

# ZAŠILJENO KOŠTANO ORUĐE IZ BRONČANODOBNOG STOBREČA: SIROVINSKA, TEHNOLOŠKA, TIPOLOŠKA I FUNKCIONALNA ANALIZA

## POINTED BONE TOOLS FROM BRONZE AGE STOBREČ: ANALYSES OF RAW MATERIAL, TECHNOLOGY, TYPOLOGY AND FUNCTION

ANTONELA BARBIR

Institut za arheologiju u Zagrebu  
Institute of Archaeology in Zagreb  
Jurjevska ulica 15  
HR-10 000 Zagreb  
abarbir@iarh.hr

MARINA UGARKOVIĆ

Institut za arheologiju u Zagrebu  
Institute of Archaeology in Zagreb  
Jurjevska ulica 15  
HR-10 000 Zagreb  
mugarkovic@iarh.hr

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Ovaj rad pruža prvu studiju grupe zašiljenih koštanih oruđa iz nedavno otkrivenog i dijelom istraženoga prapovijesnog naselja na području današnjeg Stobreča kod Splita, odnosno, po svemu sudeći, njegova srednjeg i kasnog brončanodobnog horizonta. Provedene su detaljne analize sirovine, tehnologije izrade, tipologije i funkcije kako bi se rekonstruirali aspekti svakodnevnog života ove prapovijesne zajednice te produbio uvid u njezine ekonomske aktivnosti i strategije iskorištavanja resursa. Istraživanje je pokazalo dominantnu upotrebu kostiju domaćih životinja, uz prisutnost lovne komponente. Morfološke karakteristike kostiju, kao i razvijene metode obrade, bile su ključne za oblikovanje oruđa poput probojaka, šila, igala i projektila. Funkcionalna interpretacija, temeljena na mikroskopskoj analizi tragova, ukazuje na obradu kože i biljnih vlakana te tekstilnu proizvodnju, kao i potencijalnu upotrebu u lovu ili ratovanju. Obogaćujući skromnu građu o prapovijesnim koštanim izrađevinama na istočnojadranskom priobalju, ova studija istodobno naglašava važnost interdisciplinarnoga holističkog pristupa za cjelovitu rekonstrukciju prapovijesnih praksi.

### KEY WORDS:

bone artefacts, raw  
material, technology,  
typology, functional  
analysis, Bronze Age,  
Stobreč, Dalmatia

This paper presents the first study of a group of pointed bone tools from a recently discovered and partially investigated prehistoric settlement in the area of present-day Stobreč near Split, corresponding to its Middle and Late Bronze Age horizon. Detailed analyses of raw material, manufacturing technology, typology and function were carried out in order to reconstruct aspects of everyday life within this prehistoric community and to deepen the understanding of its economic activities and resource exploitation strategies. The research revealed a predominant use of bones from domestic animals, with evidence of a hunting component. The morphological characteristics of the bones, as well as the developed methods in which they were worked, were crucial for shaping tools such as borers, awls, needles and projectiles. Functional interpretation based on

*microscopic use-wear analysis indicates the working of hides and plant fibres, as well as textile production and possible use in hunting or warfare. Enriching the modest corpus of prehistoric bone artefacts from the eastern Adriatic coast, this study simultaneously highlights the importance of an interdisciplinary and holistic approach for the comprehensive reconstruction of prehistoric practices.*

## UVOD

Koštane<sup>1</sup> izrađevine, kao čest arheološki nalaz, osobito iz prapovijesnih razdoblja, predstavljaju bitan izvor informacija za rekonstrukciju svakodnevnog života arheoloških populacija. Zbog svojih specifičnih fizikalnih svojstava, kao što su iznimna tvrdoća i elastičnost,<sup>2</sup> koštane sirovine bile su optimalne za oblikovanje i upotrebu u širokom spektru aktivnosti. Njihova primjena obuhvaćala je obradu i izradu tekstila, izradu košara i prostirki, obradu kože i drveta, lončarstvo i lov.<sup>3</sup> Analiza ovih predmeta pruža detaljan uvid u aspekte strategija preživljavanja prapovijesnih zajednica, uključujući njihove ekonomske aktivnosti i iskorištavanje resursa, ali i spoznaje o kreativnim društvenim praksama.

Unatoč njihovoj važnosti, objavljenost studija prapovijesnih koštanih izrađevina iznimno je skromna za područje srednje Dalmacije, kao i na cjelokupnom istočnojadranskom priobalju. Dodatno, u prošlosti je primijećen selektivan pristup prikupljanju koštanih izrađevina, dok su određene objave ograničene samo na spomen njihove prisutnosti, bez dodatne dokumentacije, analize ili interpretacije.<sup>4</sup> Dostupne studije često su limitirane na osnovne tipološke ili statističke podatke, što ograničava dublju analizu funkcije i važnosti ovih predmeta u svakodnevnom životu prapovijesnih društava.

Nekoliko je studija dostupno iz razdoblja paleolitika i mezolitika.<sup>5</sup> Nešto su detaljnije

<sup>1</sup> Zbirni izraz koji obuhvaća nalaze od kosti, roga, zuba.

<sup>2</sup> REITZ, WING 2008: 39.

<sup>3</sup> CHOYKE 2013: 2.

<sup>4</sup> U obzir su uzete samo studije koje se bave ovom vrstom artefakata, dok sam spomen njihove prisutnosti nije komparativno promatran, s obzirom na to da se može pretpostaviti da su izrađevine ovog tipa prisutne na većini prapovijesnih lokaliteta, a nedostatak dokumentacije i studije onemogućava komparativnu analizu.

<sup>5</sup> Npr. KOMŠO 2006; KARAVANIĆ et al. 2013; ČUJKEVIĆ-PLEČKO, KARAVANIĆ 2017; RADIĆ 2018: 27; VIJEZOVIĆ, VUJEVIĆ, RADOVIĆ 2024.

## INTRODUCTION

Being common archaeological finds, particularly from prehistoric periods, bone<sup>1</sup> artefacts represent an important source of information for reconstructing the everyday life of archaeological populations. Owing to their specific physical properties, such as exceptional hardness and elasticity,<sup>2</sup> bone materials were optimal for shaping and subsequent application across a wide range of activities. They were used in textile working and production, basket weaving and mat making, hide and wood working, pottery and hunting.<sup>3</sup> The analysis of these artefacts provides a detailed insight into the survival strategies of prehistoric communities, including their economic activities and resource exploitation, as well as into their creative social practices.

Despite their significance, published studies of prehistoric bone artefacts for the area of central Dalmatia, as well as for the entire eastern Adriatic coast, are exceedingly rare. Additionally, a selective approach to the collection of bone artefacts has been noted in the past, while certain publications are limited merely to mentioning their presence, without further documentation, analysis or interpretation.<sup>4</sup> The available studies are often restricted to basic typological or statistical data, which limits deeper analysis of the function and significance of these artefacts in the everyday life of prehistoric societies.

A few studies are available for the Palaeolithic and Mesolithic periods.<sup>5</sup> Bone artefacts from

<sup>1</sup> Collective term encompassing finds made of bone, antler, horn and tooth.

<sup>2</sup> REITZ, WING 2008: 39.

<sup>3</sup> CHOYKE 2013: 2.

<sup>4</sup> Only studies dealing specifically with this type of artefact have been taken into account, while mere mentions of their presence have not been considered comparatively, since it can be assumed that artefacts of this kind were present at most prehistoric sites, and the lack of documentation and research prevents comparative analysis.

<sup>5</sup> E.g. KOMŠO 2006; KARAVANIĆ ET AL. 2013; ČUJKEVIĆ-PLEČKO, KARAVANIĆ 2017; RADIĆ 2018: 27; VIJEZOVIĆ, VUJEVIĆ, RADOVIĆ 2024.



SLIKA 1. Lokalitet Stobreč (izradila: A. Barbir)

FIGURE 1 Stobreč site (made by A. Barbir)

obrađene koštane izrađevine s neolitičkih lokaliteta Crno vrilo,<sup>6</sup> Pokrovnik,<sup>7</sup> Zemunik,<sup>8</sup> Barice-Smiličić<sup>9</sup> te eneolitičkog lokaliteta Lastvine,<sup>10</sup> dok su bronzanodobni lokaliteti iznimno slabo zastupljeni. Najdetalnija je studija koštanih izrađevina s bronzanodobnog lokaliteta u Hrvatskoj ona iz Monkodonje u Istri,<sup>11</sup> a treba spomenuti i gradinu Sveti Mihovil kod Bala<sup>12</sup> te špilju Pupičina peć,<sup>13</sup> dok su s područja srednje Dalmacije objavljene studije sa sojaničkog naselja Du-

Neolithic sites such as Crno Vrilo,<sup>6</sup> Pokrovnik,<sup>7</sup> Zemunik,<sup>8</sup> and Barice – Smiličić,<sup>9</sup> as well as from the Aeneolithic site of Lastvine,<sup>10</sup> have been treated in somewhat greater detail, whereas Bronze Age sites are extremely poorly represented. The most detailed study of bone artefacts from a Bronze Age site in Croatia is that of Monkodonja in Istria<sup>11</sup>; also worth mentioning are the hillfort of Sveti Mihovil near Bale<sup>12</sup> and the cave of Pupičina Peć.<sup>13</sup> From the area of central Dalmatia, studies have been published on the pile-dwelling settlement of Dugiš<sup>14</sup> and the hillfort of Rat

<sup>6</sup> VUJEVIĆ 2009.

<sup>7</sup> HORVAT, VUJEVIĆ 2017: 49.

<sup>8</sup> MARIJANOVIĆ, HORVAT 2016: 53.

<sup>9</sup> VUJEVIĆ, HORVAT 2012: 38–40; MARIJANOVIĆ 2022: 80.

<sup>10</sup> MARIJANOVIĆ, MARIJANOVIĆ 2017: 24–25.

<sup>11</sup> MLAKAR 1988: 157–189; MAUEL 2008; PUC 2020: 265–415.

<sup>12</sup> Riječ je o dvije igle (inv. br. P-31991, P-31996) i šilu (inv. br. P-31997) (ZLATUNIĆ 2021: 28–30; T. 1).

<sup>13</sup> U bronzanodobnim slojevima pronađena je motika (sl. 8.5:11), šiljak (sl. 8.5:10) (AMATT, MIRACLE 2006: 407–408).

<sup>6</sup> VUJEVIĆ 2009.

<sup>7</sup> HORVAT, VUJEVIĆ 2017: 49.

<sup>8</sup> MARIJANOVIĆ, HORVAT 2016: 53.

<sup>9</sup> VUJEVIĆ, HORVAT 2012: 38–40; MARIJANOVIĆ 2022: 80.

<sup>10</sup> MARIJANOVIĆ, MARIJANOVIĆ 2017: 24–25.

<sup>11</sup> MLAKAR 1988: 157–189; MAUEL 2008; PUC 2020: 265–415.

<sup>12</sup> These include two needles (Inv. Nos. P-31991, P-31996) and an awl (Inv. No. P-31997) (ZLATUNIĆ 2021: 28–30; Pl. 1).

<sup>13</sup> In the Bronze Age layers, a hoe (Fig. 8.5: 11) and a point (Fig. 8.5: 10) were found (AMATT, MIRACLE 2006: 407–408).

<sup>14</sup> MAROVIĆ 2001: 249–251; KLIŠKIĆ 2024: 83–97.

giš<sup>14</sup> i gradine Rat na Braču.<sup>15</sup> Iako većina spomenutih studija ima skroman uzorak koštanih izrađevina, Monkodonja i Dugiš ističu se većim brojem detaljno obrađenih nalaza, što omogućava komparativnu analizu.

Slijedom navedenog, cilj je ovog rada prezentirati detaljnu studiju grupe zašiljenoga koštanog oruđa iz nedavno otkrivenoga prapovijesnog naselja u srednjoj Dalmaciji, koje je egzistiralo na području današnjeg Stobreča kraj Splita (sl. 1). Kroz kontekstualan i sveobuhvatan analitički pristup, fokusirat ćemo se na sirovinu, tehnologiju obrade, tipologiju i funkciju ovog specifičnog skupa nalaza, nastojeći produbiti naše razumijevanje materijalne kulture i određenih aspekata svakodnevnog života prapovijesnih zajednica srednje Dalmacije.

## ARHEOLOŠKI KONTEKST NALAZA

Naselje Stobreč smješteno je na istočnoj obali Jadranskog mora, oko 7 km jugoistočno od Splita. Povoljan geografski položaj te blizina rijeke Žrnovnice, plodnih polja i izvora pitke vode zasigurno su oduvijek činili ovaj prostor atraktivnim za naseljavanje. Šire područje današnjeg Stobreča iznimno je bogato arheološkim nalazištima iz različitih kronoloških okvira. Pisani izvori tu smještaju željeznodobnu zajednicu Bulina,<sup>16</sup> što je potaknulo hipoteze o kontinuitetu naseljavanja Stobreča od prapovijesti,<sup>17</sup> unatoč inicijalnom nedostatku nedvojbenih materijalnih dokaza. Stobreč je osobito poznat i istaknut kao jedno od najranijih urbanih naselja na tlu Republike Hrvatske, s obzirom na to da je tu tijekom posljednjih nekoliko stoljeća pr. n. e. egzistiralo antičko urbanizirano naselje Epetij (grč. *Epetion*).<sup>18</sup> Iako

on the island of Brač.<sup>15</sup> Although most of these studies are based on modest samples of bone artefacts, Monkodonja and Dugiš stand out for their larger number of well-documented finds, which allows for comparative analysis.

Considering the above, the aim of this paper is to present a detailed study of a group of pointed bone tools from a recently discovered prehistoric settlement in central Dalmatia, located in the area of present-day Stobreč near Split (Fig. 1). Through a contextual and comprehensive analytical approach, attention will be focused on the raw material, working technology, typology and function of this specific assemblage, with the aim of deepening our understanding of the material culture and specific aspects of the everyday life of prehistoric communities in central Dalmatia.

## ARCHAEOLOGICAL CONTEXT OF THE FINDS

The Stobreč settlement is situated on the eastern coast of the Adriatic Sea, about seven km south-east of Split. A favourable geographical position, proximity to the river Žrnovnica, fertile fields and sources of fresh water have undoubtedly always made this area attractive for settlement. The wider area of present-day Stobreč is exceptionally rich in archaeological sites from various chronological periods. Written sources place the Iron Age Bulini community here,<sup>16</sup> which has led to hypotheses about the continuity of settlement in Stobreč since prehistoric times,<sup>17</sup> despite the initial lack of unequivocal material evidence. Stobreč is particularly well known and significant as one of the earliest urban settlements in the territory of the Republic of Croatia, since during the last few centuries BC it was the site of the ancient urbanised settlement of Epetion (Greek *Ἐπέτιον*).<sup>18</sup> Although its foundation has

<sup>14</sup> MAROVIĆ 2001: 249–251; KLIŠKIĆ 2024: 83–97.

<sup>15</sup> SANFORD GAASTRA, CRISTIANI, BARBARIĆ 2014.

<sup>16</sup> MÜLLER 1855: 28 (SCYL. 22), 213 (SCYMN. 404).

<sup>17</sup> OREB 1978; FABER 1983; MARŠIĆ 1997.

<sup>18</sup> FABER 1983; MARŠIĆ 1997; KIRIGIN 2010.

<sup>15</sup> SANFORD GAASTRA, CRISTIANI, BARBARIĆ 2014.

<sup>16</sup> MÜLLER 1855: 28 (SCYL. 22), 213 (SCYMN. 404).

<sup>17</sup> OREB 1978; FABER 1983; MARŠIĆ 1997.

<sup>18</sup> FABER 1983; MARŠIĆ 1997; KIRIGIN 2010.

se njegov osnutak tradicionalno povezuje s grčkim doseljenicima s otoka Visa, odnosno iz grada Ise,<sup>19</sup> recentnija promišljanja favoriziraju scenarij savezništva između postojeće lokalne željeznodobne i isejske zajednice, unutar šireg konteksta širenja isejskog utjecaja na prostoru srednje Dalmacije.<sup>20</sup> Smatra se da je naselje održalo svoj urbani karakter do kraja antičkog razdoblja.<sup>21</sup>

Povijest istraživanja Stobreča relativno je skromna. Arheološka iskopavanja na području današnjeg tzv. starog Stobreča, koji je smješten na poluotočiću, odvijala su se krajem 60-ih i početkom 70-ih godina 20. stoljeća.<sup>22</sup> Ova su inicijalna istraživanja bila manjeg opsega i primarno usmjerena na bedeme koji su opasavali naselje.<sup>23</sup> Sličan je fokus zadržan i tijekom arheoloških i geofizičkih istraživanja provedenih 2012.,<sup>24</sup> kad je glavni cilj bio izrada detaljne dokumentacije postojećeg stanja bedema.<sup>25</sup> Važan iskorak u opsegu istraživanja te posljedično i novim spoznajama o razvitku Stobreča kroz prošlost ostvaren je tek početkom 2024., pokretanjem opsežnih zaštitnih arheoloških iskapanja, koja su nastavljena i tijekom 2025. (sl. 2). Do sredine 2025. istražena je površina od oko 1000 kvadratnih metara, a rezultati su nedvojbeno potvrdili višeslojni karakter lokaliteta, ukazujući na kontinuitet ljudskog naseljavanja u razdoblju od nekoliko tisućljeća.<sup>26</sup>

<sup>19</sup> NOVAK 1952; GABRIČEVIĆ 1973; CAMBI 1974; FABER 1983.

<sup>20</sup> MARŠIĆ 1997; KIRIGIN 2010; UGARKOVIĆ, KONESTRA 2020.

<sup>21</sup> CAMBI 1974; SUIĆ 2003: 63.

<sup>22</sup> CAMBI 1974; FABER 1983.

<sup>23</sup> FABER 1983. Istraživanja je provodio Institut za arheologiju (dr. Aleksandra Faber).

