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## WITHERS HEIGHT OF PIG – *Sus scrofa domestica* L. 1758, DOMESTIC COW – *Bos taurus* L. 1758 AND SHEEP – *Ovis aries* L. 1758 AT THE “GORNJA ŠUMA” ARCHAEOLOGICAL SITE (NOVI SAD)

**ABSTRACT:** In spring 2012, osteological material was collected at the “Gornja Šuma” site (site no. 47), located in the territory of Novi Sad, and it was dated to the early 9<sup>th</sup> century. The withers heights of pig – *Sus scrofa domestica*, domestic cow – *Bos taurus* and sheep – *Ovis aries*, as the three most dominant species at this archaeological site, were analysed based on the length of bones and according to various authors [Boessneck 1956; Zalkin 1960; Matolcsi 1970; Teichert 1975]. It was determined that in these three species the withers heights mostly corresponded to the data from the Middle Ages.

**KEYWORDS:** withers height, *Sus scrofa domestica*, *Bos taurus*, *Ovis aries*, “Gornja Šuma” archaeological site

### INTRODUCTION

Osteological material has been collected at the archaeological sites in Vojvodina since 1930s. This material comes from different periods, such as: **Neolithic Age** – New Stone Age (6000–3200 B.C.), **Eneolithic Age** – Copper Age (3200–2000 B.C.), **Bronze Age** (2000–950 B.C.), **Early Iron Age** (950–300 B.C.), **Later Iron Age** (4<sup>th</sup> century B.C. – 1<sup>st</sup> century A.D.), **Roman period** (1<sup>st</sup>–4<sup>th</sup> century A.D.), **Migration period** (4<sup>th</sup>–9<sup>th</sup> century A.D.), and **Middle Ages** (9<sup>th</sup> century – 1526 A.D.) [Cerović *et al.*, 1997].

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Certain animal species, due to their characteristics useful for humans, were subjected to the process of domestication. Main characteristics of domestication are, predominantly, anatomical-morphological changes related to the reduction in body dimensions, changes in the structure and density of bones, thinning of cortical part of bones, expanding of modular channel, accompanied by changes in behaviour and physiology. The domestication process is long and depends on many factors [Bököny 1974]. Changes occur due to anthropogenic effect on species, artificial selection and reproductive isolation. Through selection, humans favoured certain animal characteristics that suited them, and they tried to pass these characteristics to following generations, while 'unfavourable' characteristics were eliminated over time. The human influence and reproductive isolation led to differentiation between domestic and wild populations.

The domestication process started as early as the Neolithic Age (circa 6,000 B.C.). The first examples of domestication of animals in Europe can be found in Thessaly in the 7<sup>th</sup> century B.C. (first goats and sheep). Only animals living in herds could be domesticated (large herbivores), most likely in several phases: non-systemic hunting → selective hunting → tracking herds → enclosing herds → herding. Certain species (such as dog and pig) were probably domesticated through certain symbiosis with humans, especially where permanent settlements started to appear [Clutton et Brock 1999].

The process of domestication of animals did not have the same direction and intensity. Differences that can be observed in archaeological material are the result of different conditions, of which the most important ones are ecological factors and characteristics of breeding that are specific for certain cultures [Blažić 2005 a].

The goal of this paper is to analyse values of the withers height of pig – *Sus scrofa domestica* L. 1758, domestic cow – *Bos taurus* L. 1758, and sheep – *Ovis aries* L.1758, as three most common species at the “Gornja Šuma” medieval archaeological site (site no. 47), located in the territory of Novi Sad, and to draw comparisons with values from other archaeological sites of the same and earlier dates, in order to track changes in body dimensions of these animals throughout history.

## DESCRIPTION OF THE SITE

The “Gornja Šuma” site (site no. 47) is located in north-west part of Novi Sad city area, in the zone of E-75 motorway. It is situated on southern part of Bačka loess plateau, in the hinterland of old high Danube bank.

