacts (cf. Bačkalov 1979; Nikolić *ed.* 2008). Also, as mentioned above, the stratigraphic situation is not always clear in case of the sites of Divostin and Grivac. Fortunately, some of these assemblages come from meticulous, careful excavations – recent campaigns at Drenovac, Belovode, Pločnik, Vitkovo and Jakovo-Kormadin (see references for each of the sites for more details on the history of excavations, stratigraphy, preservation, *etc.*).

In the Vinča culture, as in the Starčevo culture, the osseous raw materials were used mainly for everyday tools (awls, needles, points, scrapers, spatulae, chisels, axes, adzes, hammers, small percussion tools), for other utilitarian artefacts (such as handles of hafts), for weapons (harpoons, fish hooks) and for ornaments (beads, pendants, buckles, bracelets).

Raw material management and selection

The differences between raw material choices within Starčevo and Vinča cultures are not drastic, but more of a question of nuances. Ungulate long bones were the preferred raw materials, along with large mammal ribs (mainly cattle). Among the long bones, metapodia, in particular sheep/goat metapodia were the predominant choice, while other long bones are only rarely identified. Pig bones were still mainly avoided. As a new skeletal element, we now encounter worked astragal bones.

As a general trend, we may note an increased standardisation in the raw material choices, *i.e.*, the increase of metapodial bones and ribs at the expense of other bones. However, this is difficult to measure, since it often cannot be identified with certainty which particular bone the long bone segments belong to, but, we may note that techno-types such as heavy points or awls from ulnae or spatula-chisels made from tibiae were not identified at any of the analysed sites. Ribs also seem to be used more often, and typological repertoire is more diverse (see below), but, due to the different nature of the available record, it is not possible to quantify the increase of the rib usage (Fig. 5).

The exploitation of antlers is more prominent within the Vinča culture. While within the Starčevo culture there were assemblages where antler artefacts were few or completely absent, antlers are more frequently encountered in Vinča settlements (all analysed assemblages included antler objects); furthermore, there are several sites where not only antler artefacts prevail, but also a considerable

Figure 5. Awls made from ribs, Belovode.

amount of manufacture debris were discovered – such as sites of Jakovo-Kormadin (Vitezović 2010; Krištofić 2016) and Divostin (Vitezović 2013c) (Fig. 6).

Another difference is visible regarding mollusc shells. As in the Starčevo culture, only marine shells were used, mainly fresh ones, with possible exception of use of fossil *Dentalium* shells (cf. Dimitrijević 2014). Contrary to only a few objects from shells in the Starčevo culture and from a few sites only, shells are now encountered more often and are more diverse both regarding the typological repertoire and their species. However, it is difficult to interpret this situation. As already mentioned, differences in excavations strategies and the generally much larger quantity of discovered portable finds from Vinča settlements do not reflect the real situation. Furthermore, the richest assemblage in terms of both quantity and quality comes from the site of Vinča-Belo Brdo, where over 300 fragmented and complete artefacts were discovered, from *Spondylus, Glycymeris, Dentalium* and *Cardium* shells. The typological repertoire is also diverse, and includes beads, bracelets, applications, pendants (Srejović and Jovanović 1959; Dimitrijević and Tripković 2002; 2006). Not only does Vinča-Belo Brdo have the largest portion of the site excavated, it is extraordinary in all other aspects – the prehistoric settlement at Vinča had an extremely long duration of occupation and its character was probably also extraordinary, *i.e.*, it was a trade and exchange centre

Figure 6. Semi-finished object and manufacture debris from antler, Jakovo-Kormadin.

(cf. Vitezović and Antonović 2019). Furthermore, the discovery of a unique Vinča culture cemetery at the site of Botoš-Živanića Dolja yielded an amount of personal ornaments that is not encountered within settlements, and thus contributed to the quantity and diversity of finds of exotic mollusc shells[1] (Marinković 2010). Therefore, although the increase in quantity and diversity of mollusc shell objects in the Vinča culture is connected with more intensified occupation, it is also the result of differences in the nature of the available archaeological record.