<sup>24</sup> Istraživanja je provodio Institut za arheologiju (dr. sc. Marina Ugarković), u suradnji sa Sveučilištem Karl-Franzens u Grazu u Austriji (dr. Tina Neuhauser).

<sup>25</sup> NEUHAUSER, UGARKOVIĆ 2013; UGARKOVIĆ, NEUHAUSER 2013; NEUHAUSER *et al.* 2014.

<sup>26</sup> Istraživanja, koja su u tijeku, provodi Institut za arheologiju (dr. sc. Marina Ugarković), u suradnji s hvarskom tvrtkom Kantharos d.o.o. (Eduard Visković), a financira privatni investitor, tvrtka Arrivéé d.o.o. (Stobreč).

traditionally been linked to Greek settlers from the city of Issa on the island of Vis,<sup>19</sup> more recent interpretations favour a scenario of an alliance between the existing local Iron Age community and that of Issa, within the broader context of the expansion of Issaeon influence across central Dalmatia.<sup>20</sup> It is believed that the settlement retained its urban character until the end of the Classical period.<sup>21</sup>

The history of research in Stobreč is relatively modest. Archaeological excavations in what is now called Old Stobreč, located on a small peninsula, were carried out in the late 1960s and early 1970s.<sup>22</sup> These initial investigations were limited in scope and primarily focused on the fortification walls surrounding the settlement.<sup>23</sup> A similar focus was maintained during archaeological and geophysical research conducted in 2012,<sup>24</sup> when the main objective was to produce detailed documentation of the existing condition of the walls.<sup>25</sup> A significant step forward in the scope of research, and consequently in the understanding of the development of Stobreč through time, was achieved only at the beginning of 2024, with the commencement of extensive rescue excavations, which continued throughout 2025 (Fig. 2). By mid-2025, an area of approximately 1,000 square metres had been excavated, and the results unequivocally confirmed the multilayered character of the site, indicating continuity of human occupation over several millennia.<sup>26</sup>

<sup>19</sup> NOVAK 1952; GABRIČEVIĆ 1973; CAMBI 1974; FABER 1983.

<sup>20</sup> MARŠIĆ 1997; KIRIGIN 2010; UGARKOVIĆ, KONESTRA 2020.

<sup>21</sup> CAMBI 1974; SUIĆ 2003: 63.

<sup>22</sup> CAMBI 1974; FABER 1983.

<sup>23</sup> FABER 1983. The research was conducted by the Institute of Archaeology (Aleksandra Faber, PhD).

<sup>24</sup> The research was carried out by the Institute of Archaeology (Marina Ugarković, PhD) in cooperation with Karl-Franzens University in Graz, Austria (Tina Neuhauser, PhD).

<sup>25</sup> NEUHAUSER, UGARKOVIĆ 2013; UGARKOVIĆ, NEUHAUSER 2013; NEUHAUSER *ET AL.* 2014.

<sup>26</sup> The ongoing research is being conducted by the Institute of Archaeology (Marina Ugarković, PhD) in cooperation with the Hvar-based company Kantharos d.o.o. (Eduard Visković), and is financed by a private investor, the company Arrivéé d.o.o. (Stobreč).



SLIKA 2. Ortogonalna snimka lokaliteta (snimio: N. Romac)  
 FIGURE 2 Orthogonal view of the site (photo by N. Romac)

Tijekom ovih iskopavanja prvi su put otkriveni kontekstualni materijalni ostaci koji potvrđuju postojanje naselja u Stobreču prije dolaska Grka. Već su se 2024. pojavili prvi tragovi prapovijesnog Stobreča, dok su nalazi koji su izašli na svjetlo dana sljedeće godine omogućili znatno dublji uvid u slojevitost, strukturu naselja te različite aspekte materijalne kulture i društvenih praksi ove lokalne zajednice. Preliminarni uvid u bogatu materijalnu građu te uslojenost istraženih situacija otkriva nam da su istraživanja iznjedrila ostatke iz raznih prapovijesnih razdoblja. Pronađeni su dijelovi nastambi i povezani depoziti, ostaci struktura, urušenja i podnica, koji jasno ocrtavaju postojanje više faza naseljavanja i izgradnje, dok brojni pra-teći pokretni nalazi, od kojih su mnogi sačuvani *in situ* i u cijelosti, dodatno naglašavaju iznimnu važnost istraženog dijela prapovijesnoga stobrečkog naselja. U svrhu relativnog datiranja stratigrafskih jedinica, odnosno uspostavljanja grube radne kronologije i interpretacije istraženog prostora, preliminarno su obrađeni dijagnostički keramički nalazi koji sugeriraju dataciju stobrečkog naselja

During these excavations, contextual material remains confirming the existence of a settlement in Stobreč prior to the arrival of the Greeks were discovered for the first time. In 2024, the first traces of prehistoric Stobreč had already begun to emerge, while the finds uncovered in the following year provided a significantly deeper insight into the stratigraphy, settlement structure, and various aspects of the material culture and social practices of this local community. A preliminary examination of the abundant material assemblage and the stratified nature of the excavated contexts reveals that the investigations have yielded remains from various prehistoric periods. Parts of dwellings and associated deposits, remains of structures, collapses and floor surfaces were found, clearly outlining the existence of several phases of habitation and construction, while numerous accompanying movable finds, many of which were preserved *in situ* and intact, further emphasise the exceptional significance of the excavated part of the prehistoric settlement at Stobreč. For the purposes of relative dating of the stratigraphic units, that is, establishing a rough working chronology and interpretation of the excavated area, diagnostic ceramic finds were

od srednjeg i kasnog bronzanog doba do starijeg i mlađeg željeznog doba.<sup>27</sup>

Koštane izrađevine otkrivene su tijekom istraživanja bronzanodobne prapovijesne nastambe. Ovi artefakti pronađeni su u depozitima (SJ 215, 384, 419, 436), zapunama jama (SJ 6, 376) i urušenjima (SJ 131, 470), koji su dokumentirani tijekom istraživanja spomenutog prapovijesnog objekta, kao i u kontekstu podnice od nabijene tupine (SJ 176) i zemljane peći (SJ 426) unutar objekta. Interpretirani su kao slojevi upotrebe nastambe te je u njima zabilježena znatna količina ostataka lončarije, životinjskih kostiju i drugih artefakata. Zemljane zapune plitkih jama sadržavale su i ostatke gara (SJ 6, 376) te su u jednoj od njih osim koštanih artefakata pronađeni i keramički ulomci te kameni brus (SJ 6). Zatečena urušnja bila su bogata izgoranim kućnim lijepom te ulomcima keramike i životinjskih kostiju (SJ 131) ili se nalaze samo ostaci gara i kućnog lijepa (SJ 470). Preliminarna analiza zateknute stratigrafske situacije i popratnih nalaza sugerira dataciju opisanih slojeva u srednje i kasno bronzano doba, dok je detaljnija analiza u tijeku.

## MATERIJALI I METODE

### *Prikupljanje i obrada uzoraka*

Za potrebe ove studije, koja se temelji na analizi i interpretaciji odabranog skupa nalaza koštanih izrađevina, prikupljeni su svi artefakti tog tipa koji su pronađeni tijekom zaštitnih arheoloških istraživanja provedenih u Stobreču, i to u prvoj polovici 2025.<sup>28</sup> Većina analiziranih nalaza dokumentirana je *in situ*

<sup>27</sup> Detaljna je studija otkrivenih dijelova naselja i popratnog pokretnog materijala, zajedno s konzervacijom, u tijeku, a više selektiranih uzoraka poslano je u Debrecen u Mađarsku na AMS 14C analizu.

<sup>28</sup> Na prostoru koji je istražen 2024. nisu zabilježeni nalazi ovog tipa.

subjected to a preliminary analysis, which suggests that the Stobreč settlement dates from the Middle and Late Bronze Age to the Early and Late Iron Age.<sup>27</sup>

Bone artefacts were discovered during the excavation of a prehistoric Bronze Age dwelling. These artefacts were found in deposits (SU 215, 384, 419, 436), pit fills (SU 6, 376) and collapse layers (SU 131, 470), which were documented during the excavation of this prehistoric structure, as well as in the context of an earthen oven (SU 426) within it and a compacted marl floor (SU 176). They are interpreted as occupation layers of the dwelling, containing significant remains of pottery, animal bones and other artefacts. The earthen fills of shallow pits also contained remains of soot (SU 6, 376), and in one of them, in addition to the bone artefacts, ceramic fragments and a whetstone were found (SU 6). The recorded collapse layers were rich in burned daub, as well as fragments of pottery and animal bones (SU 131), or contained only traces of soot and house daub (SU 470). A preliminary analysis of the recorded stratigraphic situation and associated finds suggests that the described layers date to the Middle and Late Bronze Age, while a more detailed analysis is still in progress.

## MATERIALS AND METHODS

### *Sample collection and working*

For the purposes of this study, which is based on the analysis and interpretation of a selected set of bone artefacts, all artefacts of this type discovered during the rescue excavations conducted in Stobreč in the first half of 2025 were collected.<sup>28</sup> Most of the analysed finds were documented *in situ* during manual excavation, while three specimens were subse-

<sup>27</sup> A detailed study of the uncovered parts of the settlement and associated movable material, along with conservation work, is currently in progress, and several selected samples have been sent to Debrecen, Hungary, for AMS <sup>14</sup>C analysis.

<sup>28</sup> No finds of this type were recorded in the area excavated in 2024.

tijekom ručnog iskopa, dok su tri primjerka naknadno izdvojena iz šireg skupa životinjskih ostataka. Svi nalazi ručno su oprani, osušeni, fotografirani, obrađeni te pohranjeni uz pripadajuće kontekstualne podatke. Artefaktima su izmjerene dužine i težine. Za obradu i pohranu podataka korišten je MS Office (Word, Excel), a predlošci za grafičke prikaze životinja preuzeti su s interneta.<sup>29</sup> Za makroskopsku analizu korištena je ručna lupa s povećanjem od 10 puta.

Analiza predmeta obuhvatila je promatranje niza parametara, općenito podijeljenih u pet kategorija: sirovina, tehnologija obrade, tipologija i funkcija te kontekstualni podaci.

### *Analiza sirovine*

Za određivanje sirovine provedena je anatomska i tafonomska analiza, pri čemu su upotrijebljeni relevantni priručnici.<sup>30</sup> Cilj je bio identificirati odabrane životinjske vrste te specifične anatomske dijelove korištene za izradu oruđa.

Gdje je bilo moguće, relativna životna dob životinje u trenutku smrti procijenjena je na temelju stupnja sraštanja kostiju.<sup>31</sup> Uzorci su potom svrstani u dobne skupine: mlado i odraslo. Uzorci kojima nije bilo moguće odrediti dob označeni su kao neodređeni.

Na uzorcima su bilježene i tafonomske promjene, nastale postdepozicijskim procesima.<sup>32</sup> Promatrane su prirodne promjene uzrokovane djelovanjem vaskularnih biljaka (jetkanje korijena), životinja (glodanje) i vode (poliranje), kao i izloženost atmosferilijama koja rezultira različitim pukotinama i listanjem kosti. Evidentirane su i antropogene modifikacije, poput tragova gorenja.<sup>33</sup> Tragovi gorenja mogu nastati na više načina, a uzimajući

često su odvojena od većeg skupa životinjskih ostataka. Svi nalazi ručno su oprani, osušeni, fotografirani, obrađeni te pohranjeni uz pripadajuće kontekstualne podatke. Artefaktima su izmjerene dužine i težine. Za obradu i pohranu podataka korišten je MS Office (Word, Excel), a predlošci za grafičke prikaze životinja preuzeti su s interneta.<sup>29</sup> Za makroskopsku analizu korištena je ručna lupa s povećanjem od 10 puta.

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### *Raw material analysis*

To determine the raw material, anatomical and taphonomic analyses were carried out using relevant reference manuals.<sup>30</sup> The aim was to identify the selected animal species and the specific anatomical parts used in the manufacture of the tools.

Where possible, the relative age of the animal at the time of its death was estimated on the basis of degree of bone fusion.<sup>31</sup> The samples were then classified into age groups: juvenile and adult. Samples for which age could not be determined were designated as indeterminate.

Taphonomic alterations resulting from post-depositional processes were also recorded on the samples.<sup>32</sup> Natural changes caused by the action of vascular plants (root etching), animals (gnawing), and water (polishing) were observed, as well as exposure to weathering, which results in various cracks and flaking of the bone. Anthropogenic modifications, such as traces of burning, were also documented.<sup>33</sup> Burn marks can occur in several ways, and giv-

<sup>29</sup> <http://photos.archeozoo.org/>.

<sup>30</sup> SCHMID 1972; HILLSON 1992; FERNÁNDEZ-JALVO, ANDREWS 2016.

<sup>31</sup> SILVER 1969; REITZ, WING 2008.

<sup>32</sup> FERNÁNDEZ-JALVO, ANDREWS 2016.

<sup>33</sup> STINER *et al.* 1995.

<sup>29</sup> <http://photos.archeozoo.org/>.

<sup>30</sup> SCHMID 1972; HILLSON 1992; FERNÁNDEZ-JALVO, ANDREWS 2016.

<sup>31</sup> SILVER 1969; REITZ, WING 2008.

<sup>32</sup> FERNÁNDEZ-JALVO, ANDREWS 2016.

<sup>33</sup> STINER *et al.* 1995.

u obzir da analizirane izrađevine dolaze iz kontekstualnih jedinica s tragovima gorenja, bilo je bitno razlučiti je li riječ o slučajnom gorenju koštanih izrađevina pri požaru u naselju, pri pripremi hrane<sup>34</sup> ili nakon što su izrađevine već bile prekrivene arheološkim slojem.<sup>35</sup>

### **Tehnologija obrade i tipologija predmeta**

Na analiziranom koštanom materijalu identificirane su različite metode izrade oruđa, koje se posljedično reflektiraju na tipologiju samih predmeta. Tehnologija izrade oruđa promatrana je kroz tri faze: primarno lomljenje sirovine, oblikovanje i završna obrada predmeta.<sup>36</sup> Površinske promjene promatrane su makroskopski i mikroskopski. Makroskopskim pregledom bilježeni su tipovi loma<sup>37</sup> i način obrade oruđa<sup>38</sup>. Pri opisivanju morfologije predmeta korišteni su standardizirani termini: baza ili proksimalni dio, tijelo ili mezijalni dio te vrh ili distalni dio.<sup>39</sup>

Tipologija predmeta definirana je prvenstveno kroz međuodnos oblika izrađevine i anatomskog elementa životinje od koje su izrađeni.<sup>40</sup> Premda oblik predmeta nije uvijek indikator upotrebe, može biti generalni pokazatelj, s obzirom na to da forma ipak donekle diktira načine upotrebe.<sup>41</sup> Za određivanje tipologije predmeta u ovom radu korištena je tipološka klasifikacija koju je dopunila i modificirala<sup>42</sup> S. Vitezović za koštanu industriju u prapovijesti jugoistočne Europe<sup>43</sup>. Ova tipološka klasifikacija odabrana je zbog kronološke i geografske sličnosti s predmetnim materijalom. Bitan

en that the analysed artefacts come from contextual units showing traces of burning, it was important to determine whether these represented accidental burning of the bone artefacts during a settlement fire, burning during food preparation,<sup>34</sup> or after the artefacts had already been buried in the archaeological layer.<sup>35</sup>

### **Bone working technology and artefact typology**

Various methods of tool manufacture were identified on the analysed bone material, which in turn are reflected in the typology of the artefacts themselves. The tool production technology was examined through three stages: primary reduction of the raw material, shaping, and final finishing of the artefact.<sup>36</sup> Surface modifications were observed both macroscopically and microscopically. Macroscopic examination recorded fracture types<sup>37</sup> and methods of tool shaping.<sup>38</sup> In describing the morphology of the artefacts, standardised terminology was used: base or proximal part, body or mesial part, and tip or distal part.<sup>39</sup>

The typology of the artefacts was defined primarily through the relationship between the shape of an artefact and the anatomical element of the animal from which it was made.<sup>40</sup> Although the shape of an artefact is not always an indicator of its use, it can serve as a general guide, since form to some extent dictates modes of use.<sup>41</sup> For determining the typology of the artefacts in this study, the typological classification supplemented and modified<sup>42</sup> by S. Vitezović for the bone industry of south-eastern Europe in the Prehistoric period was used.<sup>43</sup> This typological classification was chosen because of

<sup>34</sup> CARROLL, SMITH 2018.

<sup>35</sup> STINER *et al.* 1995.

<sup>36</sup> VITEZOVIĆ 2011: 263–268.

<sup>37</sup> VILLA, MAHIEU 1991.

<sup>38</sup> VITEZOVIĆ 2016.

<sup>39</sup> *Ibid.*

<sup>40</sup> ALLENTUCK 2011: 380.

<sup>41</sup> HORWITZ, GARFINKEL 1988.

<sup>42</sup> Prema A. Bačkalovu (BAČKALOV 1979). Za detaljni razvoj tipologije vidjeti VITEZOVIĆ 2016.

<sup>43</sup> VITEZOVIĆ 2011.

<sup>34</sup> CARROLL, SMITH 2018.

<sup>35</sup> STINER *et al.* 1995.

<sup>36</sup> VITEZOVIĆ 2011: 263–268.

<sup>37</sup> VILLA, MAHIEU 1991.

<sup>38</sup> VITEZOVIĆ 2016.

<sup>39</sup> *Ibid.*

<sup>40</sup> ALLENTUCK 2011: 380.

<sup>41</sup> HORWITZ, GARFINKEL 1988.

<sup>42</sup> According to A. Bačkalov (BAČKALOV 1979). For a detailed development of the typology, see VITEZOVIĆ 2016.