During the construction of the new energy corridor around Novi Sad (gas and oil pipelines), archaeological excavations and researches were done at this site under supervision of the Institute for the Protection of Cultural Monuments of the City of Novi Sad. These works included partial excavation of a medieval settlement dated to the 9<sup>th</sup> century in the length of circa 800 metres. Apart

from household items, a large amount of bones of domesticated animals was also found.

## MATERIAL AND METHODS

The osteological material at the “Gornja Šuma” site (site no. 47) was collected and analysed in the period March–April 2012.

Determination of Vertebrata species was done using the key Schmidt [1972] and comparative osteological collections.

Measurement of the osteological material was done according to proposed guidelines given by Driesch [1976]. Calliper of 0.1 mm precision and digital calliper of 0.01 mm precision were used for measurement. The measurement box was used for bone parts that were not in the same plane.

The withers height of *Sus scrofa domestica* was calculated according to Teichert [1969], for the species *Bos taurus* this parameter was calculated based on the coefficient given by Boessneck [1956], Zalkin [1960] and Matolsci [1970], while the withers height of *Ovis aries* was calculated according to Teichert [1975].

## RESULTS AND DISCUSSION

The “Gornja Šuma” site (site no. 47) hosts remains of a settlement dated to the early Middle Ages, more precisely to the 9<sup>th</sup> century. After the analysis of animal bone remains, the members of the following classes were recorded: Mammalia, Aves and Osteichthyes. Similarly to other sites in Vojvodina [Radmanović *et al.*, 2013; 2014 a,b] and Europe [Bököny 1974] mammals are dominant, and the total share of pig – *Sus scrofa domestica*, domestic cow – *Bos taurus* and sheep – *Ovis aries* equals 94.15%. With 45.45% of the total sample of bone fragments, pig was the dominant species, which is not usual for sites from this period because then pork was less used in diet due to religious reasons [Nedeljković 2008]. Therefore, this archaeological site in the territory of Novi Sad is very interesting. The second most numerous species was domestic cow (26.88%) and sheep was the third one (21.82%).

The withers height, as one of the characteristics of domestication, can be calculated only using whole bones.

### **Withers Height of Pig – *Sus scrofa domestica***

There were only two whole bones in the entire osteological material of *Sus scrofa domestica* from the “Gornja Šuma” site (site no. 47): femur and tibia. By multiplying their maximum length with the coefficient given by Teichert [1969], it was calculated that the withers height based on femur was 69.9 cm, and based on tibia 82.1 cm.

Blažić [1988] analysed the withers height of *Sus scrofa domestica* from the Early Iron Age from the “Gomolava” site (Hrtkovci), and stated that this parameter was 67.2 cm based on the calcaneus length, 69.8 cm based on astragalus length, and 65.2 cm based on scapulae length. The same author analysed in 2010 osteological material from the “Asfaltna Baza” site (Zemun), also from the Early Iron Age, and based on measurements of astragalus and calcaneus stated that the withers height of this domesticated species was 79.26 cm and 77.52 cm respectively.

Based on astragalus of domesticated pig from the “Vranj” site (Hrtkovci), which belongs to the Roman period, Blažić [1993] calculated the withers height in the range between 68 and 77 cm, and concluded that these values were closer to autochthonous individuals than to so called improved Roman race.

Nedeljković [2008] stated that at the “Sirmium 85” site (Sremska Mitrovica) the withers height of domestic pig in the Roman period was 76.23 cm, and this result was based on calcaneus length.

Bartosiewicz [1996] stated that the withers height of pig from the Middle Ages in Hungary was 66.1 cm, based on the length of humerus.

Blažić [1999] stated that, at the “Ras-Gradina” medieval site (Novi Pazar), the value of withers height of domestic pig was in the range between 52 and 91 cm with mean value of 73 cm, but it was not stated which bones were used to calculate it. The values from the “Gornja Šuma” site fit these data.

