

# ARCHAEOZOOLOGICAL RESEARCH OF THE ROMAN FORT AT IŽA (SW SLOVAKIA)

## History and Current Knowledge<sup>1</sup>

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**Abstract:** Despite extensive archaeological research, the ecofactual data from the Roman fort in Iža – a Brigetio bridge-head – remain limited and scattered across hard-to-access papers. This study summarizes and revises the existing archaeozoological data, highlighting key findings. Since 1984, approximately 6,000 bones and shells have been analyzed, primarily from the earth-and-timber phase of the camp's existence (175–179 AD). Taxonomic and anatomical identification, kill-off patterns, and bone modifications indicate that the Roman army relied on local faunal resources, although there were occasional imports of new species, such as the domestic ass (*Equus asinus*). Soldiers from Iža-Leányvár primarily consumed meat from young adult caprines aged two to three years. Animals were brought on hooves, slaughtered, and processed locally. Biometric data revealed consumption of oxen and rooster meat. Preliminary analysis of shellfish and fish remains from the later stone fort (2<sup>nd</sup>–4<sup>th</sup> century AD) suggests that large fish (e.g., *Silurus glanis*, *Cyprinus carpio*, *Esox lucius*) and shellfish (e.g., *Unio crassus*) played a significant role in the diet. At the same time, Mediterranean species such as the European flat oyster (*Ostrea edulis*) and the banded dye-murex (*Hexaplex trunculus*) appeared among the finds.

## INTRODUCTION

One of the most important monuments testifying to the permanent military presence of the Romans on the territory of present-day Slovakia is the Roman fort in Iža. It was built on a strategic site near the confluence of the Danube and Vár rivers, as a bridgehead of Brigetio, the headquarters of the first auxiliary legion (Fig. 1). The fort controlled the adjoining section of the empire border and provided defense for the foreland of Brigetio (Bartus *et al.* 2022; Rajtár 2000). Besides their military-strategic function, Brigetio and Iža played an important role in cross-border and long-distance trade (Kuzmová/Rajtár 2017, 7). Two main phases of development have been recognized: first, a brief phase with an earth-and-timber camp during the Marcomannic wars (175–179 AD) and the second, spanning the subsequent period of the existence of the stone fort (2<sup>nd</sup>–4<sup>th</sup> century AD). They differ not only in the circumstances of their establishment and duration but also in the quantity and quality of finds and the information obtained by the archaeological research (Hajnalová/Rajtár 2009, 195). The earth-and-timber camp was built as a permanent frontier fortification, whose military garrison – most likely formed of cavalry units of archers – was tasked with overseeing compliance with the terms of peace between Romans and Germans (Quadi) and protecting the adjoining section of the border from sudden invasion (Rajtár 2000, 36). The camp was destroyed by fire after an unexpected attack in around 179. Before the construction of the new stone fort, during the reign of Emperor Commodus, original structures were levelled, so all finds from the early phase of the fort's existence can be reliably dated between 175 and 179 AD (Rajtár 1992).

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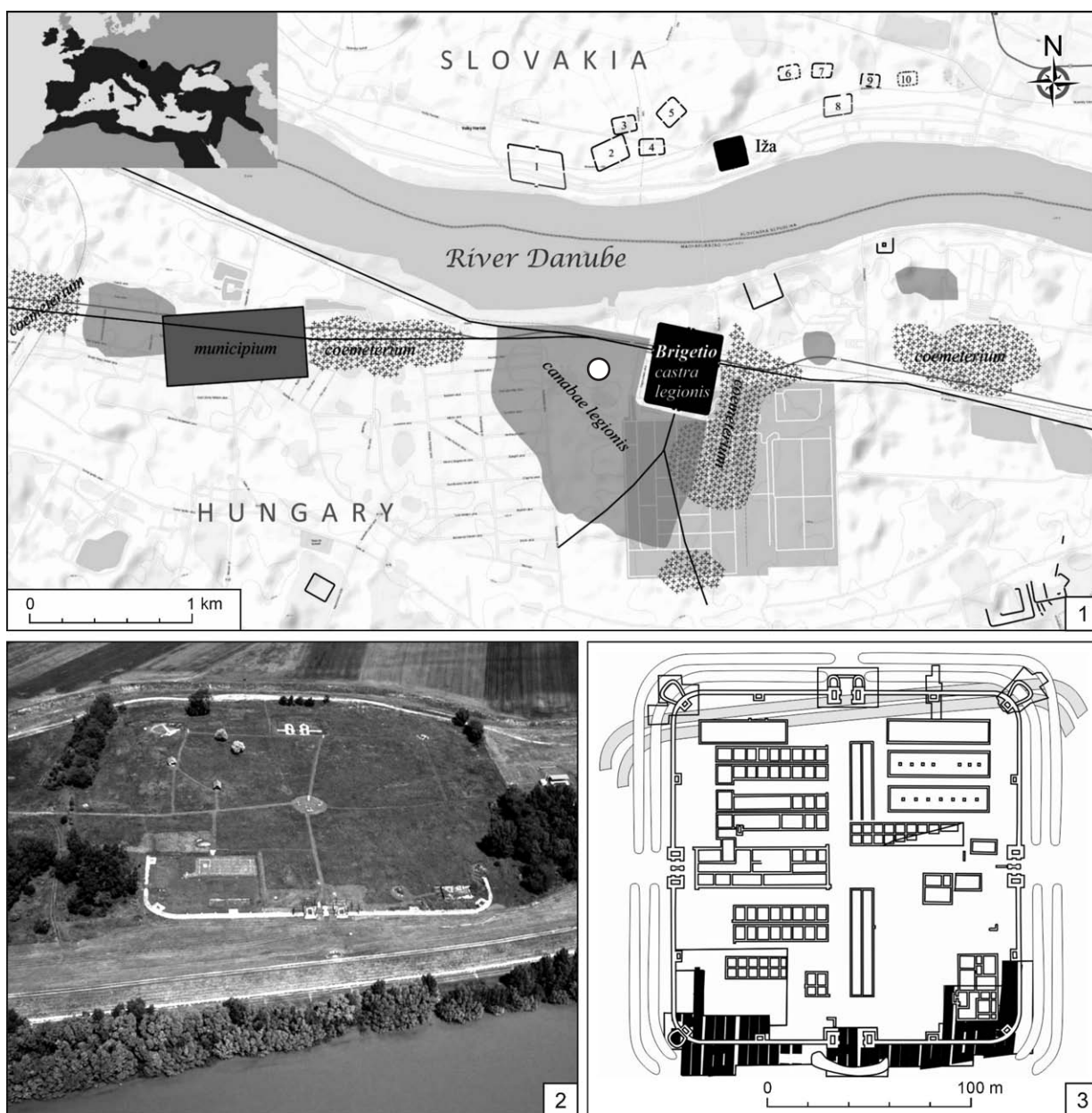


