AN INSIGHT INTO ANIMAL EXPLOITATION DURING THE MIDDLE BRONZE AGE IN THE TERRITORY OF VATIN CULTURE: FAUNAL REMAINS FROM JARUGA – IZBIŠTE SITE (SERBIA)

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Abstract: *Although today there are a lot of various publications about the Vatin culture, its periodisation, characteristics, and material culture, the data on the exploitation of animals based on the analysis of faunal material is very modest. Therefore, this paper provides a valuable insight into animal exploitation during the Middle Bronze Age, based on results of archaeozoological analysis of one small assemblage from the Jaruga – Izbište site, related to the Vatin Culture. Relative distribution of species and skeletal elements, butchering marks, and bone fragmentation, suggest that animal remains from this sample mostly represent food leftovers. Faunal assemblage predominately consisted of mammal remains, while molluscs were present as well. Animal husbandry had a significant role, according to the high representation of domestic mammals (cattle, caprines, pig, horse, and dog), while hunting had a secondary role (rare remains of wild boar were the only specimens among wild mammals). The presence of freshwater shells from the Unio genus suggests exploitation of aquatic resources as well.*

Keywords: *faunal remains, Middle Bronze Age, Vatin Culture, Southern Banat, Izbište*

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UVID U EKSPLOATACIJU ŽIVOTINJA TOKOM SREDNJEG BRONZANOG DOBA NA PROSTORU VATINSKE KULTURE: OSTACI ŽIVOTINJA SA LOKALITETA JARUGA – IZBIŠTE (SRBIJA)

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Apstrakt: *Iako danas postoji puno različitih publikacija o Vatinskoj kulturi, njenoj periodizaciji, karakteristikama i materijalnoj kulturi, podaci o eksploatacji životinja, bazirani na rezultatima analize faunalnog materijala, su skromni. Stoga, ovaj rad pruža uvid u eksploataciju životinja tokom srednjeg bronzanog doba, na osnovu rezultata arheozoološke analize malog faunalnog skupa sa lokaliteta Jaruga – Izbište, koji pripada vatinskoj kulturi. Zastupljenost vrsta i skeletnih elemenata, tragovi kasapljenja i fragmentacija kostiju, ukazuju na to da većina životinjskih ostataka iz ovog uzorka predstavlja ostatke hrane. Ostaci sisara čine veći deo faunalnog skupa, dok su ostaci mekušaca takođe prisutni. Stočarstvo je bilo veoma značajno sudeći po velikoj zastupljenosti domaćih vrsta sisara (goveče, ovikaprini, svinja, konj i pas), dok je lov imao sekundarnu ulogu (retki ostaci divlje svinje jedini su primerci divljih vrsta sisara). Prisustvo slatkovodnih školjki roda Unio ukazuje na eksploataciju akvatičkih resursa, takođe.*

Ključne reči: *ostaci životinja, srednje bronzano doba, Vatinska kultura, južni Banat, Izbište*

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INTRODUCTION

The Vatin Culture, identified at the beginning of the 20th century by F. Milleker (Milleker 1905), is one of the most important phenomena of the Middle Bronze Age in Southeastern Europe. The territory of Vatin Culture included the southern part of the Pannonian Plain, the area south of the Danube River, and the area alongside the Sava River. Calibrated radiocarbon dates place the Vatin Culture roughly in the first half of the 2nd millennium BC (Gogâltan 2004: 133–134; Ljuština 2012, 2019)[1]. Even though the degree of the archaeozoological research of Vatin Culture settlements is extremely low, it might be assumed that animals had a significant role for their inhabitants, according to the archaeological finds such as spindle whorls, bone tools, as well as animal figurines (Ljuština 2012). Although the analyses of the faunal remains are important for understanding the strategies of animal exploitation, bioarchaeological material is often neglected. The need for this type of research is necessary, for the purpose of a wider consideration of economic strategies of the settlements in the past.

Today there are information about faunal assemblages only for five archaeological sites related to the Vatin Culture. These are Feudvar (Becker 1991; Blažić 1991, 2005), Vinča – Belo Brdo (Arnold and Greenfield 2006a, 2006b; Greenfield 2014), and Ljuljaci (Arnold and Greenfield 2006a, 2006b; Greenfield 1986a, 1986c) located in Serbia, and Gornea – Păzărişte and Foeni – Gomila Lupului (El Susi 1996) located in Romania. Therefore, this research is very important, since the archaeofaunal data are not numerous.

However, this work aims to reconstruct the possible dietary habits and exploitation of different animal species (primarily the most economically important domestic species such as cattle, caprines, and pigs) during the Middle Bronze Age, based on one faunal sample unearthed 2017 during the rescue excavations of the archaeological site Jaruga in the Izbište village (Municipality of Vršac, Southern Banat) (Map 1). The site is located about 16.5 km southwestern of the city of Vršac, and 3.5 km southwestern of Izbište village. It is positioned in the area of the South Banat Loess plateau, on the right bank of the small watercourse Jaruga. The Jaruga – Izbište site was discovered in 2012, during

1 With other references given in these publications.

Map 1. Geographical position of Jaruga

the ground survey conducted by the Institute for the protection of cultural monuments Pančevo, related to the construction of the *Košava* wind farm. Archaeological excavations during 2017 at the position of transmission line tower no. 16, reviled the remains of six features, which most likely represent the periphery of the Middle Bronze Age settlement. This settlement remains are dated back to this period based on pottery finds typical for the Vatin Culture, more precisely for the Pančevo-Omoljica variant of this culture (Живковић et al. 2019, 86). In this part of the Southern Banat and in the vicinity of Jaruga – Izbište site, other Vatin Culture settlements are located. These are, among other, Židovar in Orešac, At and Crvenka sites in Vršac, as well as the eponymous site Bela bara in Vatin (Ljuština 2012).