Manufacturing techniques

Again, main techniques for obtaining blanks and shaping osseous artefacts do not differ considerably from those used in the Starčevo culture, although specific manufacturing procedures of the early Neolithic gradually disappear in the Vinča culture.

Metapodial bones, the main raw material, are usually longitudinally divided by grooving and then further shaped by abrasion. It is not clear if the method of shaping by abrasion only was still in use in the early phases of the Vinča culture, however, it was certainly completely abandoned by the later stages.

One new technique for production of pointed artefacts from long bone segments is recognized in the late Neolithic in the region, labelled quartering – the long bone was first divided longitudinally into two equal halves and then

1 Vinča culture graves are known so far only from the sites of Gomolava (several intra-murial burials) and from Botoš-Živanića Dolja (extra murial burials), while only single or several burials located within settlements – at Velesnica, Golokut, *etc.* – are known from the Starčevo culture – see Borić 1996 for details and references.

divided again into four blanks (Choyke and Tóth 2013). However, it is difficult to assess to what extent this specific technique was used within the Vinča culture. We can note, however, that, beside pointed artefacts made from one longitudinal half of a long bone, with a semi-circular cross-section, pointed tools made from diverse long bone segments were also relatively frequent. These include irregularly shaped splinters, probably obtained by direct percussion and finalized by abrasion, as well as tools with a very small portion of the epiphysis preserved at the basal part and a more or less triangular cross-section, obtained either by quartering technique or simply irregular longitudinal division.

Manufacture debris discovered within one pit at the site of Vitkovo is particularly interesting. Several bone segments have a partially executed groove for longitudinal division – the breakage does not follow the groove entirely, but runs next to it. Such "mistakes" could have been quickly fixed; straight, smooth edges were easily obtained by use of abrasive tools. This find from Vitkovo, along with the increased use of diverse, less regular long bone segments, disappearance of some (more time-consuming) débitage procedures (such as careful transversal division by grooving and by use of abrasive fibre) and increased use of abrasion, actually show that *débitage* phases in bone tool production were now quicker, simpler, less carefully executed and more effort was invested in later phases, namely into the final shaping by abrasion. Abrasion in general is very efficient for smoothing rough, irregular surfaces or edges of bones and especially for repairing any mistake or irregularity in the shape (cf. Semenov 1974). Again, quantifying and measuring these changes is very difficult, but all these technological aspects actually suggest an increased production, perhaps because of increased demand for osseous tools and related time-saving manufacturing techniques.

Antler working techniques were also slightly changed. Antlers were generally divided into segments by a combination of diverse techniques, and the following techniques were identified on the Vinča culture material: *débitage by segmentation, débitage by extraction* and *débitage by fracturation* (Vitezović 2017; cf. also Averbouh 2000; Averbouh and Pétillon 2011; Billamboz 1977; Rigaud 2004). The technique called *débitage by segmentation* (*débitage par tronçonnage*) or *cut-and-break technique* (cf. Averbouh 2000, 186; Averbouh and Pétillon 2011, 41) was used for transversal division and included a combination of grooving, cutting and chopping. While in the Starčevo culture the groove was usually made with a chipped stone tool and wet abrasive fibre and was almost perpendicular to the antler piece, in the Vinča culture the groove was most often made by cutting antler with a flint blade or the cortex was thinned by a gradual removal of thin stripes – by whittling and cutting small pieces. This technique may be identified by the negative traces of removed pieces, usually concentrated at the basal part of the tool, which are in some cases quite long, over one cm. After the cancellous tissue was reached, the remaining portion of the antler was chopped off, cut off with one or several blows, or snapped by flexion, and occasionally rough edges from remaining portion that was broken off may still be preserved (Fig. 6).