Fig. 1. Iža, Leányvár. 1 – location of the Roman fort as a bridgehead of Brigetio; 2 – an aerial view of the fort remnants (National Cultural Monument and UNESCO site); 3 – ground plan of the stone fort and parts of the earth-and-timber camp (areas filled with black; source: archive of the AI SAS).

Since 1978, the site has been systematically investigated by researchers from the Institute of Archaeology in Nitra under the leadership of J. Rajtár, together with late colleagues T. Kolník and K. Kuzmová (*Buranská/Kolník/Rajtár 1980; Kolník 1977; Rajtár 1981*).<sup>2</sup> Despite multiple re-buildings and re-adjustment phases, the excavation has yielded rich evidence on its architecture and inner life and helped to clarify the chronology of the site complicated by the lack of clear contexts and undisturbed layers (e.g. *Kuzmová 2020; Kuzmová/Rajtár 1986; 2010; Rajtár 2000*). Many architectural elements, pottery, parts of military equipment, clothing, coins, tools, or decorative objects made of iron, bronze, precious metals, glass, bone, antler or stone have been revealed and partly analysed (e.g. *Daňová 2012; Hrnčiarik 2017; Chrastina 2003; Rajtár 1987; Šimunková 2013; Švaňa 2012*).

<sup>2</sup> For the full list of excavation reports see the yearbook AVANS published by the Institute of Archaeology of the Slovak Academy of Sciences in Nitra and the references in *Daňová 2021*.

In the past, the ecofacts were systematically collected and analysed to shed more light on the military diet and provisioning the garrison with fuel and building materials. The archaeobotanical research has also provided a glimpse into the natural environment of the fort and testified it's warm and dry, deforested hinterland suitable for cultivating crops and/or grazing of domestic livestock (Čejka/Hajnalová 2000; Hajnalová/Rajtár 2009). Similar to pottery, the use of local and non-local materials was recorded, suggesting that some of the fuel or building wood might have been rafted downstream from Noricum and Raetia (Hajnalová/Rajtár 2009, 198). The cereal and pulse crops together with livestock were probably imported from the opposite bank of the Danube (Hajnalová/Rajtár 2009, 202). This paper aims to extend the present knowledge with information obtained by analyses of animal remains. Several local researchers have been involved in studying bone and shell remains from Iža. Besides the basic taxonomic and anatomical identification, they provided information on the sex and age (at death) of the consumed animals, the nature of bone modification or the size of the animals. However, for decades they remained unpublished and unassessed. We have therefore decided to make them available to the professional public on the occasion of the jubilee of the head of the archaeological excavations in Iža, Ján Rajtár. His genuine interest in animal remains and results of archaeozoology never ended only with the findings from the Roman fort.

### ARCHAEOZOOLOGICAL MATERIAL AND ITS RECOVERY

The majority (ca. 80–90%) of analysed animal bones and shells in Iža originate from contexts datable to the earth-and-timber camp phase and were retrieved between 1984 and 1996.<sup>3</sup> The archaeofaunal remains retrieved before this date, if there were any, have not been reported or analysed. The collecting of samples at sporadic excavations between 1997 and the present day (Beljak/Rajtár 2007; Benková/Gere/Rajtár 2017; Kuzmová/Rajtár 1999) followed the strategy from previous years and focus on macroscopically visible remains. The majority of bone or shell finds retrieved recently are associated with the stone fort and none has yet been analysed.

There are two types of faunal materials available from the excavations in Iža – one comprising the hand-collected specimens and another the finds retrieved during flotation from the soil (archaeobotanical) samples. The field retrieval of both had been supervised by the senior archaeologist(s) and focused on easily recognizable concentration or solitary bones and teeth of the vertebrates. The molluscs' shells and larger fish bones were also hand-collected and recorded separately in the field.<sup>4</sup> The microfaunal remains including the fish scales, tiny fragments of larger bone elements, bird and small rodent remains, small molluscs shells, remains of insects, a burnt matter of animal origin were sorted out under the microscope from both, light (flot) and heavy (residue) fractions (Hajnalová 1986).<sup>5</sup> The hand-retrieved as well as flotation samples were all catalogued, including available contextual information (e.g. feature, sector, layer, date of excavation, and dating). The area of the fort was divided into smaller sections (sectors of 5 × 5 m) marked with alphabet letters and Arabic numbers (Fig. 2). For easier orientation, the buildings of the earth-and-timber camp were marked with Arabic and the stone fort with Roman numbers. As noted above, the fish remains, shells and bone/antler artefacts were sorted out from original bone samples, and catalogued/stored separately. Most of the material had been washed, cleaned, and dried in the course of the excavation seasons.