MATERIALS

During the 2017 excavation campaign, 300 animal remains were collected by hand. Mammal remains constitute the majority of faunal assemblage (NISP = 296), while mollusc remains (NISP = 4) were also present (Table 2).

Animal remains were most numerous in unit 1 which contained about 46% of the faunal sample. The remaining part of the faunal assemblage was collected in units 2–4 (Table 1). Out of a total number of specimens (300), only 22 were found in clearly defined archaeological features, while 278 came from the cultural layer (Table 1). Since the archaeological excavations could not be extended beyond the endangered area, mentioned features were partly discovered. Therefore, their purpose has not been fully defined. It is assumed that feature 1 represents a ditch, features 2, 4, and 5 pits, while the purpose of feature 3 is unknown. The most numerous animal remains were found in feature 5 (Table 1).

Table 1. Distribution of faunal material by units and structures

Unit	NISP	Feature	NISP
1	137	1	1
		3	5
2	85	4	4
3	19	2	1
4	59	5	11
TOTAL	**300**	**TOTAL**	**22**

METHODS

The species identification and anatomical determination of the animal remains were carried out consulting relevant literature (Boessneck 1969; Boyd et al. 1994; Budras et al. 2009; Frandson et al. 2009; Habermehl 1975; Halstead et al. 2002; Hillson 2005; Johnstone 2004; Meadow and Uerpmann 1991; Payne 1985; Peters 1998; Prummel and Frisch 1986; Prummel 1988; Schmid 1972; Zeder and Lapham 2010; Zeder and Pilaar 2010), and based on comparisons with specimens from the Archaeozoological Reference Collection of the Laboratory for Bioarchaeology, Faculty of Philosophy, University of Belgrade.

Quantification is given by the Number of Identified Specimens (NISP), Number of Diagnostic Zones (DZ), and Minimal Number of Individuals (MNI). The NISP includes all specimens attributed to a particular taxon. The DZ was counted if there was preserved more than half the alveoli for the 4th premolar in the upper and lower jaw, more than a half of the atlas, axis, articular end of the scapula, acetabulum, calcaneus, astragalus, proximal and distal epiphysis/metaphysis of long bones and the 3rd and 4th metacarpal/metatarsal bone as well. This parameter defined by Watson (Watson 1979) was modified and adjusted to the analysed faunal assemblage. The MNI was defined by Shotwell (Shotwell 1955), and it was counted based on the most frequent element of a particular taxon, combined with age and sex differences within the most frequent element. The determination of the age of death was based on the time of eruption and attrition of teeth (Bull and Payne 1982; Deniz and Payne 1982; Grant 1982; Habermehl 1975; Habermehl 1985; Silver 1969), and the epiphyseal fusion (Habermehl 1975; Silver 1969).

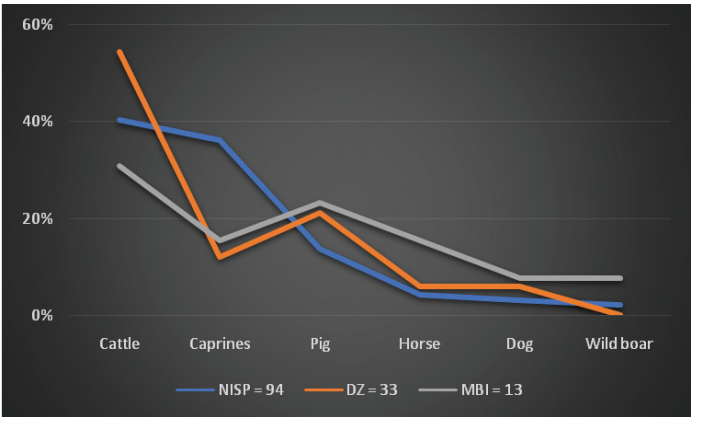
The presence of pathological changes and their position on the bones was noted and they were described in detail (Bartosiewicz 2013). Traces of taphonomic processes including weathering, gnawing, burning, and traces of anthropogenic activities were recorded. Measurements were taken following the standards from von den Driesch (Driesch 1976) (Appendix 1). Withers height for cattle was calculated using the factors given by Matolcsi (Matolcsi 1970).

FAUNAL COMPOSITION AND TAPHONOMY

Out of 300 specimens, 98 were determined to the species/genus level (about 33%). Skeletal remains of domestic mammals form the majority of these finds (Table 2, Graph 1). Among them, remains of cattle (*Bos taurus*), sheep (*Ovis aries*), goat (*Capra hircus*), pig (*Sus domesticus*), horse (*Equus caballus*) and dog (*Canis familiaris*) were present. Wild mammals were represented with wild boar (*Sus scrofa*), whereas, the freshwater shells from the *Unio* genus were the only species among the molluscs.

Table 2. Distribution of different animal taxa (expressed as NISP, DZ and MNI)

Taxon	NISP	NISP (%)	DZ	DZ (%)	MNI	MNI (%)
Cattle (*Bos taurus*)	38	40%	18	55%	4	31%
Sheep (*Ovis aries*)	4	4%	2	6%	2	15%
Caprines (*Ovis*/*Capra*)	30	32%	2	6%	/	/
Domestic pig (*Sus domesticus*)	13	14%	7	21%	3	23%
Horse (*Equus caballus*)	4	4%	2	6%	2	15%
Dog (*Canis familiaris*)	3	3%	2	6%	1	8%
Wild boar (*Sus scrofa*)	2	2%	0	0%	1	8%
Mammals identified to the genus/species level, total:	**94**	**100%**	**33**	**100%**	**13**	**100%**
Large-sized mammals	108					
Medium-sized mammals	90					
Micromammals	4					
Mammals, total:	**296**					
Freshwater shell (*Unio* sp.)	4					
Molluscs, total:	**4**					
Total:	**300**					



Graph 1. Relative distribution of mammal remains (expressed as NISP, DZ and MNI)

Due to the great similarity in the morphology of sheep and goat skeletal elements, it was difficult to attribute some of them with certain. These specimens were classified as caprines (*Ovis*/*Capra*). Likewise, some of the specimens were identified to the class level and they were placed into the large-sized and medium-sized mammal categories. These were mostly ribs, vertebral bones, and small fragments of long bones, which probably belonged to cattle, caprines, or pig, but could not be attributed to them certainly. Furthermore, all of the micromammal remains were identified to the class level.