### **Withers Height of Domestic Cow – *Bos taurus***

In Central and Eastern Europe, domestic cow (*Bos taurus*) is almost always the most dominant or one of the most dominant species of bred animals. This is also the case with sites in the territory of Vojvodina [Radmanović *et al.*, 2013; 2014 a,b; 2015] and the entire Pannonian Basin. Its presence at sites from various periods in Romania is discussed by Stanc *et al.* [2010], noting that in the Medieval Ages its contribution in the mammal fauna was between 35% and 65%, and in domesticated mammal fauna between 45% and 65%. Such high share is the result of multi-functionality of this animal – its meat and milk are used in diet, strength for pulling, and horns and bones for producing various objects. No other species of domestic animals has surpassed the economic value of domestic cow so far [Bökönyi 1974].

As already mentioned, the withers height of an animal is calculated using whole bones, and in case of domestic cow, by multiplying their maximum length with coefficients given by Boessneck [1956], Zalkin [1960] and Matolcsi [1970]. In the entire *Bos taurus* sample from the “Gornja Šuma” site (site no. 47), there were only four bones where maximum length could be measured. These were three metatarsal bones and one tibia. Some earlier works [Archaeozoologie, 1989] state that distal epiphysis of metatarsus shortens between 2 and 2.5 years of age. Based on the fact that all three of these bones had epiphyses, we can conclude that the given individuals were younger than 2 years.

Bökönyi [1974] made an overview of osteological material found at sites in Central and Eastern Europe, on the basis of historical periods. Using the

above-mentioned data, mean values of lengths of long bones were calculated on the basis of special periods, and after that withers heights were calculated according to the given mean values. The results are in Table 2.

Table 1. Calculated values of withers heights (expressed in cm) of domestic cow *Bos taurus* from the “Gornja Šuma” archaeological site (site no. 47)

Author and year	Bone		
	Metatarsus		Tibia
	Min	Max	
Boessneck [1956]	109.6	116.8	
Zalkin [1960]	104	108.7	
Matolesi [1970]	102.8	109.5	114

Table 2. Calculated values of the withers height of *Bos taurus* based on the data by Bököny [1974], expressed in cm

Bone	Copper Age	Bronze Age	Iron Age	Roman period	Migration period	Avar period	10 <sup>th</sup> –13 <sup>th</sup> centuries	14 <sup>th</sup> –17 <sup>th</sup> centuries
Humerus			110.5		107.6	111.9	98.5	
Radius	135.5	119.5	112	126	107.5	119.2	123	117.8
Metacarpus	121.5	116.7	112.6	125.8	112.3	119.8	109	120
Femur			102.4			110		
Tibia	127.7		118.3	122		106		122
Metatarsus		117	111	122.7	120.4	120	116	136.4

The results of the withers height of domestic cow calculated using the long bones from the “Gornja Šuma” site (site no. 47) are expected, taking into consideration their date, and they correspond to the values from other sites in the region from the same period. Domestic cow from the Copper Age was bigger, like the one from the Roman period (it is believed that bigger races were introduced from the territory of present-day Italy in this period). The lowest withers height was calculated according to the average length of humerus from the period between the 10<sup>th</sup> and 13<sup>th</sup> centuries (98.5 cm), and the highest was calculated according to the radius from the Copper Age (135.5 cm) and metatarsus from the period between the 14<sup>th</sup> and 17<sup>th</sup> centuries (136.4 cm) (Table 2). These results show the tendency of decreasing of withers heights of domestic cow over time. The withers heights in the Roman period and period between the 14<sup>th</sup> and 17<sup>th</sup> centuries deviate from this rule, which can be related to the introduction of larger cow races from other areas by Romans and Turks.

El Susi [2007] collected data on domestic animals that were excavated during the first decade of this century at archaeological sites from the Early Neolithic in the territory of Romanian Banat and Transylvania. Using four

figures for the length of metacarpus, a mean withers height was calculated, and it was 125.6 cm, which is 10–13 cm higher than the withers height of domestic cow at the “Gornja Šuma” site.

