14 AGRICULTURAL AND ECONOMIC ASPECTS OF THE VUČEDOL SETTLEMENTS

ARCHAEOBOTANIC ANALYSIS

Research into the environment people had lived in began with the pioneering work of Graham Clark in the post-war period, and was expanded to include analysis of the landscape and climatic conditions in which the people had lived. With his work, Clark prompted great scientific advance, with laboratory examinations of biological remains (such as animal bones and plant remains recovered during archaeological excavations), together with their interpretation in the light of economic and environmental aspects, developing into specializations such as zooarchaeology, palaeoethnobotany and bioarchaeology (Trigger 1989).

One of the main goals of archaeobotany is the research of the history of plant cultivation, or the study of the link between man and vegetation. In contrast to pollen analysis, archaeobotany primarily studies remains of those plant species that are linked exclusively to human activities (Price 2007: 350). Remains of archaeological structures which testify to human activity – such as cultural layers, waste pits and houses – contain evidence that makes it possible to reconstruct and identify fossil plants, and links between man and his environment. These links can help us visualize a complete picture of cultural and natural changes occurring over time, the way in which man exploited his environment, how much he adapted to it, and how much he influenced the changes in his surroundings.

Nowadays, when archaeology has undoubtedly become an interdisciplinary science, archaeobotany is a discipline without which it would be impossible to imagine reconstruction of the landscape, the degree of land cultivation and the dietary habits of the population in any archaeological context. The remains of fossil plants allow us to identify agricultural activities of past populations, that is, the sorts of plants that were grown and used for everyday nutrition.

Archaeobotanic analysis has been done on four samples from the site at 14 Matija Gubec Street. One was taken from pit SU 49/50, and the remaining three from pit SU 47/48. The analysis was performed by Dr. Kelly Reed of the University of Leicester (Reed 2012; 2016). The separation

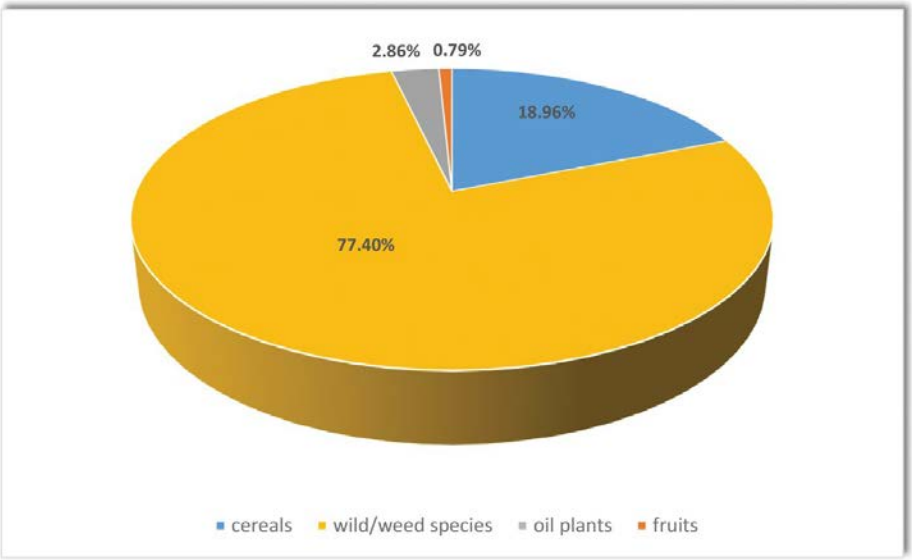

Fig. 65 – Total frequency of plant remains

of carbonized plant remains collected during the archaeological excavation was done through soil samples being washed off using a flotation device. Plant remains that can be identified after they have been dried, and after other material (earth, recent weeds and grasses) has been removed, are in very good condition, because they are not prone to bacterial and fungal contamination. The large number of identified plant species at the site of Ervenica, and two samples consisting of over 384 plant remains, suggest that samples are better preserved at sites that have been inhabited intensively and over a long period of time (Reed 2016).