This faunal sample was characterized by a high degree of bone fragmentation. Therefore, complete and almost complete bones represent 18% of the assemblage. The fragmentation was the consequence of human activities such as animal butchery and breaking the bones to obtain bone marrow. The most numerous whole bones were those not rich in meat and not suitable for processing, such are teeth, tarsal bones, and phalanges.

Traces of weathering in form of foliation or slight cracking of the bone (Figure 1) were present on 32% of the specimens, suggesting that the bones were not quickly deposed in sediment. Bones with traces of gnawing by dogs (Figure 1) were present on 10% of specimens.

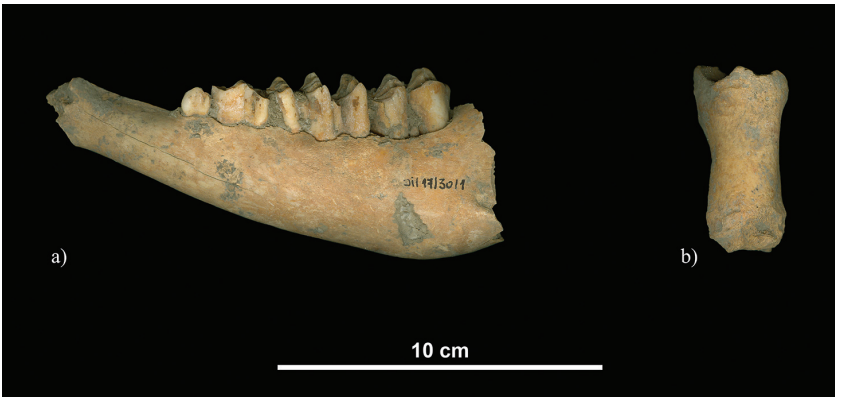


Figure 1. Cattle mandible with traces of weathering (a) and cattle first phalanx with traces of gnawing (b)

DOMESTIC MAMMALS

In Jaruga – Izbište faunal assemblage, the remains of domestic mammals were predominant (98%) (Table 2, Graph 1). According to all parameters specimens that belong to the economically most important species – cattle, caprines, and pig were the most numerous. A small number of wild mammals indicate that hunting did not play a significant role in the economy of this settlement.

The representation of different skeletal elements of cattle, caprines, and pigs is shown in Table 3. Significantly higher representation of skeletal elements from anatomical regions carrying little amount of meat such as head and lower leg parts are characteristic for all of these taxa. Skeletal elements from these anatomical regions are represented with about 81% of the remains of domestic cattle, 97% of caprines, and 77% of the remains of pigs. Among cattle remains, the most numerous were isolated teeth, mandibles, radii, and phalanges. In the group of skeletal elements that carry a high amount of meat, scapula, humerus, pelvis, and femur were present. In the case of caprines remains, the most numerous were isolated teeth (59%), while among the elements which provide more meat, only the vertebrae are represented. The most numerous skeletal elements of pigs were scapula, mandible, and ulna. Aside from scapula, among skeletal elements which carry a high amount of meat, the humerus was also present.

Table 3. Distribution of different skeletal elements in cattle, caprines and pig (expressed as NISP)

Anatomical region	Skeletal elements	Cattle	Caprines	Pig
Head	Cranium	2		
	Mandibula	4	3	4
	Tooth	4	20	1
Ribs and vertebral bones	Cervical vertebrae		1	
Upper limb parts	Scapula	1		2
	Humerus	2		1
	Pelvis	2		
	Femur	1		
	Patella	1		
Lower limb parts	Ulna	1		2
	Radius	4	1	1
	Tibia	2	4	1
	Tarsal bones	7		
Metapodials and phalanges	Metapodial bones	3	5	1
	Phalanx	4		
	Total:	**38**	**34**	**13**

A lesser representation of the elements that carry high amounts of meat could have been the result of the high degree of fragmentation due to human activities such as animal butchery and breaking of the bones to extract the bone marrow, or it might indicate that they were discarded in other settlement areas. However, the lower percentage of these elements more likely could be a consequence of the small sample size.

The main problem in constructing age at death profiles of the most important domestic species was the small sample (Tables 4 and 5). Even though age data should be taken with caution since they are based on a very small sample,

certain trends in breeding and using different species of domestic mammals might have been observed.

Table 4. Mortality data of cattle, caprines and pig based on the time of eruption and attrition of the teeth (expressed as NISP; I: 3–18 months of age for caprines and pig, and 6–24 months of age for cattle; II: 18–30 months of age for caprines and pig, and 24–48 months of age for cattle; III: more than 30 months of age for caprines and pig, and more than 48 months of age for cattle)

Age group	II		III	
Taxon	NISP	NISP (%)	NISP	NISP (%)
Cattle	1	33%	2	67%
Caprines	1	50%	1	50%
Pig	1	25%	3	75%

Table 5 – Mortality data of cattle, caprines and pig based on the time of epiphyseal fusion (expressed as NISP; I: 12 months of age for caprines and pig, and 24 months of age for cattle; II: 36 months of age for caprines and pig, and 42 months of age for cattle; III: more than 36 months of age for caprines and pig, and more than 42 months of age for cattle)

Age group	Element part	Cattle				Caprines				Pig			
		UF	F	T	% F	UF	F	T	% F	UF	F	T	% F
I	Proximal radius		4	4									
	Distal scapula		1	1							1	1	
	Distal humerus		1	1									
	Pelvis-acetabulum		2	2									
	Proximal I phalanx	1	3	4									
Total I		1	11	12	92						1	1	100
II	Distal tibia		2	2			3	3					
	Distal metapodium		3	3			2	2					
Total II			5	5	100		5	5	100				
III	Proximal femur		1	1									
	Proximal ulna									1		1	
	Distal radius									1		1	
Total III			1	1	100					2		2	50
TOTAL		**1**	**17**	**18**			**5**	**5**		**2**	**1**	**3**	

In the case of cattle, age determination was based on three mandibles. The obtained data indicate that domestic cattle were slaughtered in the subadult age (between 18 and 36 months), as well as in adult age. The absence of young individuals might be a consequence of the small sample size. In caprines, determination of age was possible for two (Figure 2), and in domestic pigs for four mandibles. Like cattle, caprines were slaughtered in subadult and adult age, while in the case of pigs, a higher percentage of adult animals were noticed.