The technique called *débitage by extraction (débitage par extraction*) or *groove-and-splinter technique* (cf. Averbouh 2000, 186; Averbouh and Pétillon 2011, 41) was used for longitudinal division and for extracting blanks from the outer part of the antler. Usually two parallel grooves were incised longitudinally and then a blank was extracted with a wedge. Although this technique was in use in the Starčevo culture as well, it seems that it was more common in the Vinča culture, *i.e.*, artefact types made from cortex segments are more frequent and more diverse, and include harpoons, chisels, spoons, *etc.*

Another technique may be recognised within the Vinča antler industry. It is the so-called *débitage by fracturation (débitage par fracturation)*, which consists of the fracturing of a block by knapping in order to produce flakes, encountered occasionally in several prehistoric cultures, mainly Palaeolithic (Averbouh 2000, 186;

Averbouh and Pétillon 2011, 41). The find of approximately fifteen small fragments of antler cortex with traces of cutting and whittling, coming from a single context, discovered at the site of Jakovo-Kormadin (Vitezović 2010, 52), suggests occasional use of this or a similar technique within the Vinča culture (Fig. 6).

Perforations on bones and teeth were made exclusively by drilling with a chipped stone perforator. They are slightly more frequent: they occur on ornaments, such as perforated teeth, other pendants and some sort of applications, but also on tools – on awls, needles, even spatulae.

Typological repertoire

Near-Eastern influences (as defined by Sidéra 1998) are no longer visible in the Vinča culture assemblages. Techno-types such as tibiae spatula-chisels, elaborated fish hooks or antlers sickles are not encountered at any of the Vinča settlements. The techno-type that resembles the spatula-spoons still exists within Vinča assemblages, but is completely altered in terms of technology and use. The main shape and the main idea are preserved: a single piece of raw material was modified into an object with an elongated handle and flat or slightly concave bowl (spoon-part). However, the strict selection of skeletal elements disappears, the entire production process is simplified, and the use wear traces show these objects were mainly used in burnishing and polishing of different organic raw materials. It is interesting that even antlers were used for spoons. Although producing such an object from a single piece of antler required certain skill, they are no longer carefully burnished and polished.

We can note that some artefact types are now much more frequent and the number of standardised subtypes and variations increases. It is not possible to present statistical data for this either, because of the different nature of the archaeological record, but it can be noted more as a general trend in the Vinča osseous industry. Medium-pointed tools or awls usually comprise more than 40% of the assemblages (cf., for example, Selevac – Russell 1990, or Drenovac – Vitezović 2007). Furthermore, they now are encountered in several standardized subtypes and variants: awls made from split ungulate metapodials with half of distal epiphysis at the base, awls from split metapodials with segments of proximal epiphysis at the base, one-sided awls made from split ribs (Fig. 5), double-pointed awls made from split ribs. As mentioned above, the use of ribs increases in the Vinča culture, and we may note two new techno-types made exclusively from ribs: spatula-awls and double-sided awls. Both types are made by using the same technique as for simple awls – ribs are divided into segments, split into two plates and further shaped mainly by abrasion. Double-sided awls have both ends pointed (and used), while spatula-awls have one end pointed and other one used as a burnisher or scraper.

Used astragals emerge as one new artefact type now. Complete astragal bones were sometimes modified, by adding one or several perforations, or used in unaltered shape. Perforations may be situated in the centre or at proximal portion, and the use-wear traces may cover condyles and/or entire lateral surfaces. Bones from ungulates (sheep/goats, cattle, red deer) were usually used, but very rarely from pigs (fig. 7). Astragals with traces of use can be encountered in numerous Neolithic and Chalcolithic sites in south-eastern Europe (cf. Grabundžija *et al.* 2016; Kogălniceanu *et al.* 2014; Meier 2013) and their function is still a matter for discussion. Bronze Age astragals from Hungary were probably used as burnishers on clay, as suggested by experimental work (Meier 2013). For the Vinča culture astragals, use-wear traces resemble consequences of contact with soft, organic materials, such as leather, hide, plant fibres (cf. Peltier 1986; Maigrot 2003; Legrand 2007) and this is why it was suggested that they are connected to textile production (cf. Grabundžija *et al.* 2016; Vitezović 2007). Perhaps they were used as burnishers, and those with perforations perhaps had an additional purpose as weights for loom or as spindle whorls, or they

Figure 7. Used astragali, some with perforations, Pavlovac-Kovačke Njive.

were related in another way to fibre production (especially those with groove running from perforation, clearly produced by use) (cf. Grabundžija *et al.* 2016; Vitezović 2007).