The results of the analysis have shown higher presence of wild-plant species (77.40%) over cultivated plants, especially cereals (18.96%) (*Fig. 65*).

The best-represented cereal is wheat, primarily emmer (*Triticum dicoccum*), followed by einkorn wheat (*Triticum monococcum*), spelt (*Triticum spelta*) and bread wheat (*Triticum aestivum/durum*). The next best-represented cereal is barley (*Hordeum vulgare*) and hulled or naked barley (*Hordeum vulgare var. nudum*). A single case of rye (*Secale cereale*) has been recorded, which does not mean that rye was grown deliberately – it could have been present in fields sown with wheat. In central Europe, rye began to be grown as a 'secondary crop' only in the Late Iron Age, and it had come here as a weed present in wheat and barley (van Zeist 1974–78: 13). Only two specimens of broomcorn millet (*Panicum miliaceum*) have been recorded (*Table 22*).

CEREALS	N. of macrofossils	%
Cereals (Cerealia indet.)	16	5.13%
Wheat *(Triticum* spp.)	51	16.35%
Emmer (*Triticum dicoccum* L.)	125	40.06%
Einkorn *(Triticum monococcum* L.)	53	16.99%
Triticum mono/dicoc	32	10.26%
Bread wheat *(T. aestivum/durum* L.)	16	5.13%
Hulled barley *(Hordeum vulgare var. nudum* L.)	9	2.88%
Barley *(Hordeum vulgare hulled* L.)	7	2.24%
Rye *(Secale cereale* L.)	1	0.32%
Broomcorn millet (*Panicum miliaceum* L.)	2	0.64%
Total	312	100.00%

Table 22 – Total number of cereal macrofossils

Glume wheat chaff has been found to be rare, while flax seeds (*Linum usitatissimum*) have been recorded in numbers higher than at other sites from the same period (Reed 2016).

Tasty, vitamin-rich fruits of several wild fruit species could be gathered in the nearby woods: cornelian cherry (*Cornus mas*), elderberry (*Sambucus sp.*) and Chinese lantern (*Physalis alkekengi*). Some wild fruits could also have been used for medicinal purposes. The fruit of Chinese lantern has pronounced curative properties, while cornelian cherry is a deciduous shrub of which only the fruits are used for medicinal purposes. Remains of these wild species have also been found at the nearby archaeological site of Sopot (Krznarić Škrivanko 2015). The samples also contained a relatively large number of wild-plant and weed species, including a high concentration of grass species (*Bromus* sp.), white goosefoot / fat hen (*Chenopodium album*), grasses (*Gramineae*), corncockle (*Agrostemma githago*) and two samples of viola (*Viola* sp.) (*Table 23*).

WILD PLANTS AND WEED SPECIES	N. of macrofossils	%
Agrostemma githago L.	2	0.16%
Asteraceae	1	0.08%
Gramineae	230	18.05%
Bromus sp.	381	29.91%
Lolium sp.	1	0.08%
Sambucus ebulus	3	0.24%
Phleum sp.	10	0.78%
Chenopodium sp.	108	8.48%
Chenopodium album L.	513	40.27%
Cyperaceae	1	0.08%
Dasypyrum/Secale sp.	1	0.08%
Galium aparine L.	2	0.16%
Hypericum sp.	1	0.08%
Polygonum sp.	2	0.16%
Potentilla sp.	1	0.08%
Teucrium sp.	2	0.16%
Verbena officinalis L.	1	0.08%
Viola sp.	2	0.16%
Small-seeded legumes	12	0.94%
Total	1274	100.00%

Table 23 – Total number of macrofossils of wild-plant and weed species

In agriculture, weeds are understood to be simple, wild plants which grow in our arable fields against our will, together with the agricultural crops, thus causing damage that is reflected in the yield. They usually emerge in places in which human activity is present. Weeds can be divided into those associated with the vegetation of summer crops, and those associated with winter crops. Of the weeds associated with summer crops (class Chenopodietea), remains of white goosefoot (*Chenopodium album*) and pale persicaria (*Polygonum lapathifolium*) have been recorded at Ervenica. Also related to such fruits are ruderal plants, which grow by waste deposits, along the edges of woods and paths, and on ruins, while some of them also spread to agricultural