Although based on very small samples (Table 5), mortality data of cattle, caprines, and pigs based on the time of epiphyseal fusion, are mostly consistent with those based on time of eruption and attrition of teeth (Table 4). In the case

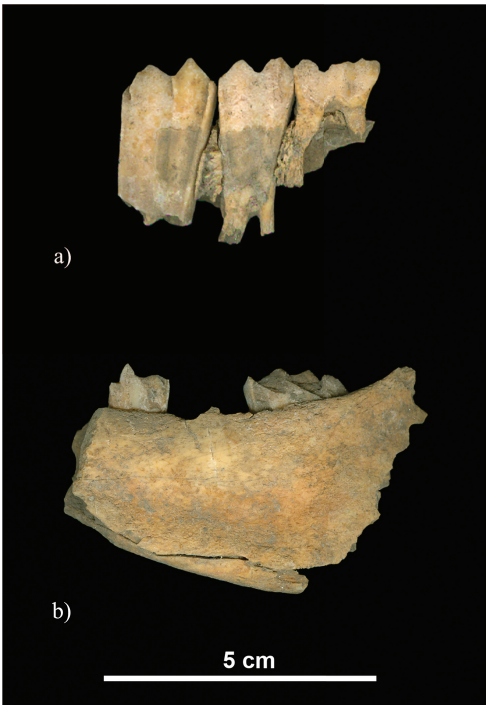


Figure 2. Subadult sheep mandible (a) and adult caprine mandible (b)

of cattle, the time of epiphyseal fusion indicates that the younger individuals were also slaughtered. Namely, one first phalanx with an unfused epiphysis originated from individual younger than 18 months. However, most of the cattle specimens had fused epiphyses and belonged to individuals older than three years of age. Since there was a small number of specimens with preserved epiphyseal ends, drawing detailed conclusions about the age of slaughtered animals in the case of caprines and pigs was difficult. All of the caprine specimens belonged to individuals older than 3 years of age, while remains of pig belonged to individuals old between one and three, as well as older than three years of age.

Butchering marks were rare (1% of NISP), but noticed on the bones of all economically most important species. They were inflicted by knives and cleavers on mandibles, scapulae, and ribs, during the disarticulation of the skeleton and meat removal.

Only one bone with pathological changes suggested that animal health was relatively good. Exostoses were noticed on the medial side of the distal part of the first phalanx of cattle. Since these changes were not caused by the fracture of the bone, bone tissue accumulation might be caused by using this animal for agricultural work, pulling, or carrying loads (Bartosiewicz 2013, 105–129).

Because of the high degree of fragmentation, withers height could be calculated based on only one cattle metatarsus. Using the factors given by Matolcsi, the withers height of this individual was 114.2 cm (Appendix 1) (Matolcsi 1970). This value correlates with withers heights for cattle from the Ljuljaci, Gornea – Păzărişte, and Foeni – Gomila Lupului sites (El Susi 1996: 61–64; Greenfield 1986a: 130). The small sample size prevented the drawing of any conclusions about the metric characteristics of animals.

Aside from economically most important domestic species, remains of horses and dogs were also present (Table 2, Graph 1). Horse is represented

with the two upper premolars or molars, radius, and tibia (Figure 3). Based on the time of the eruption and the attrition of teeth, as well as the time of epiphyseal fusion, it might be suggested that two individuals older than a year, one older than 3 years and a half, and one younger than two years were present.

Among dog remains, cranium, mandibula, and humerus are represented. According to the time of eruption and attrition of teeth, and time of epiphyseal fusion, mandibula belonged to individual older than seven months (Figure 3), while humerus belonged to individual older than five/eight months.

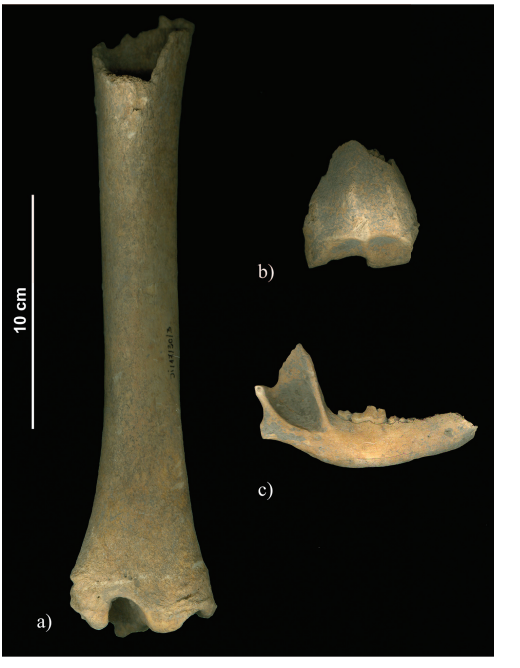


Figure 3. Horse tibia (a), horse radius (b), and dog mandible (c)

WILD MAMMALS AND MOLLUSCS

Among the faunal material from Jaruga – Izbište site, wild mammal remains were rare. They were represented with two specimens related to wild boar (Table 2, Graph 1). These are the first or the second upper molar and mandibula. According to the data about the time of eruption and attrition of teeth, mandibula belonged to individual old between one and two years of age at the moment of death.