One techno-type that disappears in the Vinča culture should also be mentioned – retouching tools. Artefacts used for pressure flaking, retouching and repairing chipped stone tools were crafted from osseous raw materials throughout the Palaeolithic times, they were still present in different Mesolithic cultures, but their frequency declined in the Neolithic period. They were present in the Starčevo culture, though not in large numbers, but their presence in the Vinča culture is questionable. It is possible that some of the small percussion tools discovered at Selevac (Russell 1990) were used as retouchers as well (for an overview of retouching tools in the Neolithic, see Vitezović 2018b).

Perhaps the most conspicuous difference in typological repertoire is visible in hunting and fishing weapons. Projectile points made from bones, relatively frequent in the Starčevo culture, now disappear. Rare examples of projectiles made from long bones are more *ad hoc*, and in a technological aspect completely different from carefully shaped Starčevo projectiles.

Harpoons and large fish hooks, sometimes barbed, emerge as a new techno-type now. They were all made from red deer antler segments. These objects are not encountered within the entire Vinča culture, but are rather limited to areas near large plain rivers – such as Gomolava, on the bank of the Sava river in Srem (objects on display at the permanent exhibition at the Museum of Vojvodina in Novi Sad), and especially Vinča-Belo Brdo, situated near the mouth of the Bolečica river into the Danube.

Harpoons were made from large segments of beams of red deer antlers. Three variants occur: uniserial harpoons, biserial symmetric and biserial asymmetric. They were made by extracting the blank first by *débitage by extraction (débitage par extraction*), and further shaped mainly by cutting and scraping with chipped stone tools (Fig. 8).

Antler hooks are quite large, the usual length of the shank is 7-9 cm, and the point can be sometimes barbed. They were also made from beam segments, through several stages of cutting and scraping with chipped stone tools. Presence of manufacture debris

Figure 8. Antler harpoon and antler hook, Vinča-Belo Brdo.

within the site of Vinča-Belo Brdo clearly shows that they were produced locally. At the site of Vinča-Belo Brdo possible lure hooks were also identified made from different bone segments (Cristiani *et al.* 2016). This would suggest, perhaps, that different fish species were hunted at Vinča-Belo Brdo (and probably other sites in the Pannonian plain) and/or different methods of fishing were applied. Also, it is possible that certain functional specialization between sites existed, and that Vinča produced large amounts of fish for exchange with other settlements (cf. Vitezović and Antonović 2019).

Differences and similarities in the typological repertoire in ornaments are more difficult to establish. Not only are personal ornaments very infrequent (with the exception of the sites of Vinča-Belo Brdo and Botoš-Živanića Dolja, as mentioned earlier – but they consist mainly of common types made from mollusc shells) in both Starčevo and Vinča assemblages, but some items have unique shapes. We can observe that buckles in the shape of an open bracelet and ring-shaped ornaments are disappearing in the Vinča culture. Possible new Vinča type, items which were probably used as some sort of decorative needles can be singled out. One unique object from Stragari can be mentioned, with the head (proximal part) resembling a bucranion. Applications made from bones or boar tusks, with two or more perforations, perhaps also represent typical Vinča ornament.

Discussion and conclusion

The acquiring and managing of raw materials changed significantly as the economy changed. Bones from sheep, goats and cattle became the predominant raw material choice in the Neolithic period, showing that domestic animals were fully adopted and accepted in all segments of economy and consumption, and became not only acceptable, but preferable raw materials for most daily tools. The predominant acquisition of shed antlers in both the Starčevo and the Vinča culture reveals the close relations to and knowledge about the surrounding environment.