Presence of wild/weed species associated with summer crops	Total n. of macrofossils	%
Chenopodiaceae	108	8.48
Chenopodium album L.	513	40.27
Polygonum sp.	2	0.16
Presence of wild/weed species associated with winter crops		
Bromus sp.	381	29.91
Wild/weed species in total	1274	100.00

Table 24 – Comparative figures for weeds associated with summer and winter crops

land. For this reason, it is difficult to draw a line between the two plant communities (Kučan et al. 2006: 66). Weeds that are specifically found in conjunction with winter crops (class Secalietea) are represented only by the species of brome grasses (*Bromus*). Based on their proportions, the assumption can be made that cereals were grown primarily as summer crops (*Table 24*). Emmer (*Triticum dicoccum*) and broomcorn millet (*Panicum miliaceum*) were grown as summer crops, while einkorn (*Triticum monococcum*) was grown as a winter crop. Barley (*Hordeum vulgare*) features the highest adaptability to the conditions in its habitat, and thus it could have been grown as either summer or winter variety (Kučan et al. 2006: 66).

Wild plants were probably used as replacements for cereals during periods of shortage, and as herbs or greenery for some kind of soup (Hršak 2009). Recent research suggests that many weeds discovered by archaeological excavation were used as the first vegetables in human nutrition. This category includes seeds of white goosefoot (*Chenopodium album*) and pale persicaria (*Polygonum lapathifolium*), plants that can be found as weeds among spring cereals and in vegetable gardens, which grow in moderately warm climates and in nitrogen-rich habitats (Kučan et al. 2006: 66). At Ervenica, a large number of white goosefoot seeds have been identified (40.27%), while the presence of pale persicaria was not significant (0.16%). The question remains open whether the Ervenica population collected white goosefoot and used it in their diet as a vegetable (due to its fleshy leaves). A similar situation has been recorded at the Neolithic site of Okolište (Kučan et al. 2006).

The great quantity of wild-plant and weed species could indicate the possibility that the cereals had not been cleaned, and the species present could also point to the vegetation which grew in nearby meadows and gardens, and in the settlement's surroundings. The information about the presence of wild-plant and weed species is undoubtedly a very valuable piece of information on the prehistoric environment, vegetation, and usability of nearby meadows and pastures.

The cereals recovered from the site of Ervenica paint a familiar picture of the tilling economy of the Aeneolithic period in central and south-eastern Europe, as evidenced by the results of archaeobotanic analyses done at various sites in the region (van Zeist 1974–78; Bankoff & Winter 1990; Jovanović 2004; Gyulai 2010). The archaeobotanic analyses of prehistoric sites have shown that the majority of plant remains belong to einkorn wheat (*Triticum monococcum*), emmer (*Triticum dicoccum*) and barley (*Hordeum vulgare*), confirmed to be the oldest domesticated plant species. In addition to these, peas, broad beans, lentils and oats were also grown, but their remains have not been found at Ervenica.

Wheat and barley marked the beginning of food production, which eventually set the foundation of Neolithic agriculture and became the main wheel of its successful spread. Before those species were cultivated, wild cereal fruits were gathered and used as food. Einkorn wheat and emmer, as well as barley, were the core agricultural crops grown in prehistoric times. The einkorn yield was poorer, but it survived and spread because it could be grown on poorer soil. Emmer provided a better yield and a higher quality of bread. The production of these two species fell towards the end of the Iron Age, and nowadays they are present only as relics. In parts of central and south-eastern Europe the predominant crop was emmer, and in this respect the Ervenica settlement fits into the existing framework.