Aside from the mammals, remains of molluscs were also unearthed. These were four specimens that belonged to the freshwater shells from the *Unio* genus (Table 2, Figure 4).

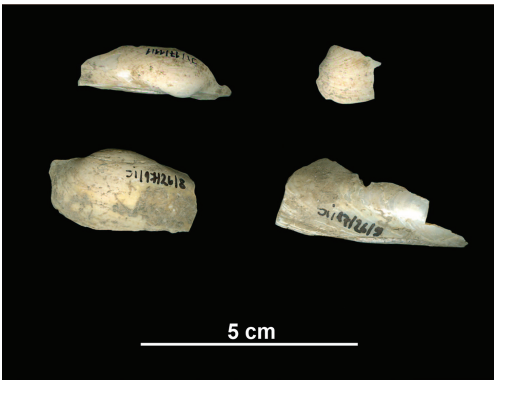


Figure 4. Freshwater shells (*Unio* sp.)

CONCLUSION

Previous knowledge about the economy of Bronze Age communities in the territory of present-day Serbia is based on archaeozoological research of several sites located in different regions. In the territory of Northern Serbia these are Feudvar (Becker 1991; Blažić 1991, 2005), Gradište – Iđoš (Molloy et al. 2020), Mokrin (Blagojević 2020; Bökönyi 1972; Стефановић и Димитријевић 2007), Mitrovačke Livade – Sremska Mitrovica, Livade – Sremska Mitrovica, and Erem – Sremska Mitrovica (Blažić 1995). In the area south of the Sava and the Danube rivers the number of sites is more numerous: Bubanj (Bökönyi 1991; Bulatović 2020), Vinča – Belo Brdo (Arnold and Greenfield 2006a, 2006b; Greenfield 2014), Crkvine, Petnica and Livade (Arnold and Greenfield 2006a, 2006b; Greenfield 1986a), Novačka Ćuprija (Arnold and Greenfield 2006a, 2006b; Greenfield 1986a, 1986b), Ljuljaci (Arnold and Greenfield 2006a, 2006b; Greenfield 1986a, 1986c), Vrbica, Sarina Međa and Vecina Mala (Greenfield 1986a; 1996), Rit and Nad Klepečkom (Vuković and Marković 2019).

Among these sites, only four could be attributed to the Middle Bronze Age (Feudvar, Erem – Sremska Mitrovica, Vinča – Belo Brdo, and Ljuljaci), while three of them – Feudvar, Vinča – Belo Brdo, and Ljuljaci could be related to the Vatin Culture (Arnold and Greenfield 2006a, 2006b; Becker 1991; Blažić 1991, 1995, 2005; Greenfield 2014, 1986a, 1986c). In Romania, archaeozoological analyses were carried out only for Gornea – Păzărişte and Foeni – Gomila Lupului sites, attributed to the Vatin Culture (El Susi 1996).

Throughout the Middle Bronze Age, the economy of the settlement at the Jaruga – Izbište site was almost exclusively based on animal husbandry, while hunting had a secondary role. During this period, cattle, caprines, and pigs were mostly bred. Even though the data on the age of the most economically important domestic animals are based on very small samples (Tables 4–5), it can be assumed that domestic pigs were bred for meat, while other species were bred for milk (cattle and caprines), strength (cattle) and wool (sheep) as well. The presence of the spindle whorl further testifies to the usage of sheep wool for clothing. Although present, horses and dogs had very little importance in the economy, and their meat was not used in the diet of the inhabitants of this Vatin Culture settlement. Aside secondary products and meat, local population exploited bone as a raw material which is confirmed by the findings of awls. Once again, it is important to highlight that faunal sample form Jaruga – Izbište site is small, therefore these results could be biased by sample size.

In the above-mentioned Bronze Age faunal assemblages, the most important domestic animals were those usually used in the diet (cattle, caprines, pigs), while their proportions vary depending on the site. The distribution of wild animals is not negligible, especially in the case of red deer (Arnold and Greenfield 2006a,

2006b; Becker 1991; Blagojević 2020; Blažić 1991, 2005; Блажић 1995; Bökönyi 1972, 1991; Bulatović 2020; El Susi 1996; Greenfield 1986a, 1986b, 1986c, 1996, 2014; Molloy et al. 2020; Стефановић и Димитријевић 2007; Vuković and Marković 2019). The faunal collection from Jaruga – Izbište site is mostly consistent with these assemblages and differs only regarding the representation of wild animals, which might be a consequence of the small sample size.

Albeit small, the faunal collection from Jaruga – Izbište site is significant since it is the only known Vatin Culture faunal assemblage from the territory of Serbian Banat, and one of few from the whole area of this culture. Although they are based on a relatively small assemblage, the data obtained from the analysis of faunal material from the Jaruga – Izbište site are important because they provide valuable insight into economy strategies practiced during the Middle Bronze Age in the territory of the Vatin Culture.

BIBLIOGRAPHY

Arnold, E. and Greenfield, H. 2006a. *The Origins of Transhumant Pastoralism in Temperate Southeastern Europe: A Zooarchaeological Perspective from the Central Balkans*, BAR International Series 1538, Archaeopress: Oxford.

Arnold, E. and Greenfield, H. 2006b. The Origins of Transhumant Pastoralism in Temperate Southeastern Europe, In: C. Cluney (ed) *An Odyssey of Space: Proceedings of the 34th Chacmool Conference, Calgary, Alberta*, 243–251.

Bartosiewicz, L. 2013. *Lame Ducks, Shuffling Nags: The archaeology of animal disease*, Oxford/Oakville: Oxbow Books.

Becker, C. 1991. Haustierhaltung und Jagd in der fruehen Bronze-und Eisenzeit in der Vojvodina – Erste Resultate zu Tierknochenfunden aus Feudvar, *Bericht der Roemisch Germanischen Kommission Band* 72: 178–190.