El Susi [1998] determined the withers height of domestic cow at medieval sites in the territory of Romanian Banat. The withers height of males was between 112 and 118 cm, and of females between 107 and 108 cm.

Blažić [1992 c] worked with remains of animal bones from the sites along the motorway through Srem. At the “Zlatara” site (Ruma) from the Neolithic period, the calculated withers height of domestic cow was between 102.3 and 108.2 cm. At the “Livade” site (Sremska Mitrovica) from the Eneolithic period (Copper Age), the withers height was estimated according to metacarpus length and it was 115 cm. At the “Vrtlozi” site (Šimanovci) from the Early Iron Age, the calculated withers height of domestic cow was between 109.6 and 112.3 cm. In the Late Iron Age, the withers height was between 106 and 109 cm at the “Tromeđa” site (Pećinci) and 118 cm at the “Vrtlozi” site (Šimanovci). The withers height increased in the Roman period due to the introduction of cows from other parts of Europe. Therefore, the authors stated that at the “Malo Kupalovo” site (Krnješevci) the withers height of indigenous cows was 123 cm, and of the introduced ones 142 cm. At other sites in Vojvodina, the withers height of indigenous cows was between 104.6 and 123.8 cm, and of introduced ones between 125.5 and 136.3 cm. Blažić [1993] also discussed animal bone remains from the “Vranj” site from the Roman period and determined that the withers height of indigenous cows was between 109 and 118 cm, and of introduced ones between 124 and 131 cm.

Blažić [1988] discussed material from the “Gomolava” site from the Early Iron Age and determined the withers height according to the length of metacarpus and metatarsus. The withers height of these domestic cows was 109.8 and 106 cm, which is similar to the height of cows from our research site.

Bökönyi [1988], in the analysis of the osteological material from the “Kalačače” site (Beška), a settlement from the Early Iron Age, used the measures of radius, metacarpus, tibia and metatarsus to calculate the withers height. Based on the mean length of radius, the calculated height was 116.5 cm, based on the length of metacarpus it was 116.3 cm, on the length of tibia 107.2 cm, and on the length of metatarsus 117.9 cm. The withers heights in this period do not significantly differ from the withers heights calculated at the “Gornja Šuma” site.

Bökönyi [1976] discussed animal bone remains from the site in the southern part of Hungary, which was inhabited by the Sarmatians. Based on his data on the length of radius, tibia and metatarsus, the following withers heights of domestic cow were calculated: for radius the height was 115 cm, for tibia 117 cm, and for metatarsus 122 cm. The above-mentioned sites were dated to the Migration period. The withers height of domestic cow from these sites is somewhat larger than the withers height of domestic cow whose remains were found at the “Gornja Šuma” site.

Bartosiewicz [1996] published data on the length of bones from the medieval sites and those from the Ottoman period. The withers height was calculated according to the length of the long bones (humerus, radius, metacarpus, femur,

tibia, metatarsus) in the 14th century (118 and 120 cm), in the Late Middle Ages (119 cm), while the Ottoman period showed increase in the withers height (between 118 and 165 cm).

Considering the withers height of domestic cow, the osteological material from the “Otok” medieval site in Slovenia [Bartosiewicz 2006] corresponds with the “Gornja Šuma” site. The mean height of domestic cow from this site was circa 108 cm in layers of unknown date, 106.5 cm in layers from the 12<sup>th</sup> century; the lowest specimens were in layers from the 13<sup>th</sup> century (96 cm), and the highest ones in layers from the 14<sup>th</sup> century (117 cm).

Clason [1979] discussed the osteological material from the “Gomolava” site from the Vinča (Neolithic) and La Tène (Late Iron Age) periods, and determined the withers height between 102 and 125 cm in Vinča, and between 92 and 113 cm in La Tène period. The same author [1980] determined the withers height of domestic cow from the “Starčevo” Neolithic site (Starčevo culture), which was between 120 and 116.4 cm.