<sup>43</sup> VITEZOVIĆ 2011.

faktor pri izboru tipologije bio je način klasifikacije (grupa, tip, podtip, varijanta) koji dozvoljava daljnje modificiranje tipologije ovisno o periodu i lokalitetu, što olakšava daljnju usporedbu materijala među lokalitetima i periodima.<sup>44</sup>

### *Analiza tragova upotrebe*

Interpretacija tragova upotrebe na koštanim izrađevinama provedena je primjenom utvrđenih kriterija iz relevantne literature.<sup>45</sup> Analiza je obuhvatila sljedeće parametre:

- 1) Mikrotopografija: Opisana je razlika u distribuciji nižih i viših točaka na površini koštane izrađevine, gdje znatne razlike ukazuju na heterogenu mikrotopografiju, dok male razlike upućuju na homogenu.<sup>46</sup>
- 2) Mikroreljef: Riječ je o detaljnijem opisu mikrotopografije, promatrane pod povećanjem od 200 puta, pri čemu je bilježeno jesu li visoke točke iste visine (što rezultira pravilnim reljefom) ili postoje znatne razlike u visini (što ukazuje na nepravilan reljef). Morfologija točaka klasificirana je kao zaobljena ili ravna, dok je tekstura opisana kao hrapava ili glatka.<sup>47</sup>
- 3) Strije: Promatrane su pod povećanjima od 20, 50 i 200 puta. Bilježena je njihova distribucija (transverzalna, longitudinalna, nasumična) i pozicija (paralelna, prekrivena, nepravilna). Morfologija strija promatrana je s obzirom na širinu (uska, široka, raznolika – ako se širina strije mijenjala duž njezine duljine), dubinu (duboka, plitka), duljinu (duga, kratka) i formu (ravna, valovita).<sup>48</sup>

<sup>44</sup> *Ibid.*: 67.

<sup>45</sup> LEGRAND 2007; BUC 2011.

<sup>46</sup> LEGRAND 2007.

<sup>47</sup> BUC 2011.

<sup>48</sup> *Ibid.*

its chronological and geographical similarity to the analysed material. An important factor in the choice of typology was its structure (group, type, subtype, variant), which allows for further modification depending on the period and site, thereby facilitating subsequent comparison of material between sites and periods.<sup>44</sup>

### *Use-wear analysis*

The interpretation of use-wear traces on bone artefacts was carried out by applying established criteria from relevant literature.<sup>45</sup> The analysis included the following parameters:

- 1) Microtopography: The difference in the distribution of lower and higher points on the surface of the bone artefact was described, where significant variations indicate a heterogeneous microtopography, while minor variations suggest a homogeneous one.<sup>46</sup>
- 2) Microrelief: This refers to a more detailed description of the microtopography, observed under 200× magnification, which recorded whether the high points were of equal height (resulting in a regular relief) or whether significant height differences were present (indicating an irregular relief). The morphology of the points was classified as rounded or flat, while the texture was described as rough or smooth.<sup>47</sup>
- 3) Striations: Observed under magnifications of 20×, 50×, and 200×. Their distribution (transverse, longitudinal, random) and orientation (parallel, crossed, irregular) were recorded. The morphology of the striations was examined in terms of width (narrow, wide, and variable – if the width changed along their lengths), depth (deep, shallow), length (long, short) and form (straight, wavy).<sup>48</sup>

<sup>44</sup> *Ibid.*: 67

<sup>45</sup> LEGRAND 2007; BUC 2011.

<sup>46</sup> LEGRAND 2007.

<sup>47</sup> BUC 2011.

<sup>48</sup> *Ibid.*

Posebna je pažnja posvećena modifikacijama oruđa, s naglaskom na abraziju, ljuštenje i spljoštavanje oruđa ili njegovih dijelova. Abrazija se tumači kao posljedica ponavljajućeg trošenja. Ljuštenje je uzrokovano mikrofrakturama na kosti, često interpretiranima kao rezultat udarca o tvrđu površinu, no može nastati i dugotrajnom upotrebom. Spljoštavanje predstavlja prvu fazu u procesu trošenja oruđa, pri čemu se koštana vlakna povlače uslijed oštećivanja ili pritiska.<sup>49</sup> Mikroskopski pregled proveden je s pomoću digitalnog mikroskopa (Dino-Lite), uz primjenu povećanja od 20, 50 i 200 puta.

## REZULTATI

### *Sirovina*

U ovoj studiji analizirano je ukupno 11 šiljasto obrađenih koštanih izrađevina, pri čemu su svi predmeti izrađeni od kostiju sisavaca. Dominantnu kategoriju predstavljaju domaće životinje: dva su primjerka izrađena od kostiju goveda (*Bos taurus*), dok sedam potječe od porodice *Caprinae* (ovce ili koze). Na razinu podreda parnoprstaša (*Ruminantia*) i porodicu jelena (*Cervidae*) određen je po jedan primjerak.

Anatomske elemente korišteni za izradu oruđa pokazuju visoku uniformnost, s metapodijalnim kostima kao primarnim odabirom (sl. 3). Preciznije, riječ je o kostima donožja (*ossa metatarsalia III et IV*) goveda (tab. 1; PN 66, PN 91), jelena (tab. 1; PN 153) i ovce/koze (tab. 1; PN 141, PN 160, PN 171) te kostima zapešća (*ossa metacarpalia III et IV*) ovce/koze (tab. 1; PN 194) u jednom slučaju. U tri slučaja oruđe je izrađeno od goljenične kosti (*tibia*), isključivo ovce/koze (tab. 1; PN 38; PN 149; PN 172). Za jedan primjerak nije bilo moguće precizno odrediti anatomske element, osim da

<sup>49</sup> SIDÉRA, LEGRAND 2006; LEGRAND 2007; LEGRAND, SIDÉRA 2007.

Special attention was given to tool modifications, with emphasis on abrasion, flaking and flattening of the tool or its parts. Abrasion is interpreted as the result of repetitive wear. Flaking is caused by microfractures in the bone, often interpreted as resulting from impact against a harder surface, though it can also occur through prolonged use. Flattening represents the initial stage in the wear process, during which bone fibres retract due to damage or pressure.<sup>49</sup> Microscopic examination was carried out using a digital microscope (Dino-Lite) at magnifications of 20×, 50× and 200×.

## RESULTS

### *Raw material*

A total of 11 pointed bone artefacts were analysed in this study, all of which were made from mammal bones. The dominant category consists of domestic animals: two specimens were made from cattle bones (*Bos taurus*), while seven originated from members of the *Caprinae* family (sheep or goats). One specimen was identified to the *Ruminantia* (even-toed ungulates) suborder and one to the *Cervidae* (deer) family.

The anatomical elements used for tool production show a high degree of uniformity, with metapodial bones being the primary choice (Fig. 3). More precisely, the finds include metatarsal bones (*ossa metatarsalia III et IV*) of cattle (T. I; SF 66, SF 91), deer (T. I; SF 153), and sheep/goats (T. I; SF 141, SF 160, SF 171), as well as a metacarpal bone (*ossa metacarpalia III et IV*) of sheep/goats (T. I; SF 194) in one case. In three cases, the tools were made from *tibia* bones, exclusively of sheep/goats (T. I; SF 38, SF 149, SF 172). In one specimen, the anatomical element could not be precisely determined,

<sup>49</sup> SIDÉRA, LEGRAND 2006; LEGRAND 2007; LEGRAND, SIDÉRA 2007.

**TABLICA 1.** *Popis analiziranih koštanih izrađevina s kontekstualnim podacima i podacima za sirovinu (anatomski element i takson) (izradila: A. Barbir)*

**TABLE 1** *List of analysed bone artefacts with contextual data and raw material information (anatomical element and taxon) (made by A. Barbir)*

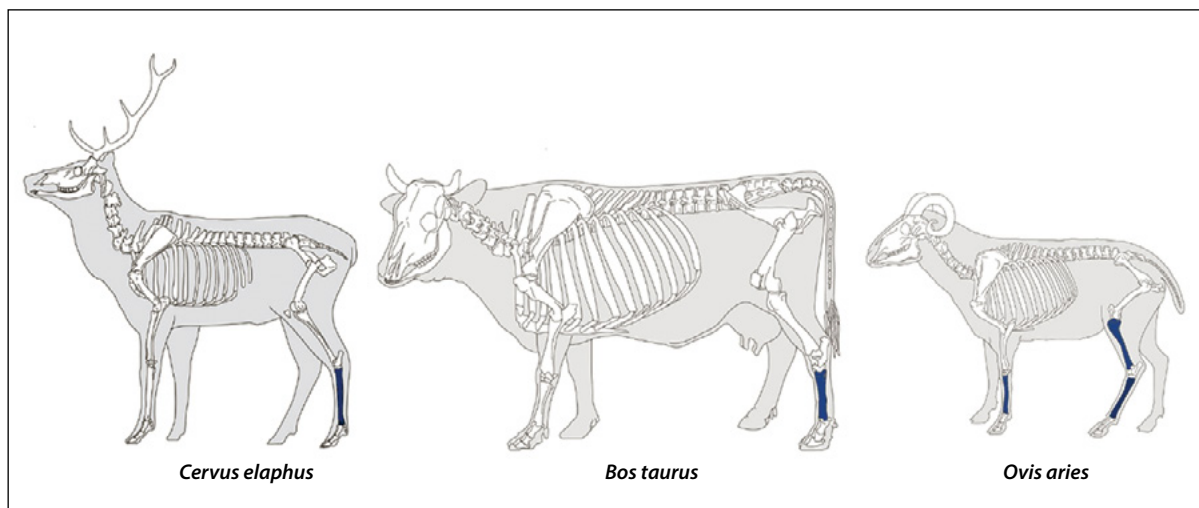
PN/SF	Sonda / Trench	Sektor / Sector	□	SJ / SU	Anatomski element / Anatomical element	Takson / Taxa
66	2	1	C1	131	ossa metatarsalia III + IV	Bos taurus
91	2	1	B1	6	ossa metatarsalia III + IV	Bos taurus
141	2	1	B1	384	ossa metatarsalia III + IV	Ovis/Capra
160	2	3	D2	426	ossa metatarsalia III + IV	Ovis/Capra
171	2	3	E2	470	ossa metatarsalia III + IV	Ovis/Capra
194	2	3	E2	436	ossa metacarpalia III + IV	Ovis/Capra
38	2	3	D2	176	tibia	Ovis/Capra
149	2	1	C2	419	tibia	Ovis/Capra
172	2	1	B2	376	tibia	Ovis/Capra
153	2	3	D2	423	ossa metatarsalia III + IV	Cervidae
173	2	3	E2	470	duga kost / long bone	Ruminantia

je riječ o dugoj kosti (tab. 1; PN 173).

Kad je riječ o starosti jedinki, za šest nalaza (PN 66, PN 91, PN 194, PN 141, PN 160, PN 171) utvrđeno je da potječu od odraslih životinja. Nalaz PN 38 izrađen je od kosti mlade jedinice ovce/koze, što je jasno vidljivo na temelju nesrasle proksimalne epifize goljenične kosti. Za preostala četiri nalaza (PN 149, PN 153, PN 172, PN 173) relativna životna dob jedinice u trenutku smrti nije se mogla pouzdano utvrditi.

except that it was a long bone (T. I; SF 173).

As for the age of the individuals, six finds (SF 66, SF 91, SF 194, SF 141, SF 160, SF 171) were determined to originate from adult animals. Find SF 38 was made from a juvenile sheep/goat bone, as clearly indicated by the unfused proximal epiphysis of the tibia. For the remaining four finds (SF 149, SF 153, SF 172, SF 173), the relative age of the individual at the time of death could not be reliably determined.

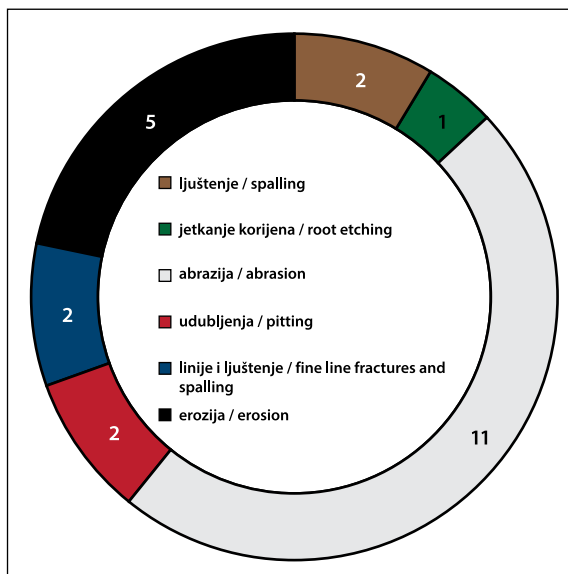


**SLIKA 3.** *Taksonomski pregled vrsta i anatomskih elemenata korištenih kao sirovina (prema ArchéoZoo.org; doradila: A. Barbir)*

**FIGURE 3** *Taxonomic overview of species and anatomical elements used as raw material (after ArchéoZoo.org; adapted by A. Barbir)*

## Tafonomija

Na analiziranim nalazima uočena je prisutnost višestrukih tafonomskih modifikacija (sl. 4). Abrazija je identificirana na svim obrađenim koštanim predmetima. Sljedeća je po učestalosti erozija, zabilježena na pet primjeraka. Podjednako su zastupljeni ljuštenje, udubljenja te kombinacija tankih, finih linija i pločastog ljuštenja kosti. Tragovi nagorenosti uočeni su na tri nalaza, a njihova je pozicija konzistentno povezana s medijalnim dijelom dijafize kosti. Nalaz PN 38 specifičan je po prisutnosti karakterističnih zelenih tragova na proksimalnom dijelu goljenične kosti, što sugerira blisku interakciju s brončanim predmetom unutar arheološkog konteksta.



SLIKA 4. Prisutnost tafonomskih modifikacija na koštanom oruđu (izradila: A. Barbir)

FIGURE 4 Presence of taphonomic modifications on bone tools (made by A. Barbir)

## Tehnologija obrade

Obrada koštane sirovine može se podijeliti na pripremnu i završnu fazu.<sup>50</sup> Prva, odnosno pripremna faza obuhvaća primarnu pripremu kosti, pri čemu se primjenjuju tehnike udaranja i rezanja u cilju uklanjanja

<sup>50</sup> VAN DER BROEKE 1983.

## Taphonomy

Multiple taphonomic modifications were observed on the analysed finds (Fig. 4). Abrasion was identified on all worked bone artefacts. The next most frequent alteration was erosion, recorded on five specimens. Flaking, pitting, and combinations of fine, thin lines and lamellar flaking of the bone were equally represented. Traces of burning were observed on three finds, consistently located on the medial part of the bone diaphysis. Find SF 38 is distinctive due to the presence of characteristic green traces on the proximal part of the tibia, suggesting close contact with a bronze artefact within the archaeological context.

## Working technology

The working of raw bone material can be divided into preparatory and finishing stages.<sup>50</sup> The first, or preparatory stage, involved the primary preparation of the bone using striking and cutting techniques aimed at removing excess material and obtaining the general shape of the artefact, or fragmenting the bone into smaller pieces suitable for further modification. The second, or finishing stage, included less aggressive methods such as smoothing and polishing with abrasive materials, for example sandstone. The drilling technique was also recorded. The following section provides a detailed description of the working technologies for each individual find:

**SF 66** (*Bos taurus*, *ossa metatarsalia III et IV*, T. I/1): This artefact has an unworked base consisting of the distal part of the metatarsal bone, while the tip of the artefact is pointed. It was made using the technique of longitudinal splitting, which, owing to the natural groove (*sulcus*) of the metatarsal bone, resulted in the division of the bone into two equal parts. The edges of the artefact are parallel and ta-

<sup>50</sup> VAN DER BROEKE 1983.

viška materijala i dobivanja općeg oblika izrađevine, ili fragmentacije kosti u manje komade pogodne za daljnju modifikaciju. Druga ili završna faza podrazumijeva manje agresivne metode poput glačanja i poliranja abrazivnim sredstvima, primjerice pješčenoj. Također je zabilježena i metoda bušenja. U nastavku slijedi detaljan opis tehnologija obrade za svaki pojedini nalaz.

**PN 66** (*Bos taurus, ossa metatarsalia III et IV*, T. I/1): Ovaj predmet posjeduje neobrađenu bazu, koja se sastoji od distalnog dijela donožne kosti, dok je vrh predmeta zašiljen. Izrađen je tehnikom longitudinalnog lomljenja, koje je, zahvaljujući prirodnom žlijebu (*sulcus*) kosti donožja, rezultiralo podjelom kosti na dva jednaka dijela. Rubovi su predmeta paralelni i blago se sužavaju prema vrhu. Površina je uglačana gotovo cijelom dužinom, s iznimkom baze, čija prirodna hrapavost pogoduje funkciji baze kao drške. Rubovi su zaobljeni i uokviruju prirodni žlijeb anatomskog elementa, formirajući lučni presjek koji je posebno izražen prema baznom dijelu. Vrh je zašiljen i ispoliran, no djelomično je oštećen.

**PN 91** (*Bos taurus, ossa metatarsalia III et IV*, T. I/2): Predmet je tipološki i tehnološki sličan prethodno opisanom PN 66. Riječ je o većem predmetu čija je baza (distalni dio donožne kosti) ostavljena u prirodnom stanju. Izrađen je uzdužnim lomljenjem duž osi prirodnog žlijeba kosti. Dodatnom obradom postignuta je visoka uglačanost gotovo cijelom površinom tijela i vrha, uključujući i unutrašnjost. Rubovi su zaobljeni, a presjek je blago lučan. Vrh je zašiljen i neoštećen.

**PN 153** (*Cervidae, ossa metatarsalia III et IV*, T. I/3): Potpuno obrađena kost, od baze do vrha uglačana i neoštećena. Baza je oblikovana stanjivanjem grubim potezima te je naknadno uglačana. Tijelo je u potpunosti uglačano, a rubovi prirodnog žlijeba kosti dodatno su zaobljeni. Vrh je u potpunosti obrađen.

**PN 173** (*Ruminantia, duga kost*, T. I/4): Predmet pokazuje pravilne linije obrade oš-

per slightly towards the tip. The surface is polished along almost its entire length, except for the base, whose natural roughness enhances its function as a handle. The edges are rounded, framing the natural groove of the anatomical element, forming an arched cross-section that is particularly pronounced towards the basal part. The tip is pointed and polished but partially damaged.