Blagojević, T. 2020. Animals in the Early Bronze Age Funerary Practice at Mokrin and Ostojićevo Cemeteries, Serbia. In: N. Marković and J. Bulatović (eds) *Animal Husbandry and Hunting in Southeast Europe Through Time*. Oxford: Archaeopress, 80–92.

Blažić, S. 1991. Die Fiscfunde von Feudvar. *Bericht der Römisch – Germanischen Kommission* 72: 190–193.

Блажић, С. 1995. Остаци животињских врста са локалитета на траси ауто – пута кроз Срем, У: З. Вапа (ур.) *Археолошка истраживања дуж аутопута кроз Срем*, Покрајински завод за заштиту споменика културе: Нови Сад; 321–346.

Blažić, S. 2005. *Fauna arheoloških lokaliteta u Vojvodini* (katalog izložbe), Muzej Vojvodine: Novi Sad.

Boessneck, J. 1969. Osteological differences between Sheep (*Ovis aries* Linn.) and Goat (*Capra hircus* Linn.), In: D. Brothwell and E. Higgs (eds) *Science in Archaeology: a survey of progress and research*, London: Thames and Hudson, 331–358.

Boyd, J. S., Peterson, C. and May, A. H. 1994. *Colour Atlas of Clinical Anatomy of the Dog and Cat*, London: Mosby-Wolfe.

Bökönyi, S. 1991. Prehistoric animal remains from Bubanj–Hum at Niš, *Старинар* 40–41: 89–94.

Bököny, S. 1972. Životinjski ostaci iz grobova nekropole bronzanog doba u Mokrinu, U: S. Foltiny (ed.) *Mokrin II: Nekropola ranog bronzanog doba*, Dissertationes et monographie XII, Washington, Kikinda, Beograd: Smithsonian Institution, Narodni muzej i Arheološko društvo Jugoslavije, 91–96.

Budras, K. D. at al. 2009. *Anatomy of the horse*, Hannover: Schlütersche Verlagsgesellschaft.

Bulatović, J. 2020. Preliminary report on animal bones from Bubanj, In: A. Bulatović and D. Milanović (eds) *Bubanj, The Eneolithic and the Early Bronze Age Tell in Southeastern Serbia*, Vienna: Austrian Academy of Sciences, 329–338.

Bull, G. and Payne, S. 1982. Tooth eruption and Epiphysial Fusion in Pigs and Wild Boar. In: A. Wilson, C. Grigson, and S. Payne (eds) *Ageing and Sexing Animal Bones from Archaeological Sites*, Archaeopress, Oxford: 55–71.

Deniz, S. and Payne, S. 1982. Eruption and Wear in the Mandibular Dentition as a Guide to Ageing Turkish Angora Goats, *Ageing and Sexing Animal Bones from Archaeological Sites*, Archaeopress, Oxford: 155–205.

Driesch, A. 1976. *A guide to the measurement of animal bones from archaeological sites*, Cambridge Mass.: Peabody Museum at Harvard University.

El Susi, G. 1996. *V□nători, pescari şi crescători de animale în Banatul mileniilor VI î. Cr.-I d. Cr.*, Timişoara.

Frandson, R. et al. 2009. *Anatomy and Physiology of Farm Animals* (7th edition), Ames: Wiley-Blackwell.

Gogâltan, F. 2004. Bronzul mijlociu în Banat. Opinii priving grupul Corneşti-Crvenka. In: P. Rogozea and V. Cedica (eds) *Festschrift für Florin Medeleț zum 60. Geburstag*, Bibliotheca Historica et Archaeologica Banatica XXXII. Timisoara, 79–153.

Grant, A. 1982. The Use of Tooth Wear as a Guide to the Age of Domestic Ungulates. In: A. Wilson, A. Grant and S. Payne (eds) *Ageing and Sexing Animal Bones from Archaeological Sites*, Oxford: Archaeopress, 91–108.

Greenfield, H. 1986a. *The Paleoeconomy of the Central Balkans (Serbia): A Zooarchaeological Perspective on the Late Neolithic and Bronze Age (ca 4500–1000 B.C.)*, BAR International Series 304, Archaeopress: Oxford.

Greenfield, H. 1986b. Summary Reports on the Vertebrate Fauna from Novačka Ćuprija (Eneolithic – Late Bronze Age), *Зборник Народног Музеја* XII – 1: 63–74.

Greenfield, H. 1986c. Кичмењаци, у: М. Богдановић (ур.) Љуљаци – насеље протоватинске и ватинске културе, Крагујевац: Народни музеј, 75–78.

Greenfield, H. 1996. Sarina Međa, Vrbica and Vecina Mala: The Zooarchaeology of Three Late Bronze/ Early Iron Age Transition Localities near Jagodina, Serbia, *Старинар* XLV–XLVI: 133–141.

Greenfield, H. 2014. The origins of secondary product exploitation and the zooarchaeology of the Late Neolithic, Eneolithic, and Middle Bronze Age at Vinča-Belo Brdo, Serbia: the 1982 excavations, In: H. Greenfield (ed.) *Animal Secondary Products. Domestic Animal Exploitation in Prehistoric Europe, the Near East, and the Far East*, Oxford: Oxbow Books, pp. 274–334.

Habermehl, K. H. 1975. *Die Altersbestimmung bei Haus– und Labortieren*, Berlin/Hamburg: Paul Parey.

Habermehl, K. H. 1985. *Altersbestimmung bei Wild– und Pelztieren*, Berlin/Hamburg: Parey.

Halstead, P., Collins, P. and Isaakidou, V. 2002. Sorting the Sheep from the Goats: Morphological Distinctions between the Mandibles and Mandibular Teeth of Adult *Ovis* and *Capra*, *Journal of Archaeological Science* 29: 545–553.

Hilson, S. 1986. *Teeth*, Cambridge: University Press.

Johnstone, C. J. 2004. *A Biometric Study of Equids in the Roman World*, Thesis submitted for Ph.D., University of York, Department of Archaeology.