### Withers Height of Sheep – *Ovis aries*

In the entire sample from the “Gornja Šuma” archaeological site, there are 17 bone fragments of sheep – *Ovis aries* with maximum lengths measured for: 8 calcaneus bones, 3 radius bones, 2 metacarpus bones, 2 astragalus bones, and one tibia and metatarsus. The withers height was calculated by multiplying their maximum lengths with the coefficient given by Teichert [1975], and it is given in Table 3. Teichert gives coefficients for sub-adult and adult individuals. In order to calculate the withers height based on bones of unknown age, the mean value of both above-mentioned coefficients was used.

Table 3. Calculated values of the withers height of *Ovis aries* from the “Gornja Šuma” archaeological site (site no. 47) (expressed in cm)

Bone	N (number of bones)	Min–Max	$\bar{X}$
Radius	3	62.44–68.57	66.53
Metacarpus	2	57.06–63.79	60.42
Tibia	1	60.95–60.95	60.95
Astragalus	2	60.23–61.27	60.75
Calcaneus	8	54.12–70.07	62.73
Metatarsus	1	62.38–62.38	62.38
$\bar{X}$			62.77

Out of seventeen whole bones from the researched site, eleven are of unknown age. The remaining six bones belong to individuals of known age, one bone (metacarpus) belongs to a sub-adult individual, one bone (radius) belongs to a sub-adult/adult individual, and four bones (three calcaneus bones and one tibia) belong to adult individuals.

The withers height of sheep from the “Gornja Šuma” archaeological site is between 54.12 and 70.07 cm, and the mean value is 62.77 cm. The smallest and largest values are calculated according to the calcaneus length of adult individuals (Table 3).

As it was already stated, El Susi [2007] analysed the bones of domestic animals from the Early Neolithic period in the territory of Romanian Banat and Transylvania. The withers height was calculated according to the length of scapula, radius, metacarpus and metatarsus bones. In the territory of Banat, the withers height of sheep was between 56.9 and 60.3 cm (mean value – 58.9 cm), while in the territory of Transylvania, the height was between 48.5 and 65 cm (mean value – 56.7 cm). The above-mentioned values in this period are somewhat lower in comparison to the values from the “Gornja Šuma” site. The preliminary analysis of sheep bones indicated that these animals were smaller during the Early Neolithic period, the withers height being 62–65 cm (possibly of rams). The author stated that the obtained data corresponded with the withers height of sheep in south-eastern Europe.

Blažić [1992a] analysed fauna remains from the “Donje Branjevine” site (Deronje) from the Neolithic period and determined withers height of sheep on the basis of the length of metacarpus. The calculated withers height, according to Zalkin method [1960] was 58 cm. The author stated that the calculated values were somewhat smaller than mean values in this part of the Pannonian Basin.

Blažić and Radmanović [2011] discussed the osteological material from the late Vinča settlements of “Crkvine” and “Belež” (Kolubara basin) from the Neolithic period and cited Dimitrijević [2006], according to whom the estimated withers height of sheep was between 47.8 and 56 cm at the “Vinča – Belo Brdo” site.

Blažić [1992c] calculated the withers height of sheep from the “Bregovi – Atovac” site (Kuzmin) from the Early Iron Age using Zalkin method [1960]. Based on the longest length of metacarpus, the withers height was 65 cm, and based on the longest length of metatarsus it was 70 cm. In this paper, the author cited Bökönyi [1974], according to whom the withers height of sheep from the Neolithic was between 57 and 60 cm, and from the Eneolithic (Copper Age) between 57 and 74 cm.