**SF 91** (*Bos taurus, ossa metatarsalia III et IV*, T. I/2): The artefact is typologically and technologically similar to the previously described SF 66. It is a larger artefact whose base (the distal part of the metatarsal bone) was left in its natural state. It was produced by longitudinal splitting along the axis of the bone's natural groove. Additional working achieved a high polish over almost the entire surface of the body and tip, including the inner side. The edges are rounded, and the cross-section is slightly arched. The tip is pointed and undamaged.

**SF 153** (*Cervidae, ossa metatarsalia III et IV*, T. I/3): A completely worked bone, polished and undamaged from base to tip. The base was shaped by thinning with coarse strokes and subsequently polished. The body is entirely polished, and the edges along the natural groove of the bone are additionally rounded. The tip is fully finished.

**SF 173** (*Ruminantia, long bone*, T. I/4): The artefact shows regular working lines made with a sharp, harder material, such as a stone tool. Traces are present over the entire surface, and both ends are shaped in a similar manner: the tip is pointed, and the base tapers. However, the base is partially damaged, preventing an accurate assessment of the degree of finishing. Polishing was carried out to a medium-coarse degree.

**SF 141** (*Ovis / Capra, ossa metatarsalia III et IV*, T. I/5): This artefact is completely preserved, with traces of working visible from base to tip. The base of the artefact is the proximal epiphysis of a metapodial bone, which was perforated across its entire surface.

trim i tvrdim materijalom, poput kamenog oruđa. Tragovi su prisutni na cijeloj površini, a krajevi su oblikovani na sličan način: vrh je zašiljen, a baza se sužava. Međutim, baza je djelomično oštećena, što onemogućuje preciznu procjenu stupnja obrade. Glačanje je izvedeno u srednje gruboj varijanti.

**PN 141** (*Ovis/Capra, ossa metatarsalia III et IV, T. I/5*): Ovaj predmet potpuno je sačuvan, a znakovi obrade vidljivi su od baze do vrha. Baza je predmeta proksimalna epifiza kostiju donožja koja je probušena cijelom površinom. Tako otvorena epifiza ostala je sačuvana samo na uskim rubnim dijelovima. Vanjska strana oruđa obrađena je glačanjem. Lomljenjem distalnog dijela kosti formiran je zašiljeni vrh, koji je naknadno obrađen poliranjem. Rubovi se pojavljuju u posljednjoj trećini dužine predmeta i tvore lučni presjek, otkrivajući prirodni žlijeb kosti. Sužavaju se prema vrhu koji je obrađen sa svih strana, no bez znakova visoke uglačanosti.

**PN 160** (*Ovis/Capra, ossa metatarsalia III et IV, T. I/6*): Ovaj predmet u potpunosti je obrađen. Bazu oruđa čini proksimalni dio kosti donožja koja je oblikovana na isti način kao PN 141. Epifiza je probušena gotovo cijelom površinom, no ostala je mjestimično sačuvana na rubovima. Cijela površina oruđa obrađena je glačanjem. Vrh je dobiven lomljenjem distalnog dijela, koji je također fino obrađen sa svih strana i neoštećen.

**PN 194** (*Ovis/Capra, ossa metacarpalia III et IV, T. I/7*): Predmet koji ima sačuvan vrh, tijelo i bazu. Baza i tijelo u prirodnom su stanju. Vrh je dobiven lomljenjem distalnog dijela dijafize kosti. Vanjska strana vrha oruđa zaobljena je glačanjem, dok je unutrašnja neobrađena.

**PN 171** (*Ovis/Capra, ossa metatarsalia III et IV, T. I/8*): Predmet je djelomično sačuvan, s bazom oštećenom prije nego što je odabrana kao pogodna sirovina. Tijelo su i vrh predmeta neoštećeni. Vrh je izrađen lomom duž medijalne i lateralne površine kosti, na distalnom dijelu kosti. Daljnjom abrazivnom obradom rubovi su postali zaobljeni, postupno se sužavajući pre-

The opened epiphysis has been preserved only along the narrow marginal sections. The outer side of the tool was worked by smoothing. By breaking off the distal part of the bone, a pointed tip was formed, which was subsequently polished. The edges appear in the final third of the artefact's length, forming an arched cross-section that reveals the natural groove of the bone. They taper towards the tip, which was worked on all sides but shows no signs of high polish.

**SF 160** (*Ovis / Capra, ossa metatarsalia III et IV, T. I/6*): This artefact is fully worked. The base of the tool is formed by the proximal part of a metapodial bone, shaped in the same manner as SF 141. The epiphysis was perforated across almost its entire surface but is locally preserved along the edges. The entire surface of the tool was smoothed. The tip was produced by breaking off the distal part, which was also finely worked on all sides and remains undamaged.

**SF 194** (*Ovis / Capra, ossa metacarpalia III et IV, T. I/7*): An artefact with a preserved tip, body and base. The base and body are in their natural state. The tip was formed by breaking off the distal part of the bone diaphysis. The outer side of the tool's tip was rounded by smoothing, while the inner side remains unworked.

**SF 171** (*Ovis / Capra, ossa metatarsalia III et IV, T. I/8*): The artefact is partially preserved, with the base having been damaged before being selected as suitable raw material. The body and tip of the artefact are undamaged. The tip was shaped by fracturing along the medial and lateral surfaces of the bone at its distal end. Through further abrasive working, the edges became rounded, gradually tapering towards the tip and forming a semicircular cross-section. The tip was completely worked on all sides, with the inner side flattened and polished.

**SF 149** (*Ovis / Capra, ossa metatarsalia III et IV, T. I/9*): A fragment of a tool preserved only in the body and tip section. The tool shows

ma vrhu i tvoreći polukružni presjek. Vrh je u potpunosti obrađen sa svih strana, pri čemu mu je unutarnja strana zaravnjena i uglačana.

**PN 149** (*Ovis/Capra, ossa metatarsalia III et IV, T. I/9*): Ulomak oruđa sačuvan je samo u dijelu tijela i vrha. Oruđe pokazuje tragove angularnog loma, što ukazuje na frakturu nastalu u postdepozicijskim uvjetima. Površina oruđa obrađena je poliranjem. Lomljenjem distalnog dijela kosti stvoren je vrh. Abrazivnom obradom vrh je blago zašiljen, uglačan sa svih strana i neoštećen.

**PN 38** (*Ovis/Capra, tibia, T. I/10*): Ulomak oruđa čini oštećena baza, tijelo i vrh. Baza ima tragove loma koji su nastali prije nego što je kost upotrijebljena kao sirovina te nema tragove obrade. Tijelo je oruđa uglačano, s tragovima zelene obojenosti uzrokovane kontaktom s broncom/bakrom. Vrh oruđa nastao je lomljenjem dijafize kosti te je obrađen poliranjem sa svih strana.

**PN 172** (*Ovis/Capra, tibia, T. I/11*): Fragment dijafize goljenične kosti. Nastao je lomljenjem, no nije isključeno da je riječ o prirodno razlomljenom ulomku prenamijenjenom u oruđe. Vrh je blago ispoliran i zaobljen, dok su rubovi u prirodnom, neobrađenom stanju.

### **Tipologija koštanih izrađevina**

Analizirano koštano oruđe tipološki se može smjestiti u grupu zašiljenih predmeta. Unutar ove grupe najzastupljeniji je tip 1 – šila, s ukupno sedam nalaza. Slijedi tip 2 – probojci, s dva primjerka, dok su tip 3 – igle i tip 6 – projektili zastupljeni s po jednim primjerkom (tab. 2)

#### **Tip 1 – šila**

Šila predstavljaju svestrano oruđe karakterizirano umjereno snažnim šiljastim vrhom, pogodnim za širok spektar aktivnosti.<sup>51</sup> Među najčešćim su tipovima koštanog oru-

đevina, što ukazuje na tragove angularne frakture, indicirajući oštećenje koje se dogodilo pod postdepozicijskim uvjetima. Površina oruđa završena je poliranjem. Vrh je nastao lomljenjem distalnog dijela kosti. Abrazivnom obradom vrh je blago zašiljen, uglačan sa svih strana i neoštećen.

**SF 38** (*Ovis / Capra, tibia, T. I/10*): Fragment oruđa sastoji se od oštećene baze, tijela i vrha. Baza ima tragove frakture nastale prije nego što je kost korištena kao sirovina i nema tragove obrade. Tijelo oruđa polirano, s zelenom obojenosti uzrokovane kontaktom s broncom ili bakrom. Vrh oruđa nastao je lomljenjem dijafize kosti i poliran. Vrh je blago ispoliran i zaobljen, dok su rubovi u prirodnom, neobrađenom stanju.

**SF 172** (*Ovis / Capra, tibia, T. I/11*): Fragment dijafize tibije. Nastao je lomljenjem, ali ne može se isključiti da se radi o prirodno lomljenoj kosti koja je kasnije korištena kao oruđe. Vrh je blago ispoliran i zaobljen, dok su rubovi u prirodnom, neobrađenom stanju.

### **Typology of bone artefacts**

The analysed bone tools can typologically be classified within the group of pointed artefacts. Within this group, the most common is Type 1 – awls, with a total of seven finds. These are followed by Type 2 – borers, with two specimens, while Type 3 – needles and Type 6 – projectiles are each represented by one example (T. II).

#### **Type 1 – Awls**

Awls represent versatile tools characterised by a moderately strong, pointed tip suitable for a wide range of activities.<sup>51</sup> They are among the most common types of bone tools, as confirmed in the prehistoric layers of the site under study. The analysed awls belong to subtype I1A – awls made from

<sup>51</sup> VITEZOVIĆ 2011: 276.

<sup>51</sup> VITEZOVIĆ 2011: 276.

**TABLICA 2.** Pregled tipova koštanih izrađevina s prikazanim maksimalnim dimenzijama (izradila: A. Barbir)  
**TABLE 2** Overview of bone artefact types with maximum dimensions (made by A. Barbir)

PN/SF	Tip nalaza / Type of find	Dužina / Length	Širina / Width	Težina / Weight
91	probojac / heavy point, I2	117,9	25,18	19,2
66	probojac / heavy point, I2	155,56	30,91	42,1
38	šilo / awl, I1A2	94,94	21,71	12,1
141	šilo / awl, I1A1	108,59	20,28	14,5
149	šilo / awl, I1A2	70,13	9,71	3,3
160	šilo / awl, I1A1	104,34	17,16	13,5
171	šilo / awl, I1A2	83,4	9,24	5,2
172	šilo / awl, I1A2	98,31	11,55	5,3
194	šilo / awl, I1A2	105,61	21,87	15,6
153	igla / needle, I3	107,44	11,79	9,1
173	projektil / projectile point, I6B	88,91	9,51	9,7

đa, što je potvrđeno i u prapovijesnim slojevima predmetnog lokaliteta. Analizirana šila pripadaju podtipu I1A – šila od dugih kostiju. Prema relevantnoj literaturi,<sup>52</sup> šila od dugih kostiju (I1A) mogu se podijeliti na šila s očuvanom prirodnom epifizom (A1) i ona s odstranjenom epifizom (A2).

Šila s očuvanom epifizom (I1A1) mogu imati bazu formiranu od proksimalne ili distalne epifize metapodijalnih kostiju ili od proksimalnog dijela drugih cjevastih kostiju, prvenstveno manjih preživača.<sup>53</sup> Ova varijanta najčešća je među koštanim oruđem iz prapovijesnih slojeva Stobreča, s pet evidentiranih primjeraka. Četiri primjerka (PN 38, PN 149, PN 171, PN 194) izrađena su od sirovine koja vjerojatno potječe iz otpada pri obradi trupa životinje, a karakteriziraju ih dijafize sa spiralnim lomom nastale djelovanjem ljudi, koje su naknadno doradene abrazivnim sredstvima do uglačanog stanja. U jednom slučaju (PN 149) moguće je da je vrh nastao uzdužnom podjelom duge kosti. U situacijama daljnje abrazivne obrade oruđe poprima uglačani poluprstenasti presjek prema bazi; međutim, u ovim primjercima površno je obrađen samo vrh, dok je tijelo

long bones. According to relevant literature,<sup>52</sup> awls made from long bones (I1A) can be divided into those with a preserved natural epiphysis (A1) and those with a removed epiphysis (A2).

Awls with a preserved epiphysis (I1A1) may have a base formed from the proximal or distal epiphysis of metapodial bones, or from the proximal part of other long bones, primarily those of small ruminants.<sup>53</sup> This variant is the most common among the bone tools from the prehistoric layers of Stobreč, with five recorded specimens. Four specimens (SF 38, SF 149, SF 171, SF 194) were made from raw material probably originating from butchering waste, characterised by diaphyses with spiral fractures caused by human activity, which were subsequently refined with abrasive tools to a polished finish. In one case (SF 149), it is possible that the tip was formed by the longitudinal splitting of a long bone. In cases of further abrasive working, the tool acquires a polished semicircular cross-section towards the base; however, in these specimens, only the tip was superficially worked, while the body of the tool retained its natural state.

<sup>52</sup> *Ibid.*: 277.

<sup>53</sup> *Ibid.*: 277.

<sup>52</sup> *Ibid.*: 277.

<sup>53</sup> *Ibid.*: 277.

oruđa zadržalo prirodno stanje.

Šila s odstranjenom epifizom (I1A2)<sup>54</sup> zastupljena su s dva primjerka (PN 141, PN 160). Oba su šila probušene baze i pokazuju veliku sličnost, premda PN 141 demonstrira viši stupanj obrade i bolju očuvanost. Bušenje je pažljivo izvedeno, prateći prirodne linije proksimalnog dijela kostiju donožja, nakon čega je taj dio zaglađen.

### Tip 2 – probojci

Probojci (I2) su oruđa tipološki vrlo slična šilima, no odlikuju se masivnijom konstrukcijom i otpornijim vrhom.<sup>55</sup> U analiziranom skupu nalaza prisutna su dva probojka (PN 66, PN 91), oba s vrlo sličnim karakteristikama u pogledu odabira sirovine i tehnologije izrade. Njihova izrada tipično uključuje minimalno modificiranje prirodnog oblika kosti, s naglaskom na robusnost vrha postignutu brušenjem i poliranjem, kako bi se osigurala otpornost na jake udarce i pritiske tijekom rada. To ih čini prikladnima za aktivnosti koje zahtijevaju veću snagu i izdržljivost.

### Tip 3 – igle

Treću kategoriju čine igle, odnosno izradvine uglavnom manjih dimenzija i tankog, često oštrog vrha na distalnom dijelu.<sup>56</sup> Unutar ove kategorije obrađen je jedan primjerak (PN 153). Riječ je o igli većih dimenzija i neperforirane glave, no s fino obrađenim i uglačanim tijelom i vrhom. Izrada ovakvog predmeta uključuje pažljivu završnu obradu, poput glačanja i poliranja, s fokusom na postizanje oštrog, funkcionalnog vrha i stabilne, ergonomične baze/glave.

### Tip 6 – projektili

Projektili su tip oružja koje je uglavnom bilo namijenjeno uglađivanju na vrh koplja

Awls with a removed epiphysis (I1A2)<sup>54</sup> are represented by two specimens (SF 141, SF 160). Both awls have perforated bases and show great similarity, although SF 141 exhibits a higher degree of workmanship and better preservation. The perforation was carefully executed, following the natural lines of the proximal part of the metapodial bones, after which that section was smoothed.

### Type 2 – Borers

Borers (I2) are tools typologically very similar to awls but are distinguished by a more massive construction and a more resistant tip.<sup>55</sup> In the analysed assemblage, two borers are present (SF 66, SF 91), both showing very similar characteristics in terms of raw material selection and manufacturing technology. Their manufacture typically involves minimal modification of the bone's natural shape, with emphasis on the robustness of the tip achieved through grinding and polishing, ensuring resistance to strong impacts and pressure during use. This makes them suitable for activities requiring greater force and durability.

### Type 3 – Needles

The third category comprises needles, that is, artefacts generally smaller in size with a thin, often sharp tip at the distal end.<sup>56</sup> Within this category, one specimen (SF 153) was analysed. It is a larger needle with an unperforated head but a finely worked and polished body and tip. The manufacture of such an artefact involves careful finishing, including smoothing and polishing, with a focus on achieving a sharp, functional tip and a stable, ergonomic base or head.

### Type 6 – Projectiles

Projectiles are a type of weapon generally intended to be hafted onto the end of a spear or used as arrowheads, with variants and subvari-

<sup>54</sup> *Ibid.*: 280.

<sup>55</sup> *Ibid.*: 284.

<sup>56</sup> *Ibid.*: 288.

<sup>54</sup> *Ibid.*: 280.

<sup>55</sup> *Ibid.*: 284.

<sup>56</sup> *Ibid.*: 288.

ili kao strijele, s varijantama i podvarijantama koje mogu ukazivati na kulturnu i kronološku varijabilnost.<sup>57</sup> Prema morfološkim karakteristikama, primjerak iz Stobreča svrstan je u podtip vretenasti projektili (I6B).<sup>58</sup> Nalaz PN 173 ima zašiljen vrh i bazu koja se sužava u zaobljeni šiljak, dok je tijelo blago prošireno. Njegova robusna izrada i aerodinamičan oblik ukazuju na namjenu za probijanje, vjerojatno kao dio oružja za lov, gdje je efikasnost penetracije bila ključna. Tragovi obrade na cijeloj površini, uključujući zašiljene krajeve, sugeriraju pažljivo modeliranje s naglaskom na balans i stabilnost tijekom leta.