Ljuština, M. 2012. Stratigrafija naselja i periodizacija vatinske kulture u Vojvodini, Doktorska disertacija, Univerzitet u Beogradu, Odeljenje za arheologiju.

Ljuština, M. 2019. Rame uz rame, zajednice vatinske kulture u Banatu, U: V. Filipović, A. Bulatović i A. Kapuran (ur.) *Zbornik radova u čast 80 g. života Rastka Vasića*, Beograd: Arheološki institut, 125–135.

Matolcsi, J. 1970. Historische Erforschunge der Körpergrösse des Rindes auf Grund von ungarischen Knochenmaterial, *Zeitschr. f. Tieryuchtg. u Zuchgsbiol*. 87, 2: 89–137.

Meadow, R. H. and Uerpmann, H. P. 1991. *Equids in the ancient world*, Universität Tübingen, Institut für Urgeschichte.

Milleker, B. 1905. A Vattinai Östelep, *Történelmi és Régészeti Értesitő* XXI, Temesvár: 1–75.

Molloy, B., Jovanović, D., Bruyère, C., Marić, M., Bulatović, J., Mertl, P., Horn, C., Milašinović, L. and Mirković-Marić, N. 2020. A New Bronze Age Mega-fort in Southeastern Europe: Recent Archaeological Investigations at Gradište Iđoš and their Regional Significance, *Journal of Field Archaeology* 45 (1): 1–22.

Payne, S. 1985. Morphological distinctions between the mandibular teeth of young sheep, *Ovis*, and goats, Capra, *Journal of Archaeological Science* 12, 139–147.

Peters, J. 1998. *Römische Tierhaltung und Tierzucht: eine Synthese aus archäozoologischer Untersuchung und schriftlich-bildlicher Überlieferung.* Rahden/Westfalen: Leidorf.

Prummel, W. and Frisch H. 1986. A guide for the distinction of species, sex and body side in bones of sheep and goats, *Journal of Archaeological Science* 13, 567–577.

Prummel, W. 1988. Distinguishing features of postcranial skeletal elements of cattle, *Bos primigenius* f. *taurus*, and red deer, *Cervus elaphus*, In: *Schriften aus der Archaologisch – Zoologischen Arbeitsgruppe Schleswig-Kiel* 12, 1–52.

Schmid, E. 1972. *Atlas of Animal Bones: for prehistorians, archaeologists and quaternary geologists*, New York: Elsevier.

Shotwell, J. A. 1955. An approach to the paleoecology of mammals, *Ecology* 36 (2): 327–337.

Silver, I. A. 1969. The aging of domestic animals, In D. Brothwell and E. Higgs (eds) *Science in Archaeology: a survey of progress and research*, London: Thames and Hudson, 283–302.

Стефановић, С. и Димитријевић В. 2007. Гроб 196 на некрополи у Мокрину: покојница са приложеном главом свиње. *Гласник српског археолошког друштва* 23: 417–430.

Vuković, S. and Marković, D. 2019. Animal remains from the late prehistoric horizons from the sites of Nad Klepečkom and Rit, In A. Kapuran, A. Bulatović, S. Golubović and V. Filipović (eds) Viminacium in Prehistory, Belgrade: Institute of Archaeology, 224–249.

Watson, J. P. N. 1979. The Estimation of the Relative Frequencies of Mammalian Species: Khirokitia 1972. In: *Journal of Archaeological Science* 6: 127–137.

Zeder, M. and Lapham, H. 2010. Assessing the reliability of criteria used to identify postcranial bones in sheep, *Ovis*, and goats, *Capra*, In *Journal of Archaeological Science* 37, 2887–2905.

Zeder, M. and Pilaar, S. 2010. Assessing the reliability of criteria used to identify mandibles and mandibular teeth in sheep, *Ovis*, and goats, *Capra*, In: *Journal of Archaeological Science* 37: 225–242.

Живковић, М., Младеновић, Т. и Матић, Д. 2019. Прелиминарни резултати заштитних археолошких истраживања на локалитету Јаруга у атару села Избиште (положај стуба за далековод бр. 16). *Српско археолошко друштво, XLII Скупштина и годишњи скуп, Неготин 31. мај – 1. јун 2019. године: програм, извештаји и апстракти*: 86.

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UVID U EKSPLOATACIJU ŽIVOTINJA TOKOM SREDNJEG BRONZANOG DOBA NA PROSTORU VATINSKE KULTURE: OSTACI ŽIVOTINJA SA LOKALITETA JARUGA – IZBIŠTE (SRBIJA)

Rezime

Povodom izgradnje vetroparka *Košava*, Zavod za zaštitu spomenika kulture Pančevo izvršio je tokom 2017. i 2018. godine zaštitna arheološka istraživanja lokaliteta Jaruga u ataru sela Izbište (opština Vršac) u južnom Banatu. Na prostoru predviđenom za gradnju stuba za dalekovod br. 16 otkriven je deo naselja. Na osnovu pokretnog arheološkog materijala, naselje je datovano u srednje bronzano doba, odnosno, pripisano je Pančevačko-Omoljičkoj fazi Vatinske kulture.

Tokom pomenutih istraživanja, ručno je sakupljeno 300 ostataka životinja. Veći deo faunalne zbirke čine ostaci sisara, ali su zabeleženi i ostaci mekušaca (Tabela 2). Budući da je fragmentacija materijala bila izražena, do roda/vrste određeno je 90 primeraka. Najzastupljeniji su ostaci domaćih sisara, a među njima su prisutne sledeće vrste: goveče, ovca, koza, svinja, konj i pas. Divlje vrste sisara predstavljene su divljom svinjom, a među ostacima mekušaca sreću se slatkovodne školjke roda *Unio*.