It needs to be mentioned that part of the hand-retrieved specimens from the research period 1984–1990 were discarded.<sup>6</sup> This may have been primarily related to small unidentifiable fragments, perhaps mostly parts of ribs, skulls, vertebrae, and other highly fragmentary parts of the skeleton. In the 70ties and 80ties, this was a common practice of C. Ambros, who was at that time in charge of the bone analysis in Nitra. Fortunately, other specialists avoided this kind of treatment, and so the integrity of some of the samples has been preserved.

The archaeofaunal finds were temporarily stored at the field base in Iža and later on moved to the deposits of the Archaeological Institute in Nitra. The finds that had been sorted out, for instance, hand-collected fish and shell remains from the excavations between 1981 and 2005, are stored in two separate boxes.

<sup>3</sup> J. Rajtár, pers. comm. 2024.

<sup>4</sup> J. Rajtár, pers. comm. 2024.

<sup>5</sup> M. Hajnalová, pers. comm. 2024.

<sup>6</sup> J. Rajtár, pers. comm. 2024.

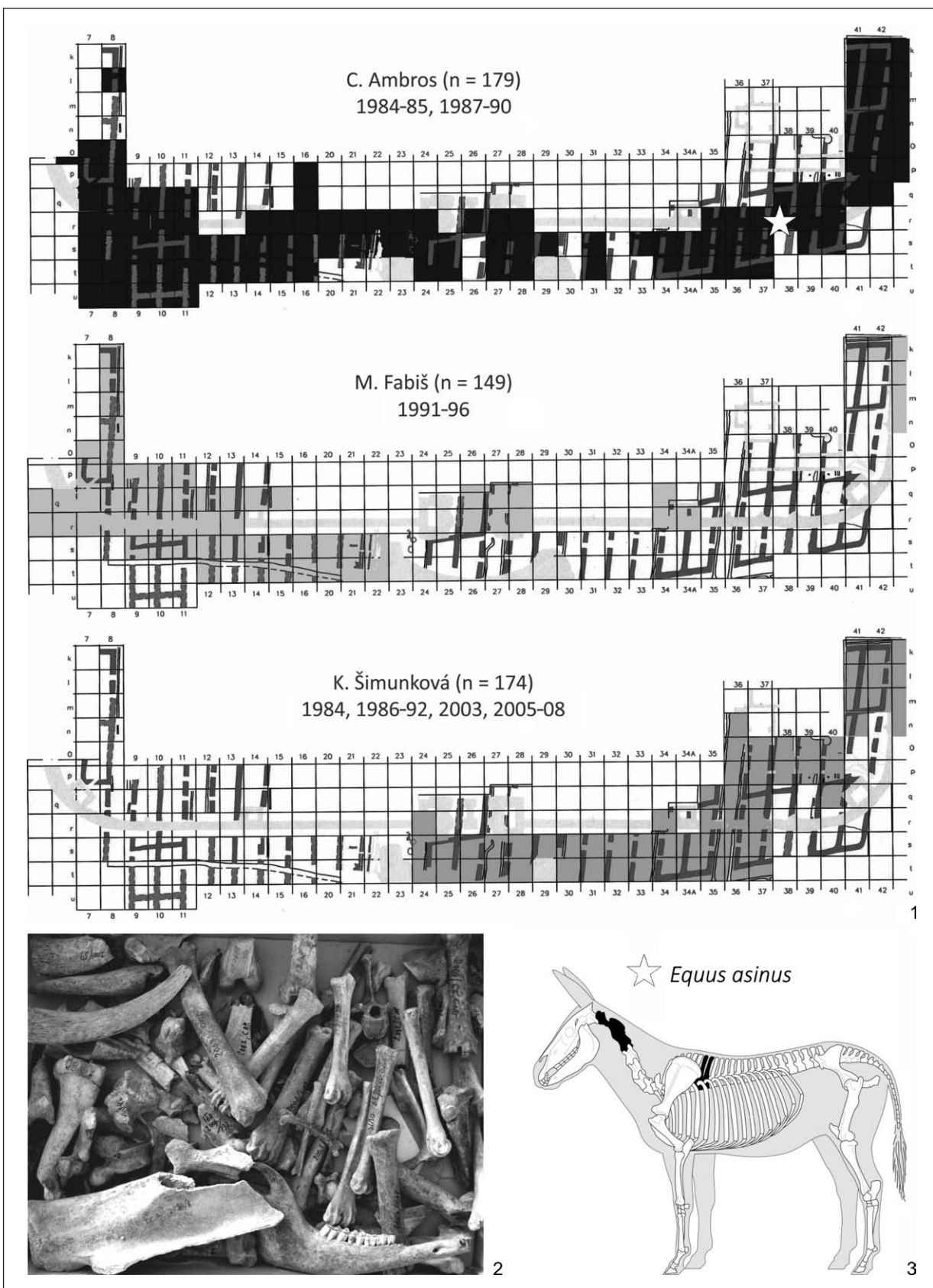


Fig. 2. Iža, Leányvár. 1 – a plan of the earth-and-timber camp with archaeozoologically analyzed areas and the name of the bone expert, number of processed samples (n), and years of excavation; 2 – a selection of the measurable bones; 3 – vertebrae of a donkey found in one of the barracks' interiors (see star in the first site plan). Source: archive of the AI SAV; photo by Z. Bielichová.