However, the archaeobotanic analysis done at the site of Vučedol has shown that there the predominant crop was einkorn, followed by emmer. It has also revealed a larger proportion of cereals (91%) over wild-plant and weed species (7%) (Reed 2012). The same situation has been

recorded in other settlements of the Middle/Late Copper Age (Đakovo-Franjevac, Tomašanci-Palača, Slavča, Čepinski Martinci-Dubrava) (Reed 2016). At Ervenica, the picture is entirely different, and wild-plant and weed species are dominant over cereals. The reason for this difference could lie in different economic priorities, or in different predispositions and usability of the environments. This could mean that the population of Ervenica was less involved in tilling land, and more in herding animals, and that they left more land available for pasture. Still, it is worth noting that the proportions of cereals and weeds at Ervenica are not necessarily the basis for any concrete conclusions regarding its economy. The archaeobotanic sample should be greater and collected from more of the Vučedol sites at Ervenica, and from various types of deposits (pits, houses, surroundings of houses).

A very interesting comparison of the total figures for plant species in specific pits is given in *Fig. 66*. Pit SU 49/50 contained a somewhat greater proportion of cereals (51.46%) than wild-plant and weed species (45.63%), while the situation in pit SU 47/48 was the opposite, because there wild-plant and weed species were dominant (79.52%) over the total share of cereals (16.79%). Several factors can influence the proportions of plant remains discovered in pits, relating to cereal origin and the activities associated with their use. These include the state of preservation of the settlement, manner of discarding and disposing of waste created during harvest, and distribution of seeds within the settlement caused by wind gusts and rain.

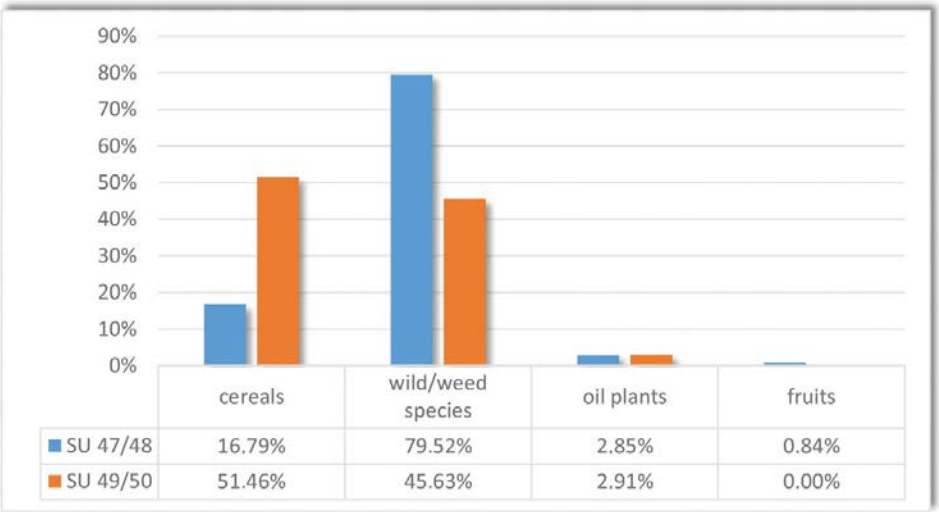

Fig. 66 – Comparative figures for plant species in pits SU 47/48 and 49/50

Another cereal crop that has been used ever since earliest prehistory is barley. Barley played an important role in the cultivation of land in Europe, and therefore it is not surprising that it was used in the Vučedol tilling economy. The species grows well even when the land is of poor quality, and thus it has persisted to the modern day. Even in the Neolithic, barley was used to make bread and porridge, and also beer, and to feed domestic animals. This cereal's resistance to diverse temperatures, its short growing period and high adaptability make it a very gratifying species (Gyulai 2010: 42).

Cereals have played an important role in the domestication of animals. These agricultural crops grow on open arable land (preferably on hard, fertile loam), their life cycle lasts less than a year, and they can be stored over a long period of time (Zohary & Hopf 1988: 10–22). Cereal-based nutrition introduced significant changes into the everyday diet, given the calorific value of

cereals. Generally, their nutritional value is high, they are rich in hydrocarbons, and wheat also contains proteins and gluten.