Na osnovu rezultata dobijenih arheozoološkom analizom, može se pretpostaviti da je ekonomija naselja bila bazirana na stočarstvu (i to pre svega na uzgoju goveda, ovikaprina i svinja), dok je lov imao sekundarnu ulogu. Podaci o starosti ukazuju na to da je svinja gajena zbog eksploatacije mesa, dok su goveda i ovikaprini gajeni i zbog eksploatacije sekundarnih proizvoda (mleka, vune, fizičke snage) (Tabele 4 i 5). Iako prisutni, konji i psi nisu bili značajni u ekonomiji, a njihovo meso nije korišćeno u ishrani stanovnika ovog naselja.

I pored nedostataka (koji se, pre svega, ogledaju u veličini uzorka), faunalna zbirka sa lokaliteta Jaruga u Izbištu značajna je jer je jedina iz perioda srednjeg bronzanog doba u južnom delu srpskog Banata, ali i jedna od retkih zbirki Vatinske kulture na celom arealu njenog rasprostiranja. Iako su rezultati bazirani na relativno malom uzorku, značajni su jer pružaju uvid u ekonomske strategije praktikovane tokom srednjeg bronzanog doba na pomenutom prostoru.

APPENDIX 1

Bone measurements according to the standardized system of A. von den Driesch (in mm; measurements name abbreviations are given in Driesch (1976); LD4 – Length of the deciduous 4th premolar, BD4 – Breadth of the deciduous 4th premolar; LP1 – Length of the first premolar, BP1 – Breadth of the first premolar, LP4 – Length of the 4th premolar, BP4 – Breadth of the 4th premolar, LM1 – Length of the first molar, BM1 – Breadth of the first molar, LM2 – Length of the second molar, BM2 – Breadth of the second molar, LM3 – Length of the third molar, BM3 – Breadth of the third molar, LD – Length of the deciduous premolar row, LP1-P4 – Length of the premolar row P1-P4, LP2-P4 – Length of the premolar row P2-P4, LM – Length of the molar row, LP1-M3 – Length of the cheektooth row P1-M3, LP2-M3 – Length of the cheektooth row P2-P4; WH – withers height)

Bos taurus

Inv. No.	Element	LD4	BD4	LP4	BP4	LM1	BM1	LD
JI/17/30/1	Mandibula	33.6	12.9			27.5	12.1	62.3
JI/17/35/1	Mandibula			19.9	13.2	20.5	15.1	

Inv. No.	Element	LG	BG	BPC	GL	SD	Bp	Dp	Bd	Dd	LA	LAR	DC	WH
JI/17/5/3	Scapula	44.8	38.8											
JI/17/5/1	Humerus								77.1	62.3				
JI/17/28/5	Ulna			43.5										
JI/17/28/3	Radius						75.8	37						
JI/17/2/4	Pelvis										65.9	53.4		
JI/17/36/4	Femur												38.1	
JI/17/3/1	Tibia								50.7	37.5				
JI/17/24/4	Tibia								50.7	43.6				
JI/17/2/1	Metacarpus								50.1	27.5				
JI/17/36/1	Metatarsus				216.3	23.3	43	42.6	47.4	29.2				114.2

Inv. No.	Element	GLl	GLm	Dl	Dm	Bd	APB	ML	AP	H
JI/17/30/2	Astragalus	65.7	61	38.1	34.1	42				
JI/17/38/1	Calcaneus						54.6			
JI/17/36/5	Centrotarsale							47.6	52.5	46.9
JI/17/36/6	Tarsale 2+3							21.4	31.9	15.9

Inv. No.	Element	GLPe	SD	Bp	Dp	Bd
JI/17/26/3	Phalanx I	55.5	21.2	25.7	32.7	
JI/17/28/1	Phalanx I	47.6	22.9		29.6	26.1
JI/17/29/1	Phalanx I	57.3	23.8	24.9	32	24.2
JI/17/36/2	Phalanx I	56.2	22.5	25.4	30.9	23.4

Ovis aries

Inv. No.	Element	LD4	BD4	LM1	BM1	LM2	Bd	Dd
JI/17/10/1	Mandibula	16.2	6.6	14.8	7.1	17		
JI/17/7/1	Tibia						25.7	21.1

Ovis/Capra

Inv. No.	Element	LM1	BM1	LM2	BM2	LM3	BM3	LM
JI/17/26/5	Mandibula	10.9	7.9	16	9.1	18.8	6.9	45.1
JI/17/30/9	Mandibula	11.1	7.5	13.8	8.5	24	9.7	51.1

Inv. No.	Element	BPacr	GLPa	PL	BFcr	HFcr	BFcd	HFcd	Bd	Dd
JI/17/37/4	Cervical	25.9	32.4	21.8	12.8	8.6	14.3	11.4		
JI/17/30/4	Metacarpal								23.5	15.7

Sus domesticus

Inv. No.	Element	LP4	BP4	LM2	BM2	LM3	BM3
JI/17/29/3	Mandibula			17.8	15.2	38.5	16.7
JI/17/33/2	Mandibula	17.3	15.1				

Inv. No.	Element	SLC	LG	BG	DPA	BPC	Bp	Dp
JI/17/8/1	Scapula	19.9						
JI/17/13/1	Scapula		26.3	21.2				
JI/17/25/3	Ulna				36.6	21.3		
JI/17/26/1	Radius						30.8	20.7
JI/17/28/4	Metatarsus III						18.5	21.5

Equus caballus

Inv. No.	Element	Bd	Dd	BFd
JI/17/13/2	Radius	67.6	41.4	62.2
JI/17/30/3	Tibia	61.6	40.8	

Canis familiaris

Inv. No.	Element	LP1	BP1	LP4	BP4	LM1	BM1	LM2	BM2	LM3	BM3	LP1-P4	LP2-P4	LM	LP1-M3	LP2-M3	Bd	Dd
JI/17/2/6	Mandibula	7	5.1	10	5.3	21.9	8.1	8.9	5.1	5.9	4.7	39.8	31.9	36.3	74.5	67.5		
JI/17/31/1	Humerus																29.4	22.9