## RASPRAVA

### *Izbor sirovine*

Precizna identifikacija sirovine jedan je od ključnih elemenata za sveobuhvatno proučavanje obrađenih predmeta. Takva determinacija može pridonijeti boljoj konzervaciji artefakata, daljnjim arheološkim istraživanjima te boljem razumijevanju povijesne interakcije između ljudskih zajednica i životinja. Nadalje, izbor sirovine često reflektira kompleksnu interakciju između fizičkih svojstava sirovine i društveno-kulturnih preferencija, služeći kao indikator tradicije, društvenih promjena ili individualnog izraza unutar određene društvene skupine.<sup>59</sup> Koštana sirovina, osim egzotičnih primjera,<sup>60</sup> u pravilu je prikupljena iz

<sup>57</sup> *Ibid.*: 276.

<sup>58</sup> *Ibid.*: 87.

<sup>59</sup> CHOYKE, O'CONNOR 2013: XIII.

<sup>60</sup> Odnosi se na životinjske vrste alohtone za područje istraživanja. Primjerice, sve životinjske vrste koje imaju kljove, osim vepra, bile bi smatrane egzotičnim resursom na području Dalmacije. Iako trenutačno nema podataka o takvim luksuznim dobrima u brončanom dobu na istočnoj obali Jadrana, primjeri postoje na brončanodobnim lokalitetima u Italiji, ali i diljem Mediterana (npr. GUGLIELMINO, IACONO, RUGGE 2011). U Monkodonji su pronađene koštana igla (PUC 2020: 399, T.17/8) i drška

ants that may indicate cultural and chronological variability.<sup>57</sup> Based on its morphological characteristics, the specimen from Stobreč is classified as the subtype of fusiform projectiles (I6B).<sup>58</sup> Find SF 173 has a pointed tip and a base that tapers to a rounded point, while the body is slightly expanded. Its robust manufacture and aerodynamic shape indicate a piercing function, most likely as part of hunting weaponry, where penetration efficiency was crucial. Working traces over the entire surface, including the pointed ends, suggest careful modelling with an emphasis on balance and stability in flight.

## DISCUSSION

### *Selection of raw material*

Precise identification of the raw material is one of the key elements for a comprehensive study of worked artefacts. Such determination can contribute to better conservation of artefacts, further archaeological research and an improved understanding of the historical interaction between human communities and animals. Furthermore, the choice of raw material often reflects a complex interaction between its physical properties and socio-cultural preferences, serving as an indicator of tradition, social change or individual expression within a particular community.<sup>59</sup> Bone material, except in exotic cases, was generally collected from the immediate surroundings of the settlement.<sup>60</sup> The primary sources were waste prod-

<sup>57</sup> *Ibid.*: 276.

<sup>58</sup> *Ibid.*: 87.

<sup>59</sup> CHOYKE, O'CONNOR 2013: XIII.

<sup>60</sup> This refers to animal species that were non-native to the area under investigation. For example, all animal species with tusks, except the wild boar, would be considered exotic resources in the Dalmatian region. Although there is currently no evidence of such luxury goods from the Bronze Age along the eastern Adriatic coast, examples are known from Bronze Age sites in Italy and throughout the Mediterranean (e.g. GUGLIELMINO, IACONO, RUGGE 2011). At Monkodonja, a bone needle (PUC 2020: 399, T.

neposredne okoline naselja. Primarni izvori bili su otpadni proizvodi nastali tijekom pripreme i konzumacije hrane ili obrade kože. S druge strane, neki specifični koštani elementi namjerno su izdvajani i čuvani za daljnju obradu još u fazi rasijecanja životinjskih trupala. Budući da prapovijesni naseobinski slojevi u Stobreču obiluju koštanim nalazima, logično je zaključiti da je sirovina za koštane izrađevine prikupljena lokalno. Tome u prilog idu tragovi nagorjelosti na mezijalnom dijelu na probojcima (PN 66, PN 91) i šilu (PN 194), nastali prije obrade sirovine. Pozicija tragova indicira skupljanje prehrambenog otpada, pri čemu su ovi koštani nalazi i nakon konzumacije bili u blizini toplinskog izvora. Analizirani materijal pokazuje da sirovina dominantno potječe od domaćih životinja, koje su bile prisutne u naseljima i njihovoj blizini. Ovaj obrazac iskorištavanja sirovine konzistentan je s nalazima na drugim lokalitetima u Dalmaciji<sup>61</sup> i Istri<sup>62</sup> od mlađega kamenog doba do protopovijesti, bez uočljivih znatnih razlika. Takav je obrazac prepoznat i na brončanodobnim nalazištima diljem Europe.<sup>63</sup>

Ipak, važno je naglasiti da su za izradu igle (PN 153) korištene kosti donožja *Cervidae* (porodice jelena). Ova činjenica upućuje na moguću prisutnost lovne komponente unutar stobrečke prapovijesne zajednice, čiji će točan opseg i značaj biti detaljnije istraženi arheozoološkim analizama. Divljač je znatno slabije prisutna kao sirovina na istočnojadranskim lokalitetima. Uglavnom se pro-

ucts generated during food preparation and consumption or the working of hides. On the other hand, certain specific bone elements were intentionally selected and retained for further working during the butchering of animal carcasses. Since the prehistoric settlement layers in Stobreč abound with bone finds, it is reasonable to conclude that the raw material for bone artefacts was collected locally. This is supported by burn marks on the mesial part on the borers (SF 66, SF 91) and the awl (SF 194), which occurred before the raw material was worked. The position of these traces indicates the collection of food waste, showing that these bones, even after consumption, remained near a heat source. The analysed material demonstrates that the raw material predominantly originated from domestic animals present within and around the settlement. This pattern of raw material exploitation is consistent with findings from other sites in Dalmatia<sup>61</sup> and Istria<sup>62</sup> dating from the Late Neolithic to Protohistoric periods, without any notable differences. Such a pattern has also been recognised at Bronze Age sites across Europe.<sup>63</sup>

However, it is important to note that the needle (SF 153) was made from the metapodial bone of a cervid (deer family). This fact indicates the possible presence of a hunting component within the prehistoric Stobreč community, the exact scope and significance of which will be further explored through archaeozoological analyses. Game is considerably less represented as a raw material at sites along the eastern Adriatic coast. Most com-

(PUC 2020: 399, T.66/5) pripisane vrsti zeca *Lepus capensis* (PUC 2020: 399). Budući da je izvorno stanište ove vrste sjeverozapadna, istočna i južna Afrika te jugozapadna Azija (LADO et al. 2019), u slučaju ispravne taksonomske determinacije može se smatrati egzotičnom vrstom.

<sup>61</sup> VUJEVIĆ 2009; VUJEVIĆ, HORVAT 2012; SANFORD GAASTRA, CRISTIANI, BARBARIĆ 2014: 22–24; MARIJANOVIĆ, HORVAT 2016; HORVAT, VUJEVIĆ 2017; KLIŠKIĆ 2024.

<sup>62</sup> MLAKAR 1988; AMATT, MIRACLE 2006; MAUEL 2008; PUC 2020.

<sup>63</sup> CHOYKE, VRETEMARK, STEN 2004; BARON, DIAKOWSKI, STOLARCZYK 2016; GÁL 2016.

I. 7/8) and a handle (PUC 2020: 399, T.66/5) have been attributed to the hare species *Lepus capensis* (PUC 2020: 399). As the native habitat of this species is north-western, eastern and southern Africa, as well as south-western Asia (LADO et al. 2019), in the case of correct taxonomic identification it can be regarded as an exotic species.

<sup>61</sup> VUJEVIĆ 2009; VUJEVIĆ, HORVAT 2012; SAANFORD GAASTRA, CRISTIANI, BARBARIĆ 2014: 22–24; MARIJANOVIĆ, HORVAT 2016; HORVAT, VUJEVIĆ 2017; KLIŠKIĆ 2024.

<sup>62</sup> MLAKAR 1988; AMATT, MIRACLE 2006; MAUL 2008; PUC 2020.

<sup>63</sup> CHOYKE, VRETEMARK, STEN 2004; BARON, DIAKOWSKI, STOLARCZYK 2016; GÁL 2016.

nalaze ostaci jelenjeg rogovlja (*C. elaphus*), koje je na lokalitetu Dugiš<sup>64</sup> služilo za izradu drški za oruđe ili oružje<sup>65</sup> te tobolaca,<sup>66</sup> slično kao i u Pupićinoj peći.<sup>67</sup> Na Monkodonji<sup>68</sup> je, međutim, zabilježen širi spektar oruđa i oružja izrađenih od rogovlja<sup>69</sup>. Jedinim primjerak probojka iz Monkodonje izrađen od sirovine divlje životinje potječe od metapodijalne kosti jelena običnog.<sup>70</sup> Osim spomenutog jelena, u Dugišu je pronađen privjesak od kljove vepra (*Sus scrofa*),<sup>71</sup> dok je u Monkodonji zabilježen retušer izrađen od rogovlja srne (*Capreolus capreolus*)<sup>72</sup>.

U ovdje analiziranom skupu koštanih izrađevina većina je izrađena od odraslih jedinki, dok je zabilježen samo jedan primjerak izrađen od mlade jedinke. Mlađe jedinke općenito se smatraju manje prikladnom sirovinom zbog veće fragilnosti pri izradi i upotrebi predmeta. Stoga veći udio takvih nalaza može ukazivati na smanjeni odabir ciljane sirovine.<sup>73</sup> Nasuprot tome, upotreba kostiju uglavnom odraslih jedinki u Stobreču upućuje na promišljen i planski pristup proizvodnji odabirom kvalitetnije sirovine.<sup>74</sup>

Osim same dostupnosti sirovine, morfološki zahtjevi finalnog proizvoda predstavljaju ključan ograničavajući faktor pri

monly, remains of red deer antlers (*C. elaphus*) have been found, which at the site of Dugiš<sup>64</sup> were used to make tool or weapon handles<sup>65</sup> and quivers,<sup>66</sup> similar to the finds from Pupićina Peć.<sup>67</sup> At Monkodonja,<sup>68</sup> however, a wider range of tools and weapons made from antler has been recorded.<sup>69</sup> The only example of a borer from Monkodonja made from wild animal bone originates from the metapodial bone of a red deer.<sup>70</sup> In addition, a pendant made from a wild boar (*Sus scrofa*)<sup>71</sup> tusk was found at Dugiš, while at Monkodonja a retoucher made from roe deer (*Capreolus capreolus*) antler was recorded.<sup>72</sup>

In the analysed assemblage of bone artefacts, most were made from adult individuals, with only one example crafted from a young specimen. Younger specimens are generally considered a less optimal raw material due to the greater fragility of their bones during both manufacture and use of the objects. Therefore, a higher proportion of such finds may indicate a less selective approach to raw material choice.<sup>73</sup> In contrast, the use of bones predominantly from adult specimens at Stobreč suggests a deliberate and planned approach to production, with a preference for higher-quality material.<sup>74</sup>

In addition to the simple availability of raw material, the morphological requirements of

<sup>64</sup> KLIŠKIĆ 2024.

<sup>65</sup> *Ibid.*: 143, inv. br. N 5668, inv. br. N 5673.

<sup>66</sup> *Ibid.*: 134, inv. br. N 5674.

<sup>67</sup> AMATT, MIRACLE 2006: 407. Riječ je o motici izrađenoj od jelenjeg roga.

<sup>68</sup> PUC 2020.

<sup>69</sup> Riječ je o šivaćim iglama (PUC 2020: 400, T. 18/1, 3), projektilu (PUC 2020: 405, T. 23/4), sjekirama (PUC 2020: 425, T. 43/1; 447, T. 65/1,2), koničnom čekićastom oruđu (PUC 2020: 428, T. 46/1), oruđu od rogova – sjekira, teslica ili motika (PUC 2020: 427, T. 45/2) te probušenoj i ornamentiranoj ploči (PUC 2020: 423, T. 41/1).

<sup>70</sup> PUC 2020: 439, T. 57/1.

<sup>71</sup> KLIŠKIĆ 2024.

<sup>72</sup> PUC 2020: 379, inv. br. A.

<sup>73</sup> CHOYKE 1997.

<sup>74</sup> Na arheološkim lokalitetima životinje korištene za meso često se konzumiraju vrlo mlade, s još nesraslim kostima neadekvatne tvrdoće. Zbog toga se takvi nalazi često interpretiraju kao prehrambeni otpad (ISAAKIDOU 2003: 235).

<sup>64</sup> KLIŠKIĆ 2024.

<sup>65</sup> *Ibid.*: 143, Inv. No. N 5668, Inv. No. N 5673.

<sup>66</sup> *Ibid.*: 134, Inv. No. N 5674.

<sup>67</sup> AMATT, MIRACLE 2006: 407. It is a mattock made from a red deer antler.

<sup>68</sup> PUC 2020.

<sup>69</sup> These include sewing needles (PUC 2020: 400, Pl. 18/1, 3), a projectile (PUC 2020: 405, Pl. 23/4), axes (PUC 2020: 425, Pl. 43/1; 447, Pl. 65/1,2), a conical hammer-like tool (PUC 2020: 428, Pl. 46/1), antler tools – axes, adzes or mattocks (PUC 2020: 427, Pl. 45/2), and a perforated and decorated plate (PUC 2020: 423, Pl. 41/1).

<sup>70</sup> PUC 2020: 439, Pl. 57/1.

<sup>71</sup> KLIŠKIĆ 2024.

<sup>72</sup> PUC 2020: 379, Inv. No. A.

<sup>73</sup> CHOYKE 1997.

<sup>74</sup> At archaeological sites, animals used for meat had often been consumed at a very young age, when their bones were not yet fused and lacked adequate hardness. For this reason, such finds are frequently interpreted as food waste (ISAAKIDOU 2003: 235).

odabiru koštanog materijala.<sup>75</sup> Veličina životinje iz koje potječe kost igra važnu ulogu; primjerice, kosti jelena običnog (*Cervus elaphus*) i goveda (*Bos taurus*) često su međusobno zamjenjive zbog pripadnosti sličnoj kategoriji veličine životinje. U skladu s time, većina oruđa izrađenih od kostiju velikih vrsta u pravilu se tipološki razlikuje od onih proizvedenih od kostiju manjih vrsta, poput ovaca/koza (*Caprinae*) ili srna (*Capreolus capreolus*).<sup>76</sup>

Također je presudan odabir specifičnoga anatomskog elementa. Metapodijalne kosti (kosti donožja i zapešća) predstavljaju prirodan odabir za izradu zašiljenih oruđa, kao što su probojci, šila i igle. Njihova pogodnost proizlazi iz prisutnosti prirodnog žlijeba (*sulcus*) koji se proteže duž longitudinalne osi kosti, olakšavajući kontrolirani lom i postizanje željenog oblika za planiranu izradu oruđa.<sup>77</sup> Takav primjer nalazimo u predmetnim šilima. Iako su u uzorku iz Stobreča šila primarno izrađivana od metapodijalnih kostiju malih preživača, posebno iz porodice *Caprinae*, zabilježena je i upotreba drugih dugih kostiju, poput goljenične. Na drugim lokalitetima prisutan je širi spektar korištenih anatomskih elemenata, uključujući lakatnu i palčanu kost,<sup>78</sup> kao i metapodijalne kosti svinje<sup>79</sup>.

### **Funkcija oruđa**

Šila predstavljaju jedan od najčešćih tipova koštanih izrađevina na arheološkim lokalitetima, što naglašava važnost rekonstrukcije njihove potencijalne funkcije. Prema različitim studijama,<sup>80</sup> šila dijele slične funkcije s probojcima, poput perforiranja kožnih sirovina, ali imaju i dodatne funkcije kao što su

the final product represent a key limiting factor in the selection of bone material.<sup>75</sup> The size of the animal from which the bone originates plays a significant role; for example, red deer (*Cervus elaphus*) and cattle (*Bos taurus*) bones are often interchangeable, as they belong to a similar size category. Accordingly, most tools made from the bones of large species generally differ typologically from those produced from the bones of smaller species, such as sheep/goats (*Caprinae*) or roe deer (*Capreolus capreolus*).<sup>76</sup>

The selection of a specific anatomical element is also crucial. Metapodial bones (metatarsals and metacarpals) represent a natural choice for the production of pointed tools such as borers, awls and needles. Their suitability arises from the presence of a natural groove (*sulcus*) running along the longitudinal axis of the bone, which facilitates controlled fracturing and the achievement of the desired shape for tool manufacture.<sup>77</sup> This can be observed in the awls discussed here. Although the awls from Stobreč were primarily made from the metapodial bones of small ruminants, particularly those from the *Caprinae* family, the use of other long bones, such as the tibia, was also recorded. At other sites, a wider range of anatomical elements is present, including *ulnae* and *radii*,<sup>78</sup> as well as metapodial bones of pigs.<sup>79</sup>

### **Function of the tools**

Awls represent one of the most common types of bone artefacts at archaeological sites, underscoring the importance of reconstructing their potential function. According to various studies,<sup>80</sup> awls share similar functions with borers, such as the piercing of leather materials, but they also served additional pur-

<sup>75</sup> RUSSELL 2001.

<sup>76</sup> CHOYKE 1997: 67.

<sup>77</sup> VITEZOVIĆ 2016.

<sup>78</sup> MLAKAR 1998.

<sup>79</sup> PUC 2020: T. 13/5.

<sup>80</sup> CAMPANA 1989; CHRISTIDOU, LEGRAND-PINEAU 2005; BUC 2011.

<sup>75</sup> RUSSELL 2001.

<sup>76</sup> CHOYKE 1997: 67.

<sup>77</sup> VITEZOVIĆ 2016.

<sup>78</sup> MLAKAR 1998.

<sup>79</sup> PUC 2020: Pl. 13/5.