OSTEOLOGICAL ANALYSIS

Archaeozoology is a scientific discipline which studies animal remains recovered from archaeological sites, or places which were created and inhabited by people at some point in the past (Lyman 1982). The purpose of archaeozoology is to contribute to a better understanding of the relationship between people and their surroundings, primarily animal populations in their surroundings, and to identify changes in the way animals were used over time and space (Reizz & Wing 1999).

The analysis of animal bones from the site at 14 Matija Gubec Street at Ervenica has included 526 remains of bones, teeth and antlers. The analysis was done, and its results were interpreted, by Dr. Tajana Trbojević Vukičević of the Institute of Anatomy, Histology and Embryology of the Faculty of Veterinary Medicine of the University of Zagreb. The number of fragments identified from the skeletal and taxonomic points of view was 243 (46.20%) (*Fig. 67*).

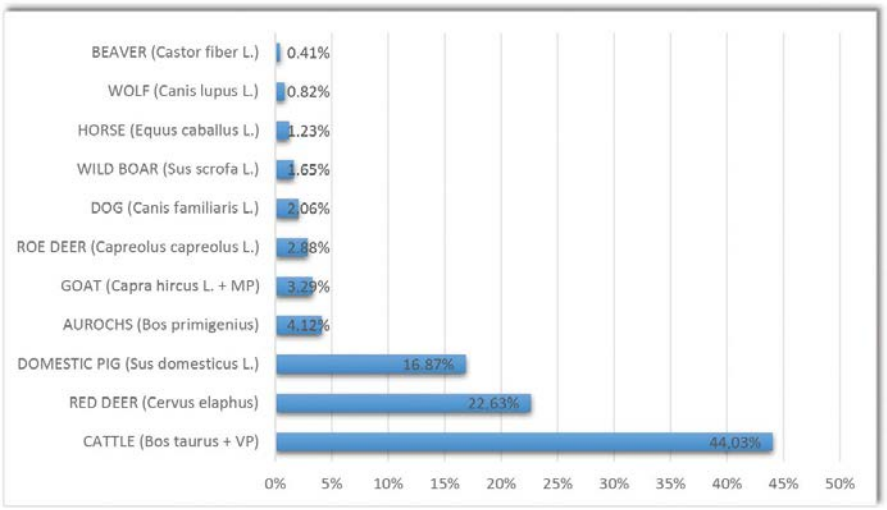

Fig. 67 – Percentages of identified specimens (% NISP)

Due to highly-fragmented samples, especially those of long bones and individual teeth, accurate identification of specific species has been very difficult. Thus the record of some skeletal elements of goat (*Capra hircus* L.) has been supplemented by bones belonging to a small domestic ruminant, for which the lack of important elements of anatomy has prevented more precise identification as to whether they belonged to a goat or a sheep (*Ovis aries* L.). For the same reason, the record of skeletal elements of cattle has been supplemented with bones from a large ruminant, where it could not be specified whether the bone element belonged to an ox (*Bos taurus* L.) or a red deer (*Cervus elaphus* L.).

On the basis of the osteometric analysis of long bones (humerus, femur and metapodial bones) of cattle, and comparison with a similar study of the Aeneolithic cattle of the Vučedol Culture period recovered from Vučedol, it has been established that no fewer than 10 bone elements belonged to the wild cattle, the aurochs (*Bos primigenius* L.). The differentiation between dog (*Canis familiaris* L.) and wolf (*Canis lupus* L.) is difficult, even when complete and recent skele-

tons (and bones) are available, making the taxonomic identification of damaged and incomplete archaeological samples nearly impossible. Some small and mostly subjective morphological differences can be observed on some other bones and skulls, and those carnivores have been classified on the basis of this criterion.

In the sample analysed, cut marks are visible on red-deer antlers, but only those left by the separation of the antlers from the rest of the skull, while other marks possibly left by further working with a view to producing an implement (or weapon, or jewellery etc.) have not been observed). One long-bone fragment, which cannot be identified in terms of either skeleton or taxonomy, reveals marks left by its being worked to produce, most probably, an awl. On several bones of cattle and red-deer tarsus, there are cut marks suggesting that bones were separated from joints, and those are treated as marks left by butchering, that is, separation and cutting of meat into smaller parts suitable for consumption. A pig's occipital bone has been cut through the middle, which is also indicative of butchering and an attempt to reach the brain (Trbojević Vukičević 2011).