## HISTORY OF ARCHAEOZOOLOGICAL RESEARCH

The analysis of archaeofaunal remains from Iža had been dependent on the requirements of the archaeologists. In the past, several bone and shell experts from the Slovak Academy of Sciences (SAV) and Comenius University in Bratislava (UK) participated in their analysis. The first information was provided by C. Ambros (Archaeological Institute SAV, Nitra), who examined 20 hand-retrieved samples collected during the 1984 and 1985 excavations (Ambros 1986). He provided basic data including the taxa, the anatomy, and (whenever possible) the age at death and sex for 1285 bone and shell specimens (Ambros 1986, 30). Using the Number of Identified Specimens (NISP) quantification, he also provided the summary tables with information on the relative representation of identified taxa and domestic species (Ambros 1986, 30). No metrical data has been attached to the report. Ambros returned to animal remains from Iža again in the early 1990s. He processed a further 159 hand-retrieved samples of the four excavation seasons 1987–1990 (Ambros 1988; 1990a; 1990b; 1991a) and significantly enlarged the overall number of the analysed material, the majority of which is connected the earth-and-timber phase contexts (Fig. 2).

The short evaluation of the primary data collected by Ambros remained only in the form of an unpublished manuscript (Ambros 1991b).<sup>7</sup> It presents the first trends observed in the taxonomic and anatomic representation and comments on the age-at-death and size of the main economic species reconstructed based on dental ageing and the standard measurements (Driesch 1976). Some of the observations Ambros compared to the contemporary Roman-provincial sites from Germany. Although very briefly, he also addresses paleopathology. More importantly, the summary tables, using two quantification methods – Number of Identified Specimens NISP and Minimum Number of Individuals MNI (Ambros 1991b, tab. 1–6) and a complete list of bone measurements were provided (Ambros 1991b, tab. 7). One of the greatest draw-backs of this manuscript is absence of detailed description of the methods, used for instance in the evaluation of the body parts (missing classification of considered skeletal elements) and the slaughter age of livestock (no methods cited). This manuscript as well as all partial unpublished reports omit the issues of taphonomy, except for a few general statements on the preservation and fragmentation of bones.

During the 90ties, a small selection of shells retrieved from the earth-and-timber layers was analysed by J. Šteffek (Institute of Forest Ecology SAV, Banská Štiavnica – Zvolen), and its taxonomic determination was briefly reported (Šteffek 1991). Some of the fish bones were taxonomically determined by K. Hensel (Faculty of the Natural Sciences, UK, Bratislava) (Balon 1995, 31, 32), who later published the most interesting specimens (Hensel 2004). The involvement of these two specialists stimulated more meticulous excavation techniques and handling of the finds. Both types of archaeofauna were given special attention already in the field – by the naked eye recognizable fish bones and molluscs were packed and separated from other ecofacts already in the field (see above). However, the studied and published information represents only a fraction of available fish bones and molluscs material.

After 1991, the study of archaeofauna was overtaken by other researchers. Few bone artefacts have been determined to taxa and elements by J. Konč (Archaeological Institute SAV, Nitra) (Konč 1991). Following the work of Ambros, another 149 bone samples from the earth-and-timber contexts have been studied by M. Fabiš (Archaeological Institute SAV, Nitra). According to the preliminary dating of the material, three of the 149 samples represent the stone fort, and eight samples represent the earth-and-timber or stone fort (in total 7% of all processed). A similar admixture of the samples from later phases (3<sup>rd</sup>–4<sup>th</sup> century) is presumed for the material processed by Ambros. Unfortunately, many results retrieved by Fabiš remained unpublished, although a summary table with the taxa representation, based on NISP and WISP (Weight of Identified Specimens) quantification methods, and the list of measurements became available (Fabiš 2008). He processed circa two thousand hand-retrieved specimens from the 1991–1996 seasons. Probably around the same time, he also studied a collection of bone and antler artefacts to determine the source of the tools, decorative and other objects from both phases of the site's occupation (Fabiš 2006).<sup>8</sup>

In the late 1990s, the study of mollusc shells from the flotation samples was carried out by T. Čejka (Botanical Institute SAV, Bratislava). In cooperation with E. Hajnalová (Archaeological Institute SAV, Nitra), who reviewed the archaeobotanical findings from the site, they published a contribution to the reconstruction

<sup>7</sup> The manuscript has been kindly provided by J. Rajtár.

<sup>8</sup> Summary tables of his unpublished report have been kindly provided by J. Rajtár.

of the past environment and plant food and building materials supply to the fort (Čejka/Hajnalová 2000). A more comprehensive assessment of the ecofacts from Iža as well as interpretations concerning the supply and subsistence of the troops stationed in the earth-and-timber camp and the stone fort was presented in the contribution of M. Hajnalová and J. Rajtár (Hajnalová/Rajtár 2009). The charcoal analysis has shown that a substantial part of wood used as timber must have been transported from distant regions, most probably by rafting down the large rivers (Hajnalová/Rajtár 2009, 201). The article also presents some of the unpublished results of past archaeozoological research (compiled by J. Rajtár), highlighting for the first time the striking dissimilarities between Iža and other military sites in Pannonia and the western provinces. The authors also discussed some results related to the animal body parts and ageing introduced by Ambros (Ambros 1991b; Hajnalová/Rajtár 2009, 202, 203).

Under the supervision of M. Hajnalová (Department of Archaeology, Constantine Philosopher University, Nitra), the archaeofaunal remains from Iža have been revisited in a master thesis project (Šimunková 2013). Joining two lines of evidence – pottery, and bones, the work of K. Šimunková focused on the analysis of Roman domestic pottery and the archaeofauna from the eastern area of the earth-and-timber camp which has been destroyed by fire and was preserved *in situ*. The main aim was to contribute to the information about the soldiers' diet and supply of food and pottery to the site. The typological analysis aimed at determining the function of different types of pottery and their use for cooking and serving dishes. Using NISP, WISP, and DZF (Diagnostic Zone Fragment) quantification methods, the representation of main economic taxa and their body parts was compared among barracks and alleyways between them. The most important contribution of this unpublished work is a joint interpretation of archaeological and archaeozoological data that offers new insights into the nature of food, its preparation, and the way of dining (Šimunková 2013, 57–62). Šimunková re-analyzed 174 bone samples and circa seven thousand specimens and included some of the more standardized methods, for instance for collecting dental data (e.g. Payne 1973) or evaluation of meat value of bones and its distribution in excavated areas (Uerpmann 1973, 316).