<sup>80</sup> CAMPANA 1989; CHRISTIDOU, LEGRAND-PINEAU 2005; BUC 2011.

izrada košara, mreža, odjeće te konstrukcija nastambi ili skloništa.<sup>81</sup> Valja napomenuti da je funkcija pojedinog oruđa mogla varirati ovisno o specifičnim trenutačnim potrebama zajednice ili naselja, ali i individualnim potrebama pojedinaca.<sup>82</sup>

Eksperimentalna studija koju su provele Christidou i Legrand-Pineau detaljno je istražila različite tehnike obrade životinjske kože primjenom koštanog oruđa.<sup>83</sup> Nakon procesa skidanja kože, eksperimenti su provedeni na netretiranoj, natopljenoj, navlaženoj i suhoj koži, pozicioniranoj na razne načine: rastegnutoj na drveni okvir, pričvršćenoj za tlo ili položenoj na drvenu dasku. Studija je pokazala da su se probojci/šila primarno upotrebljavali za perforiranje sirove, vlažne i suhe kože, primjenom tehnika rotacije i neizravnog udarca.<sup>84</sup> Kad se primjenjivala tehnika neizravnog udarca,<sup>85</sup> koža je obično bila položena na drvenu dasku, često s dodatnim komadom kože umetnutim između daske i obrađivane kože. Autorice ističu da je neizravni udarac najučinkovitija, a često i nužna metoda pri obradi debele i/ili krute kože.<sup>86</sup>

Karakteristika je svih ovdje analiziranih šila sjajna, ispolirana površina, posebno na distalnim dijelovima i samom vrhu. Ovakva ispoliranost uglavnom je rezultat kontakta s mekšim, organskim materijalima.<sup>87</sup> Vrhovi su kod većine primjeraka neoštećeni, što sugerira slab intenzitet upotrebe šila. Dva šila (sl. 5a, 5e) pokazuju transverzalne, uske strije koje se međusobno križaju, što upućuje na

poses, including basket making, net making, clothing production and the construction of dwellings or shelters.<sup>81</sup> It should be noted that the function of an individual tool may have varied depending on the specific needs of the community or settlement, as well as the personal needs of individual users.<sup>82</sup>

An experimental study conducted by Christidou and Legrand-Pineau examined in detail various techniques of animal hide working using bone tools.<sup>83</sup> After skinning, experiments were carried out on untreated, soaked, moistened and dry hides, positioned in different ways: stretched on a wooden frame, fixed to the ground or laid on a wooden board. The study showed that borers and awls were primarily used for piercing raw, wet and dry hides by employing rotation and indirect percussion techniques.<sup>84</sup> When the indirect percussion technique was used,<sup>85</sup> the hide was usually placed on a wooden board, often with an additional piece of hide inserted between the board and the one being worked. The authors emphasised that indirect percussion is the most effective, and often essential, method when working with thick and/or stiff hides.<sup>86</sup>

A characteristic feature of all the awls analysed here is their glossy, polished surface, particularly on the distal parts and the tips themselves. Such polish is generally the result of contact with softer, organic materials.<sup>87</sup> The tips of most specimens are undamaged, suggesting a low intensity of use. Two awls (Figs. 5a, 5e) exhibit narrow, transverse striations

<sup>81</sup> OLSEN 1979; CAMPANA 1989.

<sup>82</sup> CAMPANA 1989: 54.

<sup>83</sup> CHRISTIDOU, LEGRAND-PINEAU 2005.

<sup>84</sup> *Ibid.*

<sup>85</sup> Tehnika koja podrazumijeva upotrebu posredničkog oruđa u svrhu neizravnog prijenosa sile s udarača na predmet sile (INIZAN *et al.* 1999: 32). Slika (CHRISTIDOU, LEGRAND-PINEAU 2005, sl. 9) prikazuje eksperiment u kojem su autorice upotrebljavale udarač za prijenos sile na probojak/šilo, što je rezultiralo bušenjem rupe u životinjskoj koži.

<sup>86</sup> CHRISTIDOU, LEGRAND-PINEAU 2005.

<sup>87</sup> *Ibid.*

<sup>81</sup> OLSEN 1979; CAMPANA 1989.

<sup>82</sup> CAMPANA 1989: 54.

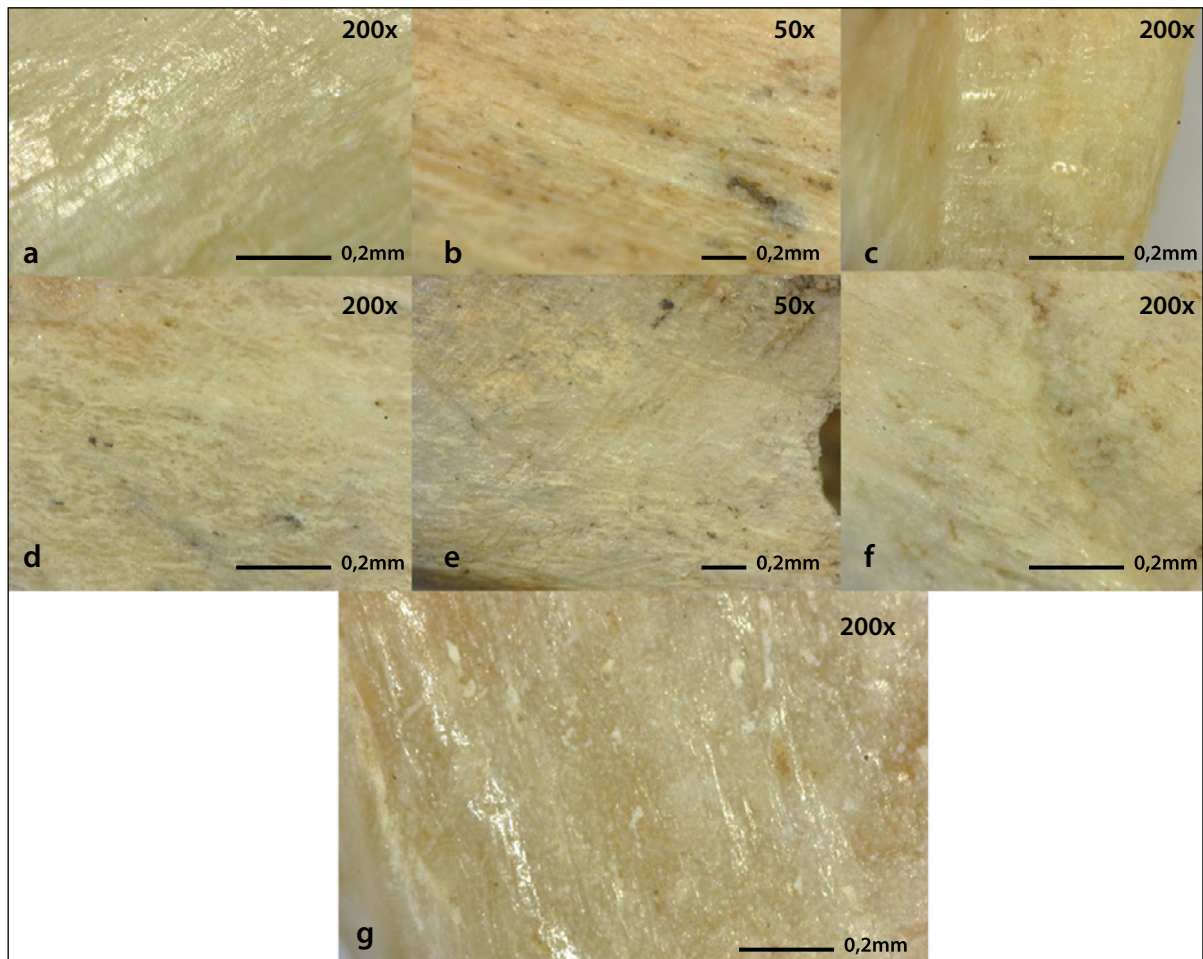
<sup>83</sup> CHRISTIDOU, LEGRAND-PINEAU 2005.

<sup>84</sup> *Ibid.*

<sup>85</sup> A technique involving the use of an intermediary tool to indirectly transfer force from the hammer to the artefact being worked (INIZAN *et al.* 1999: 32). The illustration (CHRISTIDOU, LEGRAND-PINEAU 2005, Fig. 9) shows an experiment in which the authors used a hammer to transfer force onto a borer/awl, resulting in the drilling of a hole in animal hide.

<sup>86</sup> CHRISTIDOU, LEGRAND-PINEAU 2005.

<sup>87</sup> *Ibid.*



SLIKA 5. Mikrotopografija (povećanje 200 puta, 50 puta) distalnog dijela tijela šila (PN 38 – a; PN 141 – b; PN 149 – c; PN 160 – d; PN 171 – e; PN 172 – f; PN 194 – g) (izradila: A. Barbir)

FIGURE 5 Microtopography (magnifications  $\times 200$ ,  $\times 50$ ) of distal parts of awl shafts (SF 38 – a; SF 141 – b; SF 149 – c; SF 160 – d; SF 171 – e; SF 172 – f; SF 194 – g) (made by A. Barbir)

obradu kože.<sup>88</sup> Raspored i smjer strija usko su povezani s rasporedom abrazivnih čestica u materijalu koji se obrađivao (npr. životinjska koža, biljna vlakna). U životinjskim je kožama raspored abrazivnih čestica (minerali, proteini) nepravilan, zbog čega pri obradi nastaju križno raspoređene strije na površini alata.<sup>89</sup> Kod ostalih šila (sl. 5b–d, 5g) strije nisu jasno vidljive, no njihova je mikrotopografija homogena, a mikroreljef pravilan. Takve površinske karakteristike odgovaraju obradi kako kože tako i biljnih vlakana,<sup>90</sup> što onemogućuje precizno određivanje specifič-

that intersect, indicating hide working.<sup>88</sup> The arrangement of striations is closely linked to the organisation of abrasive particles in different materials (e.g. animal hide, plant fibres). In animal hides, abrasive particles are irregularly distributed, resulting in cross-hatched striations on the tool surface.<sup>89</sup> In the remaining awls (Figs. 5b, 5c, 5d, 5g), striations are not clearly visible; however, their microtopography is homogeneous, and the microrelief is regular. Such surface characteristics correspond to the working of both hide and plant fibres,<sup>90</sup> making it impossible to determine the

<sup>88</sup> BUC 2011.

<sup>89</sup> *Ibid.*

<sup>90</sup> *Ibid.*

<sup>88</sup> BUC 2011.

<sup>89</sup> *Ibid.*

<sup>90</sup> *Ibid.*

ne funkcije ovih predmeta. Stoga je moguće pretpostaviti da su korišteni za različite aktivnosti.

Probojci analizirani u ovoj studiji izrađeni su longitudinalnim cijepanjem kostiju donožja. Ova kombinacija tehnike izrade i izbora anatomskog elementa relativno je česta, sa sličnim nalazima zabilježenima na drugim bronzanodobnim lokalitetima u Hrvatskoj<sup>91</sup> i šire.<sup>92</sup> Zabilježena je i upotreba drugih cjevastih kostiju, poput goljenične kosti.<sup>93</sup> Masivnost ovog oruđa izravno je povezana s funkcijom. Veća drška omogućuje lakši hvat, dok masivan vrh olakšava probijanje tvrdih materijala te rad s otpornijim materijalima kao što je drvo te pri izradi košara i mreža ili čak potencijalno kod popravaka kamenog oruđa.<sup>94</sup> Drške (baze oruđa) često mogu pokazivati tragove zaglađenosti koji upućuju na intenzivnu upotrebu ili pritisak.<sup>95</sup> Međutim, probojci iz Stobreča ne posjeduju takve tragove, što sugerira mogućnost da su drške bile obložene materijalom koji je poboljšavao prihvata i istodobno štiti kost. S druge strane, vrhovi obaju primjeraka pokazuju jasne tragove glačanja.

Mikrotopografske analize probojaka pokazuju homogenu površinu (sl. 6a, 6c), dok su strije uske, ravne i mjestimično dublje (sl. 6b, 6d). Dominantan je smjer strija longitudinalan, uz povremene grupacije transverzalnih strija (sl. 6b, 6d). Ovakve karakteristike koštane površine, zajedno s oblikom i pozicijom strija, upućuju na upotrebu oruđa na koži. Takve strije posebno su vidljive na PN 91 (sl. 6d). Nasuprot tome, u biljkama bogatima silicijem elementi poput fitolita raspoređeni su paralelno, što uzrokuje formiranje paralelnih strija.<sup>96</sup> Ova karakteristika može upućivati na upotrebu probojka

precise specific function of these artefacts. It can therefore be assumed that they were used for a range of different activities.

The borers analysed in this study were produced by longitudinal splitting of metapodial bones. This combination of manufacturing technique and anatomical element is relatively common, with similar finds recorded at other Bronze Age sites in Croatia<sup>91</sup> and beyond.<sup>92</sup> The use of other long bones, such as the tibia, has also been documented.<sup>93</sup> The robustness of these tools is directly related to their function. A larger handle allows for an easier grip, while a massive tip facilitates the piercing of harder materials and working with more resistant substances such as wood, as well as in basket and net making, or even potentially in the repair of stone tools.<sup>94</sup> Handles (the bases of the tools) often display traces of smoothing that indicate intensive use or applied pressure.<sup>95</sup> However, the borers from Stobreč show no such traces, suggesting the possibility that the handles were covered with a material that improved grip while simultaneously protecting the bone. Conversely, the tips of both specimens exhibit clear signs of polishing.

Microtopographic analyses of the borers reveal a homogeneous surface (Figs. 6a, 6c), while the striations are narrow, straight and locally deeper (Figs. 6b, 6d). The dominant orientation of the striations is longitudinal, with occasional clusters of transverse ones (Figs. 6b, 6d). These surface characteristics, together with the shape and position of the striations, indicate that the tools were used on hide. Such striations are particularly visible in SF 91 (Fig. 6d). In contrast, in plants rich in silica, elements such as phytoliths are arranged in parallel, resulting in the formation of parallel striations.<sup>96</sup> This feature may suggest that the borer SF 66 (Fig. 6b) was used on plant-based

<sup>91</sup> PUC 2020: 273, T. 8; 9/1,10; 52/2.

<sup>92</sup> BARON, DIAKOWSKI, STOLARCZYK 2016: 32, Pl. 7/1.

<sup>93</sup> PUC 2020: 273.

<sup>94</sup> CAMPANA 1989: 54.

<sup>95</sup> PUC 2020: 273.

<sup>96</sup> BUC 2011: 555.

<sup>91</sup> PUC 2020: 273, Pl. 8; 9/1,10; 52/2.

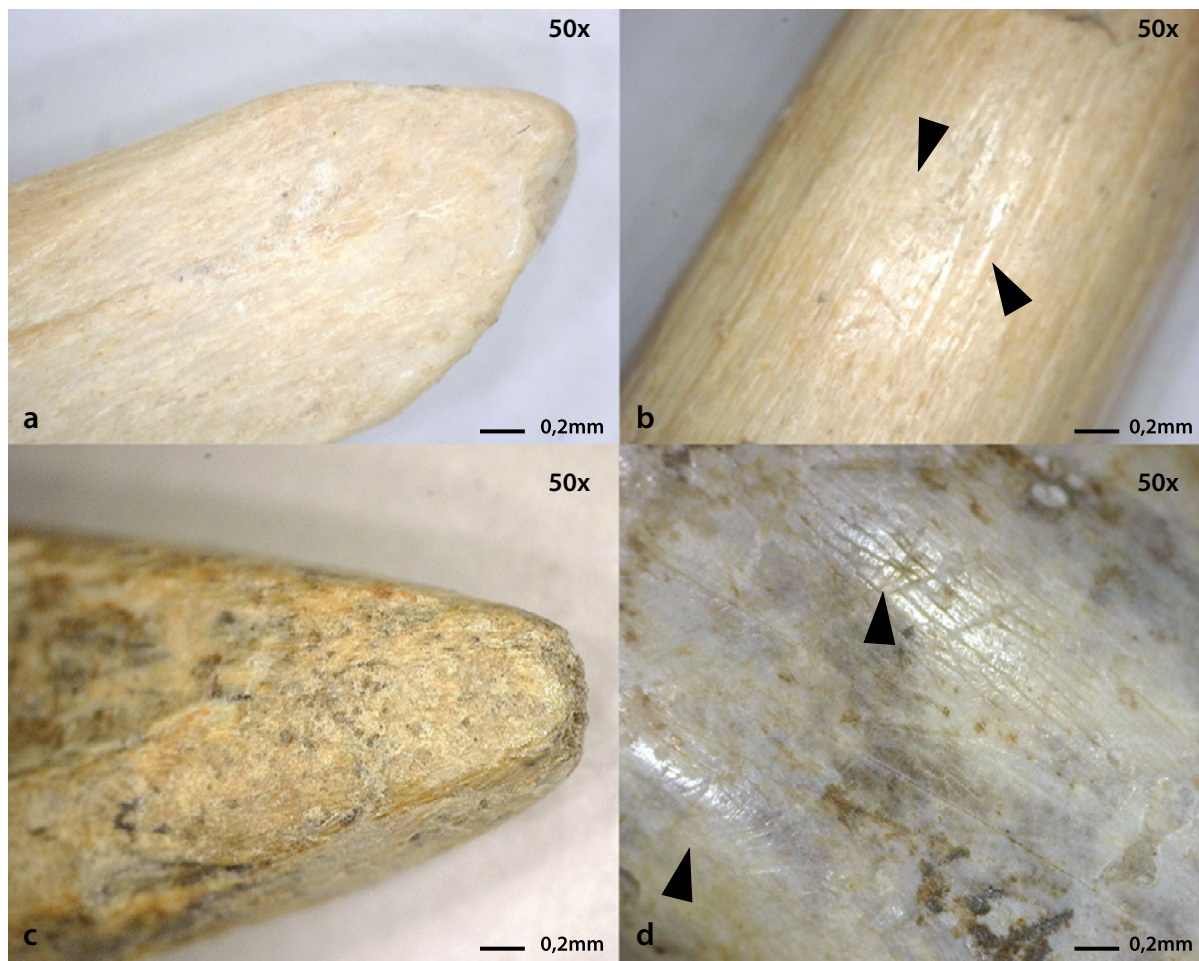
<sup>92</sup> BARON, DIAKOWSKI, STOLARCZYK 2014: 32, Pl. 7/1.

<sup>93</sup> PUC 2020: 273.

<sup>94</sup> CAMPANA 1989: 54.