The Starčevo culture osseous industry shows an interesting mix of preservation of some of the techno-typological traits connected with the Mesolithic tradition and the introduction of the new techno-types, mainly of Near-Eastern origin, but somewhat altered during the process of adoption into the new cultural milieu (cf. Sidéra 1998, Vitezović 2016b). These changes are taken further in the Vinča culture, where we can also note the increased standardization and some innovations that can be considered as a local characteristic. Mesolithic traditions that can be up to a certain extent recognized in the Starčevo osseous industries disappear in the Vinča culture. Also, Near-Eastern influences, already modified in the Starčevo culture, are no longer visible in the Vinča culture. In her analysis of new elements of Near-Eastern origin in the eastern Balkan bone industries, I. Sidéra (1998) noted that the style of production is rapidly changing from one site to another. In the case of the Starčevo culture bone industry, we may note that only a portion of the "package" of Anatolian influences was adopted; furthermore, some of these traits were adopted after having been already partially altered (such as the forms and functions of spatula-spoons). These modifications continue in the Vinča culture. Unlike, for example, the late Neolithic in Bulgaria, where techno-types such as spatula-spoons from large ungulate metapodials, spatula-chisels from caprinae tibiae or antlers sickles continue to be in use (cf. Lang 2005), the Vinča culture displays traits that can be described as more locally specific, and perhaps even more authentic, original and/or autochthonous.

Manufacturing techniques also show innovations connected with alterations in other technologies. The most important change is the adoption and widespread use of ground stone tools for several finalizing steps, burnishing and polishing. An increased quantity of fine- and medium-sized pointed tools (needles, awls), and the introduction of some new subtypes in variants in the Starčevo and even more in the Vinča culture, perhaps point to an increased production in *perishable technologies* – in processing plant fibres, leather and hides. On the other hand, a gradual disappearance of retouching tools reflects changes in chipped stone industry.

The most important difference between the Mesolithic (and earlier, Palaeolithic traditions) and the Neolithic osseous industries in both the early and the late Neolithic is in the cultural attitude towards osseous raw materials. They are no longer used for figural representations or decorations, but the new material, clay, is now preferred for diverse figural presentations and for objects of possible cultic function. In the Mesolithic, decorations may be occasionally found on non-worked skeletal elements or finished and used tools (cf. Radovanović 1996). No bone tools with decorations have been discovered in either the Starčevo or the Vinča culture, and no anthropomorphic or zoomorphic representations were made from osseous raw materials (the only exception being the projectile-shaped object from Donja Branjevina with a zoomorphic head, while the head of the decorative pin from Stragari may have not been deliberately shaped into that zoomoprhic-looking form). However, osseous raw materials were not only widely used for decorations in both cultures (Bačkalov 1979; Vitezović 2012a), but were in fact the preferred raw material for personal ornaments (particularly noticeable at the cemetery at Botoš – cf. Marinković 2010), as in numerous other prehistoric cultures across Europe and the Near East (cf. Taborin 2004).

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Notes on contributor

Selena Vitezović is archaeologist from Serbia; she studied at Faculty of Philosophy, University of Belgrade, where she defended her MPhil thesis, Bone industry in the Neolithic in the central Pomoravlje region in 2007 and defended her PhD thesis, Bone industry in the Early and Middle Neolithic in 2011. She is currently employed at Institute of Archaeology in Belgrade. Her main research focus is on the prehistoric period (in particular, Mesolithic, Neolithic and Eneolithic) and on technology and economy, especially osseous technology. She participated at numerous archaeological excavations as team member and expert for the analyses of artefacts from hard

animal tissue at prehistoric sites in SE Europe, including Vinča-Belo Brdo, Starčevo-Grad, Pavlovac, Drenovac, Bubanj, prehistoric mine on Prljuša mountain (Serbia), Vlakno (Croatia), Voden, Nova Nadežda, Mursalevo (Bulgaria) and many more. She published over 30 articles in Serbian and international scientific journals, over 25 chapters in edited volumes, and also edited or co-edited 5 books, including Archaeotechnology: studying technology from prehistory to the Middle Ages (2014), Close to the bone: current studies in bone technologies (2016) and Archaeotechnology Studies : raw material exploitation from Prehistory to the Middle Ages (2017). She published one monograph, Methodology for studying prehistoric bone industries (2016).