Most recently, the bone and antler artefacts from Iža have been studied by E. Hrnčiarik (Department of Classical Archaeology, Trnava University), who in cooperation with É. David (CNRS, UMR 7194 HNHP – Histoire naturelle de l'Homme préhistorique) re-analysed some of the finds, previously reported as made of ivory (David/Hrnčiarik 2021; Hrnčiarik 2017).

## PRELIMINARY RESULTS

As already mentioned, most of the findings presented here are from the earliest phase of the Roman military occupation of Iža. They are associated with the earth-and-timber camp – especially its southern part. Here were uncovered the well-preserved remains of (burned down) garrison barracks and the spaces (alleyways) between them (Fig. 2). Uniquely these contexts and all associated material come from a very short interval spanning only a few years (175–179 AD).

It needs to be noted again that the animal remains from a subsequent occupation phase(s) of the stone-built *castellum* from the 3<sup>rd</sup> to the 4<sup>th</sup> century AD, were not yet fully studied, except for a selection of fish and shellfish finds (see below).

### Faunal composition

The information on the assortment and proportions of recovered taxa in the assemblage is based on thousands of bones and teeth from the studied contexts (Table 1). Identified specimens reached 55.7% in a study of Ambros (NISP = 3852), 75.5% in Fabiš (NISP = 1630) and 89.3% in Šimunková (NISP = 6270). Despite evaluating different assemblages (Fig. 2) and applying different quantification methods, all three authors recorded similar species composition. In general, mammals predominate the studied samples, while birds, fish, or shellfish occur in low numbers. The majority of processed remains belong to domestic species, making up from 75% (by DZF) to 99.4% (by WISP) of the total, depending on the assemblage (author) and quantification used. The remains of wild taxa make up from 0.3% (by WISP) to 7.2% (Fig. 3; by DZF).

Plausibly attested among the hand-retrieved finds were horse (*Equus caballus*), cattle (*Bos taurus*), sheep (*Ovis aries*), goat (*Capra hircus*), pig (*Sus domesticus*), dog (*Canis familiaris*), hare (*Lepus europeus*), wild boar

Table 1. Iža, Leányvár. The earth-and-timber camp. The representation of animal taxa according to bone expert and quantification methods. DZF – diagnostic zone fragment; NISP – number of identified specimens; MNI – minimum number of individuals; WISP – weight of identified specimens (data from Ambros 1991b; Fabiš 2008; Šimunková 2013).

| Taxa                                 | C. Ambros   |            |            |            | M. Fabiš    |            |                |            | K. Šimunková |            |                |            |            |              |
|--------------------------------------|-------------|------------|------------|------------|-------------|------------|----------------|------------|--------------|------------|----------------|------------|------------|--------------|
|                                      | NISP        | %          | MNI        | %          | NISP        | %          | WISP           | %          | NISP         | %          | WISP           | %          | DZF        | %            |
| Horse, <i>Equus caballus</i>         | 5           | 0.1        | 1          | 0.8        | 2           | 0.1        | 352.0          | 2.3        | 1            | 0.0        | 20.3           | 0.0        | 1          | 0.8          |
| Equid, Equidae indet.                | .           | .          | .          | .          | 3           | 0.2        | 55.0           | 0.4        | .            | .          | .              | .          | .          | .            |
| Cattle, <i>Bos taurus</i>            | 272         | 7.1        | 6          | 4.8        | 189         | 11.6       | 3403.7         | 22.1       | 415          | 6.6        | 14982.4        | 20.2       | 7          | 5.3          |
| Caprines, <i>Ovis/Capra</i>          | 2139        | 55.5       | 61         | 49.2       | 1075        | 66.0       | 5301.8         | 34.4       | 3930         | 62.7       | 37694.3        | 50.8       | 64         | 48.9         |
| Sheep, <i>Ovis aries</i>             | .           | .          | .          | .          | 159         | 9.8        | 2201.6         | 14.3       | .            | .          | .              | .          | .          | .            |
| Goat, <i>Capra hircus</i>            | .           | .          | .          | .          | 97          | 6.0        | 1188.8         | 7.7        | .            | .          | .              | .          | .          | .            |
| Pig, <i>Sus domesticus</i>           | 1315        | 34.1       | 41         | 33.1       | 313         | 19.2       | 2734.7         | 17.8       | 1646         | 26.3       | 20629.8        | 27.8       | 41         | 31.3         |
| Dog, <i>Canis familiaris</i>         | 1           | 0.0        | 1          | 0.8        | 1           | 0.1        | 2.7            | 0.0        | 16           | 0.3        | 113.6          | 0.2        | 1          | 0.8          |
| Chicken, <i>Gallus domesticus</i>    | 74          | 1.9        | 11         | 8.9        | 29          | 1.8        | 38.1           | 0.2        | 119          | 1.9        | 171.4          | 0.2        | 10         | 7.6          |
| Pig/wild boar, <i>Sus</i> sp.        | .           | .          | .          | .          | 2           | 0.1        | 44.0           | 0.3        | .            | .          | .              | .          | .          | .            |
| Bird, Aves indet.                    | 7           | 0.2        | .          | .          | 1           | 0.1        | 0.4            | 0.0        | 6            | 0.1        | 5.4            | 0.0        | 1          | 0.8          |
| Small rodent, Rodentia               | .           | .          | .          | .          | 5           | 0.3        | 2.4            | 0.0        | .            | .          | .              | .          | .          | .            |
| Hare, <i>Lepus europaeus</i>         | 2           | 0.1        | 1          | 0.8        | 1           | 0.1        | 0.6            | 0.0        | 7            | 0.1        | 10.3           | 0.0        | 1          | 0.8          |
| Wild boar, <i>Sus scrofa</i>         | .           | .          | .          | .          | 3           | 0.2        | 44.0           | 0.3        | .            | .          | .              | .          | .          | .            |
| Red deer, <i>Cervus elaphus</i>      | 1*          | 0.0        | 1*         | 0.8        | 2?          | 0.1        | 17.6           | 0.1        | .            | .          | .              | .          | .          | .            |
| Roe deer, <i>Capreolus capreolus</i> | 1           | 0.0        | 1          | 0.8        | .           | .          | .              | .          | .            | .          | .              | .          | .          | .            |
| Fish, Pisces                         | 31          | 0.8        | .          | .          | 4           | 0.2        | 5.0            | 0.0        | 3            | 0.0        | 0.8            | 0.0        | 1          | 0.8          |
| Shellfish, Mollusca                  | 5           | 0.1        | .          | .          | .           | .          | .              | .          | 4            | 0.1        | 23.9           | 0.0        | 2          | 1.5          |
| Small mammal, indet.                 | .           | .          | .          | .          | .           | .          | .              | .          | 9            | 0.1        | 7.96           | 0.0        | 1          | 0.8          |
| Medium sized mammal, indet.          | .           | .          | .          | .          | .           | .          | .              | .          | 114          | 1.8        | 516.28         | 0.7        | 1          | 0.8          |
| <b>Total determinate</b>             | <b>3852</b> | <b>100</b> | <b>124</b> | <b>100</b> | <b>1630</b> | <b>100</b> | <b>15392.4</b> | <b>100</b> | <b>6270</b>  | <b>100</b> | <b>74176.4</b> | <b>100</b> | <b>131</b> | <b>100.0</b> |
| Determinate total                    | 3852        | 55.7       | 124        | 100        | 1630        | 75.5       | 15392.4        | 93.1       | 6270         | 89.3       | 74176.4        | 97.1       | 131        | 99.2         |
| Indeterminate total                  | 3064        | 44.3       | .          | .          | 529         | 24.5       | 1145.0         | 6.9        | 753          | 10.7       | 2233.2         | 2.9        | 1          | 0.8          |
| Total                                | 6916        | 100        | 124        | 100        | 2159        | 100        | 16537.4        | 100        | 7023         | 100        | 76409.6        | 100        | 132        | 100          |