<sup>95</sup> PUC 2020: 273.

<sup>96</sup> BUC 2011: 555.



SLIKA 6. Mikrotopografija (povećanje 50 puta) vrhova probojaka (PN 66 – a; PN 91 – c) i strija (PN 66-b; PN 91-d) (izradila: A. Barbir)

FIGURE 6 Microtopography (magnification  $\times 50$ ) of awl tips (SF 66 – a; SF 91 – c) and striations (SF 66 – b; SF 91 – d) (made by A. Barbir)

PN 66 (sl. 6b) na materijalima biljnog porijekla. Općenito, uglačanost vrha i okolnog područja sugerira kontakt s organskim materijalima,<sup>97</sup> dok oštećenje vrha na PN 66 ukazuje na intenzivnu uporabu.

Igle su karakterizirane dugim i tankim vrhom, a njihova je primarna funkcija povezana s preradom biljnih vlakana te izradom predmeta od kože, krzna i različitih tekstila.<sup>98</sup> Primjerak iz Stobreča PN 153 izrađen je od dorzalnog ulomka dijafize kostiju donožja. Igle su često izrađivane od otpadnih koštanih sirovina, unatoč čemu njihova završna obrada rezultira vrlo finim uglačanim površina-

materials. In general, the polished surface of the tip and surrounding area suggests contact with organic materials,<sup>97</sup> while the damaged tip of SF 66 indicates intensive use.

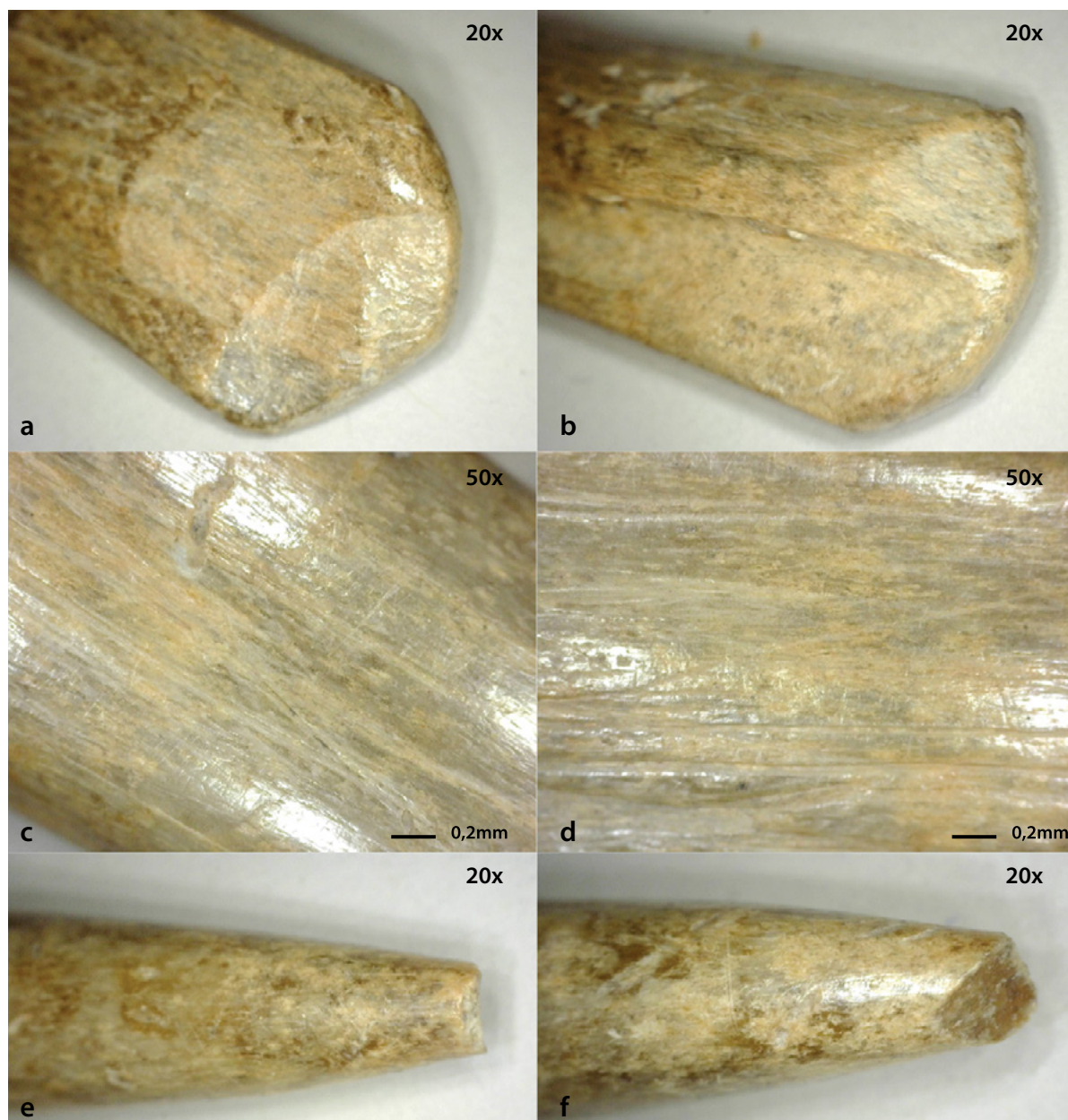
Needles are characterised by a long and slender tip, and their primary function is associated with the working of plant fibres and the manufacture of artefacts made from leather, fur and various textiles.<sup>98</sup> The specimen from Stobreč, SF 153, was made from a dorsal fragment of the diaphysis of a metapodial bone. Needles were often produced from discarded bone material, yet their final finishing typically resulted in very finely polished surfac-

<sup>97</sup> CHRISTIDOU, LEGRAND-PINEAU 2005.

<sup>98</sup> VITEZOVIĆ 2011: 288.

<sup>97</sup> CHRISTIDOU, LEGRAND-PINEAU 2005.

<sup>98</sup> VITEZOVIĆ 2011: 288.



SLIKA 7. Mikrotopografija (povećanje 50 puta) za mezijalni dio igle (PN 153) i snimka (povećanje 20 puta) za bazu i vrh (izradila: A. Barbir)

FIGURE 7 Microtopography ( $\times 50$ ) of the mesial part of the needle (SF 153) and image ( $\times 20$ ) of the base and tip (made by A. Barbir)

ma.<sup>99</sup> To je slučaj i s PN 153, koji pokazuje izrazitu zaglađenost duž cijelog predmeta (sl. 7; T. I). Usporedbe se mogu pronaći u Monkodonji<sup>100</sup> i Dugišu.<sup>101</sup> Analiza tragova upotrebe na PN 153 otkrila je sjajnu, zaglađenu površinu igle, što sugerira kontakt

es.<sup>99</sup> This is also the case with SF 153, which exhibits pronounced smoothness along its entire surface (Fig. 7, Pl. 1). Comparable examples can be found at Monkodonja<sup>100</sup> and Dugiš.<sup>101</sup> Use-wear analysis of SF 153 revealed a glossy, smoothed surface, suggesting contact

<sup>99</sup> *Ibid.*

<sup>100</sup> PUC 2020: 276.

<sup>101</sup> KLIŠKIĆ 2024: 141, inv. br. N 5664; 142, inv. br. N 5659, inv.br. N 5661.

<sup>99</sup> *Ibid.*

<sup>100</sup> PUC 2020: 276.

<sup>101</sup> KLIŠKIĆ 2024: 141, Inv. No. N 5664; 142, Inv. No. N 5659, Inv. No. N 5661.

cijelog predmeta s organskim materijalima. Glava igle pokazuje isključivo tragove povezane s morfološkim oblikovanjem, uz već spomenutu zaglađenost. Po cijeloj površini predmeta vidljive su uske, longitudinalne strije oštih rubova, no zaglađene površine. Bradfield je takve tragove upotrebe povezo s upotrebom predmeta na biljnim materijalima.<sup>102</sup> Vujević ističe kako sama morfologija igala upućuje na njihovu primjenu na prethodno pripremljenoj koži, koja je bila probušena probojcima i šilima, ili na laganijim biljnim materijalima.<sup>103</sup> Vitezović dodaje da je ovakav tip neperforiranih igala korišten za tkanje i pletenje, gdje su biljna vlakna s pomoću finog šiljka namještana i provlačena kroz prethodno izrađene rupe, pri čemu se tragovi upotrebe manifestiraju kroz ispolirnost predmeta.<sup>104</sup>

U Stobreču je zasad evidentiran samo jedan projektil (PN 173). Istodobni nalazi ovog tipa oruđa/oružja zabilježeni su na obalnim lokalitetima poput Monkodonje,<sup>105</sup> gdje predstavljaju čest tip projektila s jednim krajem oblikovanim u šiljak, a drugim suženim i manje precizno oblikovanim u zaobljeni završetak.<sup>106</sup> Ova tipologija u potpunosti odgovara primjerku iz Stobreča (sl. 8; T. I). Sličan je tip pronađen i na brončanodobnom lokalitetu Paks-Gyapa.<sup>107</sup>

Mikrotopografija tijela projektila (sl. 8a) otkriva kratke kose strije koje su orijentirane transverzalno u odnosu na os predmeta. Vjerojatno su nastale djelovanjem kamenog oruđa tijekom izrade.<sup>108</sup> Campana ističe da je u većini slučajeva teško precizno odrediti tip kamenog oruđa korištenog u obradi koštanih izrađevina.<sup>109</sup> Međutim, tragovi koje to oruđe ostavlja često su relativno mali i imaju

of the entire artefact with organic materials. The head of the needle shows only traces related to morphological shaping, along with the previously mentioned smoothness. Across the entire surface of the artefact, narrow, longitudinal striations with sharp edges yet polished surfaces are visible. Bradfield associated such use-wear traces with the use of artefacts on plant materials.<sup>102</sup> Vujević pointed out that the morphology of needles itself suggests their use on pre-prepared hide, which had been perforated with borers and awls, or on lighter plant materials.<sup>103</sup> Vitezović added that this type of non-perforated needle was used for weaving and braiding, where plant fibres were positioned and drawn through previously made holes using the fine point, resulting in the polished appearance of the artefact.<sup>104</sup>

So far, only one projectile (SF 173) has been recorded in Stobreč. Contemporary finds of this type of tool/weapon have been documented at coastal sites such as Monkodonja,<sup>105</sup> where they represent a common type of projectile with one end shaped into a point and the other narrowed and more roughly worked into a rounded tip.<sup>106</sup> This typology fully corresponds to the specimen from Stobreč (Fig. 8, Pl. 1). A similar type has also been found at the Bronze Age site of Paks-Gyapa.<sup>107</sup>

The microtopography of the projectile's body (Fig. 8a) reveals short, oblique striations oriented transversely to the artefact's axis. These were likely produced by the use of a stone tool during manufacture.<sup>108</sup> Campana notes that, in most cases, it is difficult to determine precisely which type of stone tool was used in working bone artefacts.<sup>109</sup> However, the traces left by such tools are often relatively small and exhibit

<sup>102</sup> BRADFIELD 2015: 6.

<sup>103</sup> VUJEVIĆ 2009: 95.

<sup>104</sup> VITEZOVIĆ 2011: 289.

<sup>105</sup> PUC 2020: T. 21; 22, 1-4.

<sup>106</sup> PUC 2020: T. 21, 4-6; 22, 1-2.

<sup>107</sup> GÁL 2016: 122, sl. 5.

<sup>108</sup> CAMPANA 1989: 31, Pl. 4.

<sup>109</sup> *Ibid.*: 31.

<sup>102</sup> BRADFIELD 2015: 6.

<sup>103</sup> VUJEVIĆ 2009: 95.

<sup>104</sup> VITEZOVIĆ 2011: 289.

<sup>105</sup> PUC 2020: Pl. 21; 22, 1-4.

<sup>106</sup> PUC 2020: Pl. 21, 4-6; 22, 1-2.

<sup>107</sup> GÁL 2016: 122, Fig. 5.

<sup>108</sup> CAMPANA 1989: 31, Pl. 4.

<sup>109</sup> *Ibid.*: 31.

specifičan sjaj.<sup>110</sup> Baza projektila zaobljena je i pokazuje oštećenja (sl. 8b). Na vrhu je uočljiv relativno oštar brid, dok je okolna površina zaobljena i bez izraženih strija (sl. 8c–d). Slični tragovi korištenja zabilježeni su na predmetima koji su eksperimentalno korišteni za udarce, bez obzira na to jesu li bili izravni ili neizravni.<sup>111</sup>

Iako je primarna funkcija ovih nalaza, kao vrhova kopalja ili strijela, očita, njihova je interpretacija znatno ograničena. Malen broj uzoraka, ograničenost eksperimentalnih studija i nedostatak komparabilnih lokaliteta onemogućuju precizno određivanje njihove specifične namjene, poput utvrđivanja jesu li korišteni za lov, ratovanje ili u obje svrhe. Lokaliteti s većim uzorkom, kao što je Paks-Gyapa, omogućuju pretpostavku da je glavna funkcija projektila bila lov.<sup>112</sup> S druge strane, prostorna analiza položaja projektila na Monkodonji sugerira da su povezani s napadima i opsadom naselja.<sup>113</sup> Naime, najveća koncentracija ovog oružja pronađena je uz glavni bedem, sjeverna vrata naselja i južna vrata akropole.<sup>114</sup> Bradfield i Lombard proveli su eksperimente na projektilima, s posebnim fokusom na makrofrakture.<sup>115</sup> Projektili su višekratno korišteni kao strijele i vrhovi kopalja, pri čemu su zabilježena najčešća oštećenja.<sup>116</sup> Eksperiment je pokazao da oblik oruđa i metoda korištenja (npr. strijela, koplje) utječu na formiranje tipova loma, no potrebna su daljnja eksperimentalna istraživanja kako bi se potvrdila ova mogućnost.<sup>117</sup> Oštećenje na bazi projektila (sl. 8b) odgovara oštećenju nastalom drobljenjem koje je interpretirano kao oštećenje od upotrebe kao nasađeni vrh

a characteristic sheen.<sup>110</sup> The projectile's base is rounded and shows signs of damage (Fig. 8b). At the tip, a relatively sharp edge is visible, while the surrounding surface is rounded and lacks distinct striations (Fig. 8c-d). Similar use-wear traces have been recorded on artefacts that were experimentally used for percussion, regardless of whether it was direct or indirect.<sup>111</sup>

Although the primary function of these finds – as spear or arrow points – is evident, their interpretation remains significantly limited. The small sample size, scarcity of experimental studies and lack of comparable sites prevent precise determination of their specific purpose, such as whether they were used for hunting, warfare, or both. Sites with larger assemblages, such as Paks-Gyapa, allow the assumption that the main function of projectiles was hunting.<sup>112</sup> Conversely, spatial analysis of projectile distribution at Monkodonja suggests an association with attacks and the siege of the settlement.<sup>113</sup> Namely, the highest concentration of this type of weapon was found along the main rampart, at the northern gate to the settlement and at the southern gate leading to the acropolis.<sup>114</sup> Bradfield and Lombard conducted experiments on projectiles, with a particular focus on macrofractures.<sup>115</sup> The projectiles were repeatedly used as arrow and spear tips, during which the most common types of damage were recorded.<sup>116</sup> The experiment demonstrated that the shape of the tool and the method of use (e.g. arrow, spear) influence the formation of fracture types, although further experimental research is required to confirm this possibility.<sup>117</sup> The damage on the base of the projectile (Fig. 8b) corresponds to crushing damage, which has been interpreted as resulting from its use

<sup>110</sup> *Ibid.*: 31.

<sup>111</sup> BUC 2011: 552.

<sup>112</sup> GÁL 2016: 126.

<sup>113</sup> PUC 2020: 316–317.

<sup>114</sup> PUC 2020: 316–317.

<sup>115</sup> BRADFIELD, LOMBARD 2011.

<sup>116</sup> *Ibid.*: 68.

<sup>117</sup> *Ibid.*: 73.

<sup>110</sup> *Ibid.*

<sup>111</sup> BUC 2011: 552.

<sup>112</sup> GÁL 2016: 126.

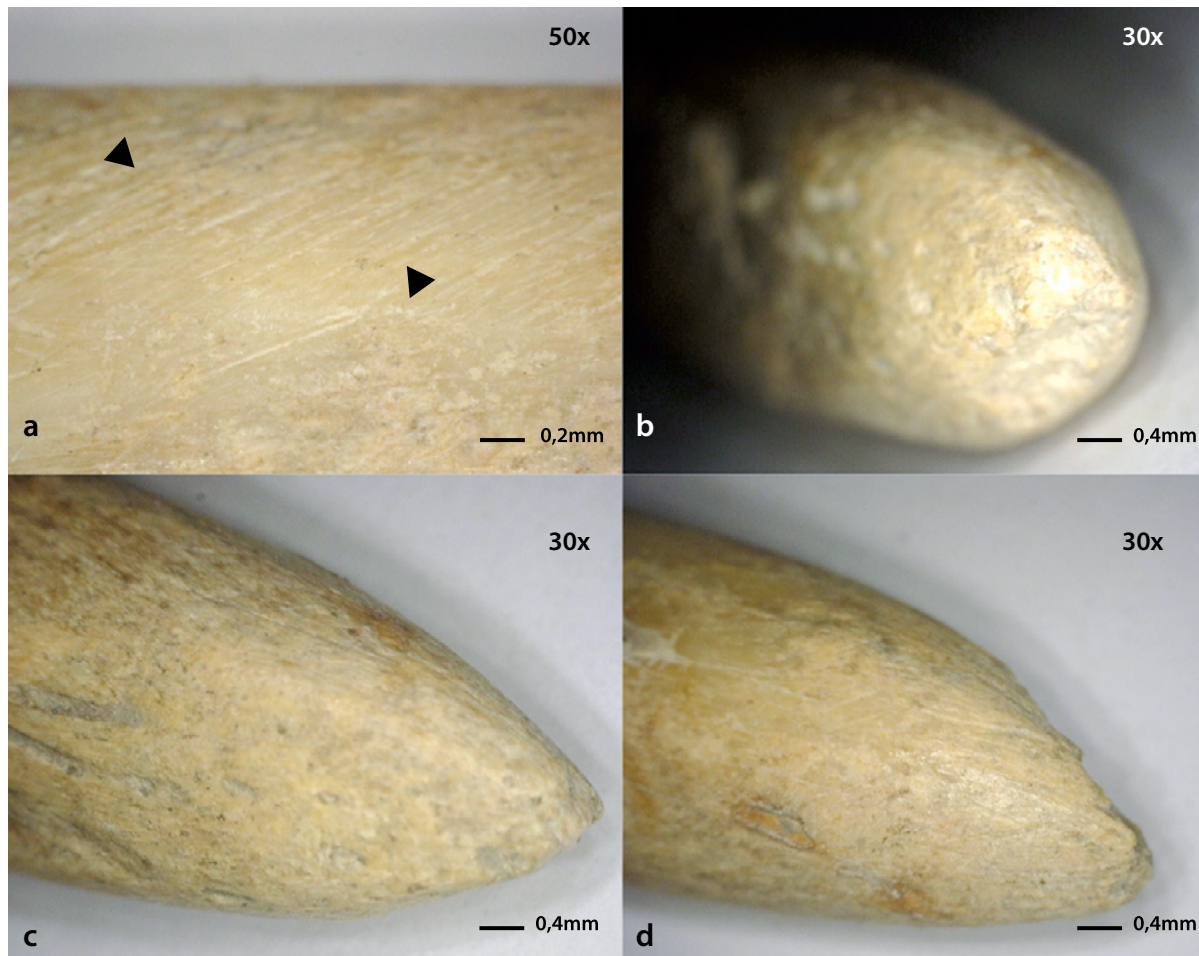
<sup>113</sup> PUC 2020: 316–317.