Blažić [1988] analysed the osteological material from the “Gomolava” site from the Late Iron Age, and based on the length of metacarpus, determined the withers height of sheep to be 57.3 cm. In 2010, the same author estimated the withers height of sheep on the basis of three whole metatarsus bones, one metacarpus bone and one calcaneus bone of sheep from the “Asfaltna Baza” site, also from the Early Iron Age, and it was between 52.47 and 60.1 cm (mean value 56.9 cm).

Bökönyi [1988] calculated the withers height of sheep from the “Kalakača” site (settlement from the Early Iron Age) according to the length of metacarpus and using the Zalkin method [1960]. He came to the conclusion that it was between 56.62 and 60.61 cm, and that it corresponded to the mean height of this animal from the Carpathian basin in the above-mentioned period.

Bökönyi [1981] also analysed material from the Early Iron Age in the territory of ex-Yugoslavia Danube basin, and stated that the withers height of one individual sheep from the “Gradina” site (Vašica) was 62.71 cm, which is similar to the mean height of sheep from the “Gornja Šuma” site.

Blažić [2005 b] analysed the osteological material from the “Kale” site (Krševica) from the Late Iron Age, and used measures of whole metacarpus, metatarsus and radius bones of adult individuals for calculating the withers height. Based on the length of these bones, the calculated mean value of the withers height was 62.21 cm, which is similar to values obtained from the “Gornja Šuma” site. The author cited Bökönyi [1974], according to whom the mean withers height of metacarpal bone from the Iron Age in Central and Eastern Europe was 57.5 cm, and of metatarsal bone 61 cm.

Blažić [1992 b] stated that the withers height of sheep in the Iron Age was between 51 and 69 cm, on the basis of ten analysed sites in Vojvodina.

Blažić [1993] also analysed animal remains from the “Vranj” site from the Roman period, and on the basis of the whole metacarpus and metatarsus bones estimated that the withers height of sheep was between 51.2 and 73.3 cm.

Nedeljković [2008] analysed fauna remains from the “Sirmium 85” site and stated that the mean withers height of sheep from the Roman period was 60.79 cm. These data were based on the length of whole metacarpus, metatarsus and radius bones. The author cited Bökönyi [1982], who stated that the new, higher races of sheep, which replaced the indigenous populations in the Roman period, most likely originated from Greece. Nedeljković [2008] also cited Bökönyi [1984], who stated that the difference in the withers height of Roman races can be up to 10 cm when compared to the indigenous specimens. Sheep bone fragments from the 5<sup>th</sup> and 6<sup>th</sup> centuries (Migration period) were also found at the “Sirmium 85” site. Two whole metacarpal bones indicated the withers height of 59.83 cm, and one metatarsal bone the height of 61.54 cm. The mean value of 60.68 cm deviates insignificantly from the mean value of the withers height of Avar sheep that is up to 60 cm. Osteological material originating from the period between the 16<sup>th</sup> and 18<sup>th</sup> centuries was also found at the “Sirmium 85” site. The withers height was calculated according to the two whole metacarpal bones of adult sheep, and it was 70.65 cm and 63.74 cm, and the withers height based on tibia was 67.45 cm. The mean height of sheep in the Middle Age was 67.28 cm, based on this sample. The values from the “Gornja Šuma” site are somewhat lower when compared to the above-mentioned data from the “Sirmium 85” site.

Blažić [1999] analysed the osteological material from the “Ras-Gradina” medieval site, and calculated the withers height of sheep according to the long bones (metacarpus, metatarsus and radius) and using the coefficients given by Teichert [1975]. The calculated withers height based on metacarpus length was between 58.56 and 69.29 cm, based on metatarsus length between 57.3 and 69.16 cm, and based on radius length between 52.8 and 58.4 cm. The mean value of the withers height calculated according to the length of metacarpus and metatarsus was 62.58 cm, which corresponds to the values obtained from the “Gornja Šuma” site. The author stated that sheep reached the lowest withers

height in the Middle Ages, after the Copper Age. The withers height of domestic races was decreasing during the Migration period and wars, when almost all results of selection and development from the Roman period were destroyed. The mean height decreased by circa 5 cm when compared to the Roman period and it is between 51 and 64 cm in the Central and Eastern Europe [Bökönyi 1974].