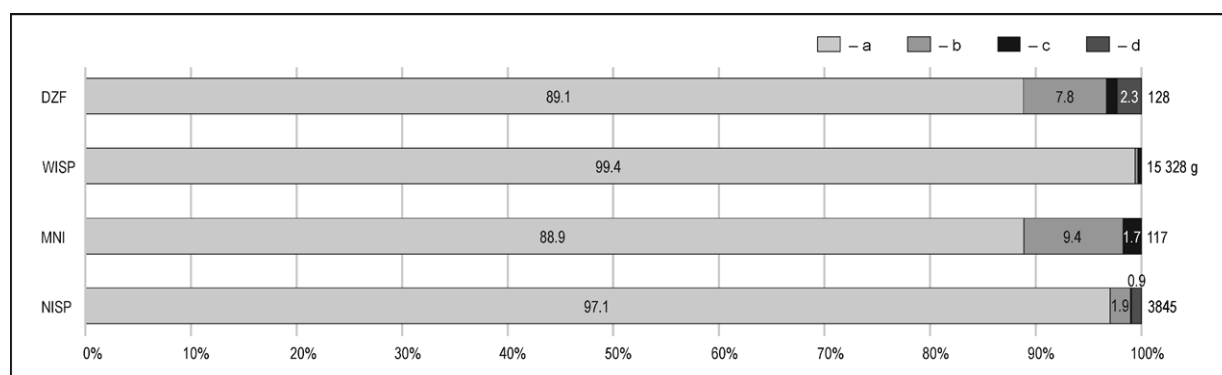


Fig. 3. Iža, Leányvár. The earth-and-timber camp. The abundance of taxa on the basis of different quantitative methods (see Table 1). Legend: a – domestic mammal; b – chicken; c – wild mammal (small rodent and antlers excluded); d – fish/shellfish.

(*Sus scrofa*), roe deer (*Capreolus capreolus*), chicken (*Gallus domesticus*), fish (Pisces) and shellfish (Mollusca). Based on different quantification methods, the overall representation of main economic species in the earth-and-timber assemblage shows no significant differences, except for the weight (Fig. 4). Circa half of the identified specimens are caprines (from 56.5% by MNI to 58.6% by WISP). Among anatomically determined finds, the sheep was represented by ca. 60% and goat by ca. 40% (Fabiš 2008). The second most common species is the domestic pig (from 18.4% by WISP to 37.9% by MNI). The MNI values suggest that beef was only an

occasional dish (5.6%). The highest proportion of cattle remains (23%) was indicated by the weight of bones.

Two more species – red deer (*Cervus elaphus*) and domestic ass (*Equus asinus*) – have been reported (Ambros 1986, 30; 1991), but their presence could not be attested plausibly either because only elements (antlers) not related to the diet were present or due to the obstacles to verify the finding (missing bag sample<sup>9</sup>). According to Ambros, three cervical and two thoracic vertebrae of a donkey were present in the material, of which the first – *atlas* – showed clear signs of chopping (Ambros 1986, 16). The report indicates that, the vertebrae originated from the interior of a garrison barrack in sector 38/r and were uncovered at a depth of 180–200 cm in 1985 (Fig. 2: 1, 3). Although without indicating the element, also Fabiš identified the equid remains (Table 1; Fabiš 2008) and supported the idea of a donkey or its crossbreeds with a horse in the camp. The donkey vertebrae would be the earliest evidence of a donkey (or mule?) in the territory of Slovakia (Fabiš/Bielichová 2014, 174, 175). While being of similar use as pack animals, the donkey was also used in gastronomy and medicine. The mules were important working animals for the military troops, used as pack animals or to pull heavy artillery such as catapults (Mitchell 2018). Probably half a million of these animals served in the Roman army by the time of Augustus (31 BC–14 AD), but yet they remained elusive in the archaeological record (*ibid*). While their osteological identification can be problematic, the morphometric and DNA studies prove that mules comprised a fairly large proportion of equids in Pannonia (e.g. Bilal Sharif *et al.* 2022). Horses were the elite animals and their frequent employment in the military services has been attested through archaeogenetics (Bilal Sharif *et al.* 2022, fig. 1; 6). In Iža, the horses occur in low numbers (Table 1), suggesting their secondary use in the meat provisioning of military garrison. The four teeth and a single scapula specimen were identified (Ambros 1991b, tab. 3). A few more horses remains, including measurable scapula and patella have been reported by other researchers (Fabiš 2008; Šimunková 2013).