<sup>114</sup> PUC 2020: 316–317.

<sup>115</sup> BRADFIELD, LOMBARD 2011.

<sup>116</sup> *Ibid.*: 68.

<sup>117</sup> *Ibid.*: 73.



SLIKA 8. Mikrotopografija (povećanje 50 puta) mezijalnog dijela projektila (PN 173), snimka (povećanje 30 puta) baze i vrha (izradila: A. Barbir)

FIGURE 8 Microtopography ( $\times 50$ ) of the mesial part of the projectile (SF 173), image ( $\times 30$ ) of the base and tip (made by A. Barbir)

strijele.<sup>118</sup> Na temelju jednog primjerka projektila u Stobreču nije moguće sa sigurnošću pretpostavljati njegovu primarnu svrhu. Preliminarni pregled životinjskih ostataka potvrdio je prisutnost divljih životinja u skupu nalaza iz brončanodobnih slojeva, što sugerira lov kao jednu od aktivnosti kojom se bavila onodobna zajednica. S druge strane, projektili mogu ukazivati i na moguće lokalne sukobe.

Na analiziranim primjercima nisu zabilježeni jasni tragovi popravaka. Prema Choyke, tri su ključna preduvjeta za reparaciju oruđa: 1) otežana dostupnost sirovine, 2) visok utrošak rada pri izradi te 3) preferencija pre-

<sup>118</sup> *Ibid.*: 72, sl. 4g.

as a hafted arrowhead.<sup>118</sup> On the basis of a single projectile specimen from Stobreč, it is not possible to determine its primary function with certainty. A preliminary examination of the animal remains confirmed the presence of wild species in the assemblage from the Bronze Age layers, suggesting hunting as one of the activities practised by the community of that period. On the other hand, the presence of projectiles may also indicate possible local conflicts.

No clear traces of repair were observed on the analysed specimens. According to Choyke, there are three key preconditions for tool repair: (1) limited availability of raw materi-

<sup>118</sup> *Ibid.*: 72, Fig. 4g.

ma određenom oruđu.<sup>119</sup> S obzirom na sirovinu od koje je izrađen predmet i kontekst nalaza, prvi preduvjet nije zadovoljen. Drugi preduvjet, povezan s utroškom rada za izradu oruđa, zasad je teško precizno utvrditi u kontekstu prapovijesnog Stobreča. Unatoč oportunističkoj izradi, neka su oruđa mogla postati preferirana zbog svoje učinkovitosti.

Analizirane koštane izrađevine svjedoče o dinamičnim svakodnevnim aktivnostima koje su uključivale obradu kože te životinjskih i biljnih vlakana. Također, govore u prilog brončanodobnoj zajednici koja je, promišljenim odabirom vrste i razine tehnološke obrade, strateški iskoristavala dostupne resurse. Uz to, prvi su indirektni materijalni indikator tekstilne proizvodnje (izrade materijala i odjeće) brončanodobnog naselja u Stobreču, među rijetkima poznatim odnosno publiciranim nalazima tog tipa u srednjoj Dalmaciji. Proizvodnja tekstila u brončanom dobu Jadrana slabo je istražena i najčešće se povezuje s keramičkim utezima i pršljenima te, primarno, s preradom vune.<sup>120</sup> U brončanom je dobu vuna bila široko rasprostranjena u velikom dijelu Europe, a važnost tekstila koji se od nje dobivao protezala se kroz sve sfere tadašnjeg društva.<sup>121</sup> Tek će buduće arheozoološke analize izučavati važnost ovce u stobrečkom brončanodobnom društvu i time pomoći u rasklapanju pitanja vunjenih tekstila u stobrečkim prapovijesnim zajednicama. Arheobotanički pokazatelji za izradu tekstila nisu brojni,<sup>122</sup> no podaci s lokaliteta Okruglo<sup>123</sup> u dolini rijeke Cetine otkrivaju nekoliko biljnih taksona koji su pogodni za takvu namjenu. Primjerice, kopriva (*Urtica dioica*) mogla se upotrebljava-

al, (2) high labour investment during manufacture, and (3) a preference for a particular tool.<sup>119</sup> Given the type of raw material and the find context, the first precondition was not met. The second precondition, related to the amount of labour invested in tool production, is difficult to determine precisely in the context of prehistoric Stobreč. Despite their opportunistic manufacture, some tools may nevertheless have become preferred due to their effectiveness.

The analysed bone artefacts bear witness to dynamic everyday activities that involved the working of hides as well as animal and plant fibres. They also attest to a Bronze Age community that, through a deliberate selection of species and a considered level of technological treatment, strategically exploited the available resources. Moreover, they represent the first indirect material indicator of textile production (the making of fabrics and clothing) within the Bronze Age settlement of Stobreč – among the few known and published finds of this kind in central Dalmatia. Textile production in the Bronze Age Adriatic region remains poorly researched and is most commonly associated with ceramic loom weights and spindle whorls, and primarily with wool working.<sup>120</sup> During the Bronze Age, wool was widespread across much of Europe, and the significance of the textiles produced from it extended into all spheres of contemporary society.<sup>121</sup> Future archaeozoological analyses will examine the role of sheep within the Bronze Age community of Stobreč and thereby contribute to clarifying questions regarding woollen textile production in the prehistoric societies of Stobreč. Archaeobotanical indicators of textile production are scarce;<sup>122</sup> however, data from the site of Okruglo<sup>123</sup>

<sup>119</sup> CHOYKE 1997: 68

<sup>120</sup> BATOVIĆ 1983: 349.

<sup>121</sup> KRISTIANSEN, STIG SORENSEN 2020: 329.

<sup>122</sup> Dostupni su podaci iz Grapčeve špilje (BOROJEVIĆ *et al.* 2008) i Čauševica (HUNTLEY 1996), no nisu evidentirani taksoni koji su pogodni za izradu tekstila. Za pregled arheobotaničkih studija u brončanom dobu Hrvatske vidjeti REED 2016; REED *et al.* 2022.

<sup>123</sup> SMITH *et al.* 2006.

<sup>119</sup> CHOYKE 1997: 68.

<sup>120</sup> BATOVIĆ 1983: 349.

<sup>121</sup> KRISTIANSEN, STIG SORENSEN 2020: 329.

<sup>122</sup> Data are available from Grapčeva Špilja (BOROJEVIĆ *et al.* 2008) and Čauševica (HUNTLEY 1996), but no taxa suitable for textile production have been recorded. For an overview of archaeobotanical studies from the Bronze Age in Croatia, see REED 2016; REED *et al.* 2022.

<sup>123</sup> SMITH *et al.* 2006.

ti za izradu finih tekstila, dok su taksoni šaš (*Carex* spp.) i krović (*Bolboschoenus* spp.) ili oblič (*Schoenoplectus* spp.) bili prikladni za proizvodnju grubljih tkanina, poput prostirki, košara ili užadi.<sup>124</sup>

Kontekstualna interpretacija promatranih koštanih izrađevina smješta ih u srednje/kasnobrončanodobno naselje na području današnjeg Stobreča. Najveća koncentracija izrađevina zabilježena je u depozitima, dok je njihova učestalost u ostalim kontekstima, poput jama, urušenih struktura i peći, smanjena. Ovakva disperzija unutar naselja upućuje na široku integriranost koštanog oruđa u svakodnevni život prapovijesne zajednice. Iako zasad nemamo potvrđene primjerke iz željeznog doba, što može biti rezultat niza faktora, pretpostavlja se da su se slični alati upotrebljavali i u tom razdoblju. Naime, njihova morfologija, koja je uvelike definirana funkcionalnošću, nije se znatno mijenjala kroz duže vrijeme.

Studija je primjer jasne potrebe za daljnjim detaljnim analizama koštanih izrađevina, uključujući eksperimentalnu arheologiju i širu komparativnu analizu s regionalnim nalazima, kako bi se preciznije definirale funkcije oruđa i u potpunosti rekonstruirali povezni aspekti ekonomskih i društvenih praksi brončanodobnih zajednica.

## ZAKLJUČAK

Ovom studijom pružena je prva detaljna analiza i interpretacija zašiljenoga koštanog oruđa iz srednje/kasnobrončanodobnih horizonta prapovijesnog naselja u Stobreču, čime je pružena dopuna skromne postojeće građe o prapovijesnim koštanim izrađevinama na području srednje Dalmacije i istočnojadranskog priobalja. Kroz preciznu analizu sirovine, tehnologije obrade, tipologije i funkcije 11 odabranih artefakata ostvaren

<sup>124</sup> SMITH *et al.* 2008: 182–183.

in the Cetina River valley reveal several plant taxa suitable for such use. For example, nettle (*Urtica dioica*) could have been used for the production of fine textiles, whereas sedges (*Carex* spp.), club-rush (*Bolboschoenus* spp.) and bulrush (*Schoenoplectus* spp.) were suitable for the manufacture of coarser materials such as mats, baskets or ropes.<sup>124</sup>

The contextual interpretation of the analysed bone artefacts places them within a Middle to Late Bronze Age settlement in the area of present-day Stobreč. The highest concentration of artefacts was recorded in depositional contexts, while their frequency in other contexts – such as pits, collapsed structures and hearths – was lower. This spatial distribution within the settlement suggests that bone tools were widely integrated into the everyday life of the prehistoric community. Although no confirmed specimens from the Iron Age have been recorded so far – which may be due to a variety of factors – it is assumed that similar tools were also used during that period. Indeed, their morphology, largely determined by functionality, did not undergo significant changes over time.

This study clearly demonstrates the need for further, more detailed analyses of bone artefacts – including experimental archaeology and broader comparative studies with regional finds – in order to define tool functions more precisely and fully reconstruct the interconnected aspects of the economic and social practices of Bronze Age communities.

## CONCLUSION

This study provides the first detailed analysis and interpretation of pointed bone tools from the Middle to Late Bronze Age horizons of the prehistoric settlement in Stobreč, thereby contributing to the modest existing corpus of prehistoric bone artefacts from central Dalmatia and the eastern Adriatic coast. Through a

<sup>124</sup> SMITH *et al.* 2008: 182–183.

je dublji uvid u materijalnu kulturu i aspekte svakodnevnog života ove brončanodobne zajednice.

Analiza sirovine potvrdila je prevladavajuću upotrebu kostiju domaćih životinja, prvenstveno goveda (*Bos taurus*) i malih preživača (*Caprinae*), što je u skladu s arheozoološkim podacima s drugih brončanodobnih lokaliteta u Dalmaciji, Istri i šire. Ova dominacija domaćih vrsta sugerira da je primarni izvor sirovine bio lokalni otpad od prerade hrane unutar naselja, što ukazuje na racionalno i oportunističko korištenje resursima. Važan je, međutim, i nalaz jednog primjerka izrađenog od kosti iz porodice jelena (*Cervidae*), što indicira prisutnost i lovne komponente u ekonomiji stobrečke zajednice. Prevladavajuća upotreba kostiju odraslih jedinki sugerira promišljeniji odabir kvalitetnije sirovine za izradu oruđa, za razliku od nekritičke upotrebe prehrambenog otpada, koji bi češće uključivao i mlađe jedinke.

Tehnološka analiza otkrila je metode obrade kosti podijeljene u dvije glavne faze: primarnu pripremu (lomljenje i rezanje) i završnu obradu (glačanje, poliranje, bušenje). Posebno je naglašena važnost morfoloških karakteristika kostiju, poput prirodnih žljebova metapodijalnih kostiju, koji su omogućavali kontrolirano lomljenje i efikasno oblikovanje zašiljenih oruđa.

Tipološka klasifikacija identificirala je četiri glavne kategorije: šila (najbrojnija kategorija sa sedam primjeraka), probojke (dva primjerka), igle (jedan primjerak) i projektile (jedan primjerak). Svaka od ovih kategorija pokazuje specifične morfološke i tehnološke karakteristike. Šila, svestrani alati, često izrađeni od metapodijalnih kostiju, korištena su za širok spektar aktivnosti, od obrade kože do izrade tekstila. Probojci, masivnije građe, bili su namijenjeni za probijanje tvrdih materijala, što je potvrđeno njihovom robusnom izradom. Prisutnost neperforirane igle (PN 153) ukazuje na aktivnosti povezane s

detailed analysis of the raw material, manufacturing technology, typology and function of 11 selected artefacts, a deeper insight has been gained into the material culture and aspects of everyday life of this Bronze Age community.

The raw material analysis confirmed the predominant use of bones from domestic animals, primarily cattle (*Bos taurus*) and small ruminants (*Caprinae*), which is consistent with archaeozoological data from other Bronze Age sites in Dalmatia, Istria and beyond. This dominance of domestic species suggests that the primary source of raw material was local food-processing waste within the settlement, indicating a rational and opportunistic use of available resources. Of particular significance, however, is the find of a single specimen made from a bone belonging to the deer family (*Cervidae*), indicating the presence of a hunting component within the economy of the Stobreč community. The predominant use of bones from adult specimens suggests the deliberate selection of higher-quality raw material for toolmaking, as opposed to the unselective use of food-processing waste, which would more often include younger animals.

The technological analysis revealed bone-working methods divided into two main stages: primary preparation (breaking and cutting) and finishing (grinding, polishing, drilling). Special emphasis was placed on the importance of the morphological features of bones, such as the natural grooves of metapodial bones, which allowed for controlled fracturing and efficient shaping of pointed tools.

The typological classification identified four main categories: awls (the most numerous, with seven specimens), borers (two specimens), needles (one specimen) and projectiles (one specimen). Each of these categories exhibits distinct morphological and technological characteristics. Awls, versatile tools often made from metapodial bones, were used for a wide range of activities, from hide working to textile production. Borers, of more robust construction, were designed for piercing

tekstilnom proizvodnjom, vjerojatno tkanje i pletenje, odnosno izradu materijala i odjeće. Konačno, nalaz vretenastog projektila (PN 173) sugerira upotrebu kosti u oružju za lov ili potencijalno ratovanje, iako je za precizniju interpretaciju potrebno više komparativnih podataka.

Funkcionalna interpretacija detaljne analize makroskopskih i mikroskopskih tragova upotrebe, uključujući mikrotopografiju, mikroreljef i strije, utvrdila je prisutnost karakterističnih strija na probojcima i šilima koji ukazuju na obradu kože, dok su na nekim primjercima zabilježeni tragovi koji upućuju na rad s biljnim vlaknima. Sjajna i uglačana površina igle PN 153 dosljedna je kontaktu s organskim materijalima i primjeni u tkanju ili pletenju. Ipak, ograničen broj uzoraka i nedostatak eksperimentalnih studija specifičnih za predmetni geografski kontekst onemogućuju preciznije definicije funkcija za sve predmete.

Integracija arheozooloških podataka, analize tragova upotrebe te eksperimentalne arheologije omogućuje sveobuhvatnije razumijevanje tehnologije, specijalizacije i ekonomije prapovijesnih zajednica pa studija koštanih artefakata iz Stobreča ilustrira da je sinteza različitih metoda ključna za što precizniju rekonstrukciju ljudskih aktivnosti i interakcija s okolinom.

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harder materials, as confirmed by their sturdy manufacture. The presence of a non-perforated needle (SF 153) indicates activities related to textile production, most likely weaving and knitting, that is, the making of fabrics and garments. Finally, the discovery of the spindle-shaped projectile (SF 173) suggests the use of bone as weapon material for hunting or possibly warfare, although a more precise interpretation requires additional comparative data.

The functional interpretation based on a detailed analysis of macroscopic and microscopic use-wear traces – including microtopography, microrelief and striations – identified characteristic striations on the borers and awls indicating hide working, while some specimens displayed traces consistent with working plant fibres. The glossy, polished surface of needle SF 153 is consistent with contact with organic materials and its use in weaving or knitting. However, the limited number of samples and the lack of experimental studies specific to the geographical context of the site prevent more precise functional definitions for all artefacts.

The integration of archaeozoological data, use-wear analysis and experimental archaeology provides a more comprehensive understanding of the technology, specialisation and economy of prehistoric communities. Thus, the study of bone artefacts from Stobreč demonstrates that the synthesis of different methodological approaches is essential for achieving a more accurate reconstruction of human activities and interactions with the environment.

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