Bartosiewicz [1996] published data on the length of sheep bones from the medieval sites and those from the Ottoman period in Hungary. The withers height was calculated according to the length of metacarpus and metatarsus bones and it was between 55.2 and 71.7 cm in the 14th century, and between 63 and 74.5 cm in the late Middle Ages. The withers height of sheep in the Ottoman period was calculated according to metacarpus length and it was between 57.4 and 71.1 cm.

## CONCLUSION

Osteological material was collected at the “Gornja Šuma” medieval site (site no. 47), located in the territory of Novi Sad, in spring 2012.

Domestic pig *Sus scrofa domestica* dominates in this material, which is unusual because pork was used less in diet during the Middle Ages due to religious reasons.

The withers height of **pig** – *Sus scrofa domestica* was calculated according to the length of whole femur and tibia bones and it was 69.9 cm and 82.1 cm respectively, which corresponds with the data from the Middle Ages.

The withers height of **domestic cow** – *Bos taurus* was calculated according to the length of one tibia and three metatarsus bones given by various authors [Boessneck 1956; Zalkin 1960; Matolcsi 1970]. The estimated withers height was between 102.8 and 116.8 cm, which corresponds with the general picture of small medieval cows.

The withers height of **sheep** – *Ovis aries* was calculated according to the length of 8 calcaneus, 3 radius, 2 metacarpus, 2 astragalus, one tibia and one metatarsal bones given by Teichert [1975], and it was between 54.12 and 70.07 cm, while mean value was 62.77 cm. Mean value of the withers height of sheep from the “Gornja Šuma” site either corresponds with or is slightly smaller than the values from the archaeological sites from the same period in Serbia and Hungary.

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ВИСИНА ГРЕБЕНА СВИЊЕ – *Sus scrofa domestica* L. 1758,  
ГОВЕЧЕТА – *Bos taurus* L. 1758 И ОВЦЕ – *Ovis aries* L. 1758  
СА АРХЕОЛОШКОГ ЛОКАЛИТЕТА „ГОРЊА ШУМА” (НОВИ САД)

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РЕЗИМЕ: Са средњовековног локалитета „Горња шума” (локалитет бр. 47) који се налази у атару Новог Сада, у пролеће 2012. године сакупљен је остеолошки материјал. У овом материјалу доминирала је домаћа свиња *Sus scrofa domestica* што је необично јер је се свињско месо током средњовековног периода из религиозних разлога мање користило у исхрани. На основу дужине целих костију фемура и тибије, израчуната је висина гребена свиње – *Sus scrofa domestica* која је износила 69,9 cm, односно 82,1 cm, што се уклапа у литературне податке из средњовековног периода.

На основу дужине једне tibia-е и три metatarsus-а израчуната је висина гребена говеда – *Bos taurus* према различитим ауторима [Voessneck 1956; Zalkin 1960; Matolcsi 1970]. Процењена висина гребена износи између 102,8 и 116,8 cm, што одговара општој слици малих средњовековних говеда.

На основу дужине осам calcaneus-а, три радијуса, два metacarpus-а, два astragalus-а, једне tibia-е и једне metatarsal-не кости овце – *Ovis aries* према Teichert-у [1975] израчуната је висина гребена која се кретала између 54,12 и 70,07 cm, а средња вредност износила је 62,77 cm. Просечна вредност висине гребена овце са локалитета „Горња шума” уклапа се или је нешто нижа у односу на израчунате вредности са археолошког локалитета истог датовања са подручја Србије и Мађарске.

КЉУЧНЕ РЕЧИ: висина гребена, *Sus scrofa domestica*, *Bos taurus*, *Ovis aries*, археолошки локалитет „Горња шума”