Similarly rare were the dog remains. A single mandible is reported by Ambros (1991, tab. 3) and further specimens (NISP = 16) by Šimunková (2013, 53, tab. 7). In Iža, a sporadic presence of this species cannot be taken as evidence that the dog flesh had been consumed, although it cannot be completely excluded. According to the observations made by Ambros, there were hardly any records of traces of dog bites on bones (Ambros 1991b, 3; see below) which may indicate the rare presence of these animals in the camp or the organized discard of food remnants and keeping of dogs away from the area. In the contexts of the Roman period and the geographic location of the site, a relatively large number of chicken bones has been identified (1.9% by NISP to 8.9% by MNI). Regarding the knowledge about the bird's domestication (e.g. Kysely 2010) and its rarity at barbaric settlements, the number of its bones in Iža is noteworthy. During the Iron Age and the Roman period, the chicken was more likely to be found at the burial sites, probably as a part of a culinary/symbolic offering to the deceased (Bielichová 2019a, tab. 7; 2019b, tab. 3). Therefore, it is possible that the consumed chicken was supplied to the camp from the Roman-provincial sites in Pannonia or they were kept in the camp to produce eggs. It is also possible that their importance was even greater than indicated by the quantification analysis, as the small and gracile elements have a smaller chance of being preserved and thus, revealed in the hand-collected samples.

A low number of wild taxa shows that the share of the game was minimal and the meat consumed occasionally. The hare was identified by all researchers, of which two radii were specified by Ambros (Ambros 1991b, tab. 1; 3; Fabiš 2008; Šimunková 2013, tab. 7). Ambros also identified a single tarsal bone of a roe deer

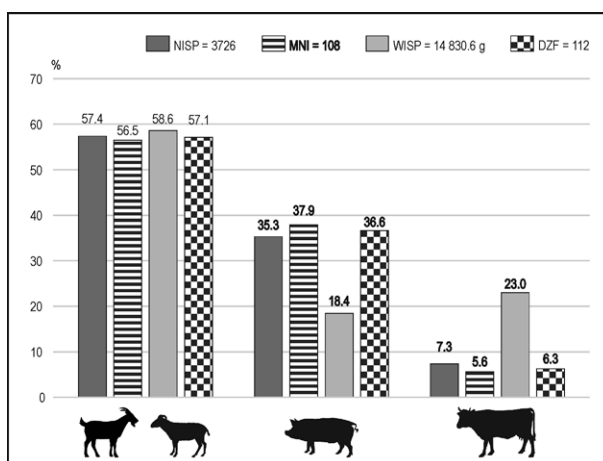


Fig. 4. Iža, Leányvár. The earth-and-timber camp. The representation of the main domestic species based on different quantitative method (see Table 1).

<sup>9</sup> The current location of the animal bone finds from the 1984 and 1985 excavation seasons remains unknown, nevertheless, some of the samples were found mixed in the bone storage (a single banana-box destroyed by the nest of a marten), but the bag with the donkey vertebrae was missing.

and one fragment of red deer antler (Ambros 1991b, tab. 3). The measurable humerus and ulna of a wild boar have been reported by Fabiš, but their context is unclear (Fabiš 2008). Fabiš also reported two bones of a red deer, but the bone anatomy is unknown (*ibid*). All recorded taxa are common to the wild fauna of the warm Danube plain (Krištofík/Danko 2012).

As for the unidentified bird bones (NISP = 7), Ambros argues that „*although it was not possible to identify them more precisely, they most probably belong to species of water birds that lived on the banks of the Danube*“ (Ambros 1991b, 3). The large river also offered an ample variety of culinary valuable fish. The rarity of their remains in the analysed hand-retrieved samples was reported by all researchers (Table 1). This can be explained by the recovery methods and further, by the separation of fish bones and molluscs from other material before the analysis (see section dealing with methods).

### Representation of body parts

Based on the identification of skeletal elements of present species, the question of meat supply to the camp has been addressed (Ambros 1991b, 3, 4, tab. 3; Šimunková 2013, 49–51, fig. 3–5). The standard approach, classifying the fragmentary specimens (elements) into skeletal portions (body parts) of the main economic mammals has been applied. Based on NISP quantifications, the balanced representation of meaty and meatless body parts of caprines, pigs, and cattle was attested. Except for the sternum and fibula, all skeletal elements have been represented in assemblage, suggesting that the animals were most probably supplied to the camp alive and slaughtered at the site (Ambros 1991b, tab. 3). The body parts with a low amount of meat, mainly

Table 2. Iža, Leányvár. The earth-and-timber camp. The representation of body parts according to the number of skeletal elements of main economic species (after Ambros 1991b, tab. 4).