The results have shown that the presence of domestic animals was higher (67.49%) than that of wild animals (32.51%).

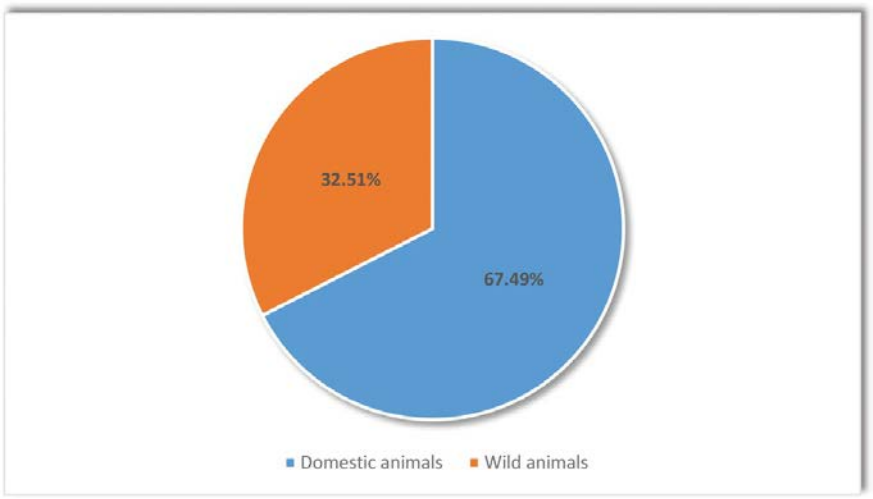

Fig. 68 – Comparative figures for domestic and wild animals (% NISP)

The most dominant of the domestic animals was cattle (*Bos taurus* L.), which during the Aeneolithic became the basis of animal herding. Wild cattle, or aurochs (*Bos primigenius* L.), were also present, but their numbers started to decline in the late Aeneolithic.

The domestication of cattle began in the middle Neolithic, when the need emerged to expand the herds; this gradually resulted in the domestication of local wild animals such as boars and aurochs. In the late Neolithic, cattle was already the most numerous of domestic animal species, and this situation remained unchanged throughout the Aeneolithic. In the early Bronze Age, the domestication of cattle was completed, the aurochs became rare, and as far as hunting is concerned, its role was taken over by red deer (Bökönyi 1971). Another important domestic animal was the pig (*Sus domesticus* L.), while goats and sheep are ranked last in this list (*Fig. 69*).

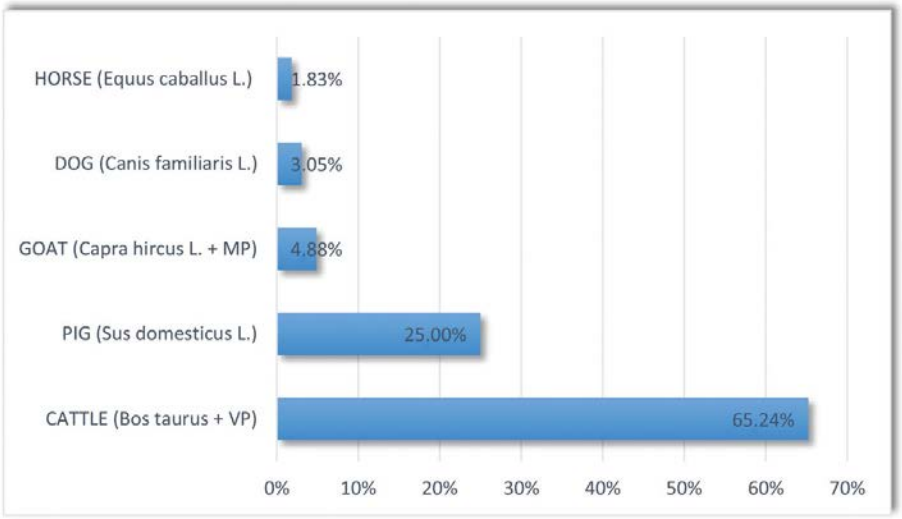

Fig. 69 – Comparative figures for domestic animals

The most widely-present wild animals were red deer (*Cervus elaphus* L.), aurochs (*Bos primigenius* L.) and roe deer (*Capreolus capreolus* L.) (*Fig. 70*).

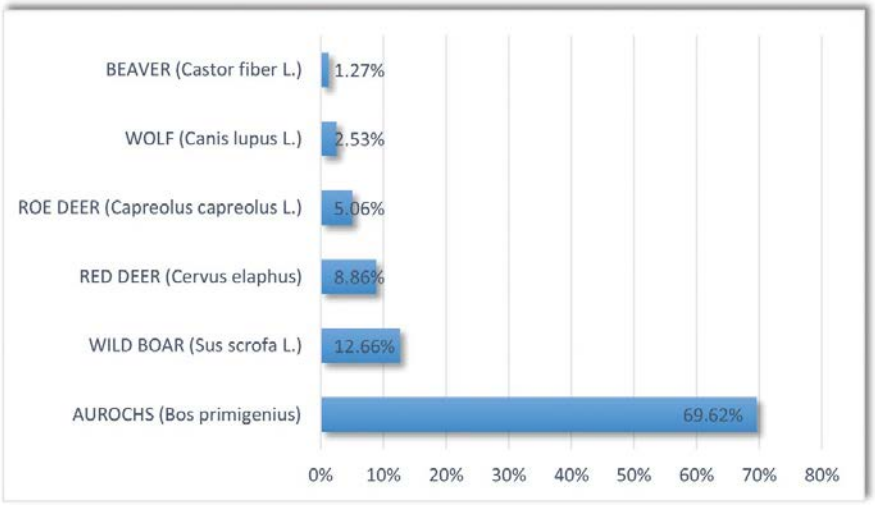

Fig. 70 – Comparative figures for wild animals

Although the red deer has been hunted in all periods primarily as a source of meat, it is also known that its hide was probably used to produce footwear, its intestines for sewing, and its bones and antlers for the crafting of tilling and household tools (Trbojević Vukičević et al. 2006). A large quantity of hoes with shafting holes, made of deer antlers, which were used for working the land, have been found at both sites (*Figs 71, 72, pp. 132-133*).

The animal bones analysed allow the conclusion that the economy of the Ervenica population was primarily based on animal herding, in which cattle played the predominant role, followed by pigs and, to a lesser extent, goats/sheep. Besides being used as a source of food, cattle could also be used to assist in tilling the land. It is well-known that the Baden Culture was the first in Europe to introduce four-wheel wagons. Among the objects frequently found at Vučedol sites there are small and large weights shaped like wheels (Pls 34: 1–3; 35: 3).

The analysis of animal bones recovered from the neighbouring site of 'Tržnica' tell has resulted in a higher share of wild animals (52.50%) than domestic (47.50%). However, the remains

of animal bones from Ervenica are more similar to those from the site of Vučedol (the position of the 'Streim Vineyard'), where domestic animals dominated (78.20%) over wild ones (21.80%) (Jurišić 1988: 25).

Animal remains found at the site of Damića Gradina could not be analysed, due to disturbed stratigraphic layers, but the osteological analysis of one animal burial has revealed that the remains, absolutely dated to the period between 2630 and 2470 BC, belonged to a cow and a fawn (Chapter 12, Table 1).

The results of archaeobotanic and osteological analyses place Ervenica well into the general picture of life in the Aeneolithic in SE Europe, where people lived from tilling (growing einkorn wheat and emmer) and herding and hunting, which boosted their living standard. The most significant domestic animals were cattle, followed by pigs and also goats/sheep. Several fish vertebrae and freshwater mussels, which cannot be identified more precisely due to insufficient indicators, suggest that the River Bosut was also used for everyday nutrition, but to a lesser degree.