| Body part           | Caprines |       | Pig  |       | Cattle |       |
|---------------------|----------|-------|------|-------|--------|-------|
|                     | NISP     | %     | NISP | %     | NISP   | %     |
| Skull               | 491      | 23.0  | 372  | 28.3  | 40     | 14.7  |
| Spine               | 182      | 8.5   | 55   | 4.2   | 43     | 15.8  |
| Forelimb            | 501      | 23.4  | 355  | 27.0  | 56     | 20.6  |
| Hindlimb            | 552      | 25.8  | 379  | 28.8  | 65     | 23.9  |
| Acropodium          | 413      | 19.3  | 154  | 11.7  | 68     | 25.0  |
| Total               | 2139     | 100.0 | 1315 | 100.0 | 272    | 100.0 |
| Of which autopodium | 811      | 37.9  | 387  | 29.4  | 118    | 43.4  |

the distal part of the limbs (*autopodium*), seem to predominate in cattle (Table 2; 43.4% of NISP), while in caprines (37.9%) and pigs (29.4%) are relatively common. This can suggest that ordinary soldiers rarely received better portions of meat (Ambros 1991b, 4). In the earth-and-timber camp, all body parts of meat suppliers had been exploited, including the meatless limb extremities or the horncores of herbivores. Their presence indicates their local slaughter or some interest of the soldiers in using them as a source of horn or glue (see below). The horn cores were present in all excavated barracks and plenty of them bear multiple chops and cut marks. As for chicken, an absence of the skull bones was observed (Ambros 1991b, tab. 3).

According to Ambros, the livestock was “*probably kept alive in the fort, as there were favourable conditions for it*” (Ambros 1991b, 4). Nevertheless, there is no archaeological evidence of structures for keeping livestock, stables, or artifacts connected with animal husbandry supporting his hypothesis and it remains unexplored in which part of the camp or for how long the animals were kept. Thus, the questions on the local raising of animals in Iža, although possible, remain unanswered. More probable seems the version of the shipment of goods including food and living animals along or across the Danube, which was possible either by boat (Hajnalová/Rajtár 2009, 203; Kolník 1978) or using a bridge connecting the later stone fort with Brigetio (more on recently discovered foundations of the bridge pillars see Daňová/Daňová/Sočuvka 2022).

### The spatial analyses

The analyses of the distribution of the main economic taxa and their body parts have suggested only minor differences in proportions within the investigated areas of the earth-and-timber camp (Šimunková 2013, 55, 56). According to the bones (NISP), five of the six barracks showed the predominance of caprines (Fig. 5). Their remains were also dominant in the alleyways. The second most abundant were pig bones, showing caprine and pork to represent a staple meat. However, the situation in barrack 1 was different. Here cattle and pigs dominated over caprines and chicken was more abundant. When the quality of caprine meat is compared

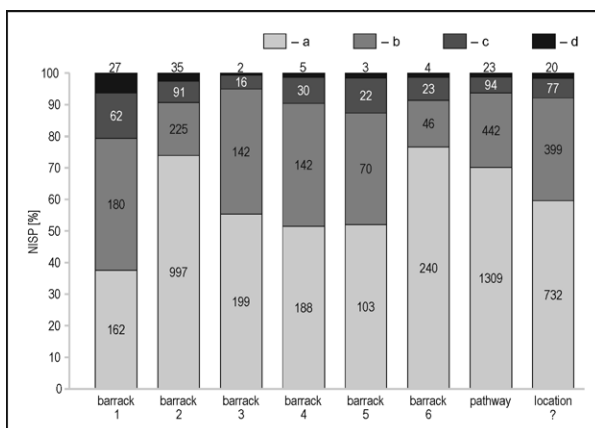


Fig. 5. Iža, Leányvár. The earth-and-timber camp. The spatial distribution of bones of main economic species in the barracks and alleyways (after Šimunková 2013, fig. 11). Legend: a – caprines; b – pig; c – cattle; d – chicken.

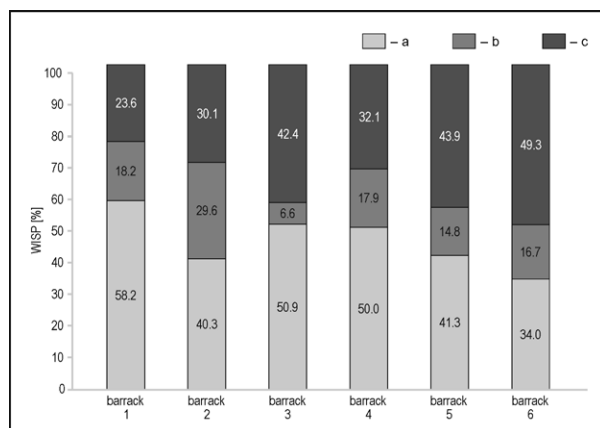


Fig. 6. Iža, Leányvár. The earth-and-timber camp. The spatial distribution of the caprines according to the bone anatomy and meat value. Legend: a – best; b – mid; c – poor quality of meat. Unpublished data by K. Šimunková.

based on the weight of bones (Fig. 6), in barrack 1 the elements bearing top-rated meat portions represented 58.2% of the total WISP. So, besides more “beef and pork” oriented dishes of the consumers, it seems that the sheep and goat meat of higher quality had been consumed in barrack 1. Behind observed results can be pre-and/or post-depositional processes (including the waste management in the camp), however, the differences can also reflect the dietary preferences of different groups among the garrison. It can be noted here that their military status, financial options, or health issues could all play a role in the catering. The preference for beef and pork was typical for the majority of the Roman military and civilian sites in the Middle Danube area (e.g. Choyke 2003, 227; Peters 1994, 49; Riedel 1993).

Regarding the most represented caprines, it has been found that the braincase, mandible, and ribs (category B) were not frequent in the barracks, but the meatless elements including facial bones, horn cores, metapodials, phalanges, and caudal vertebrae (category C) were, except for the barrack 1, abundant (ca. 30–50% of WISP). Their presence (or storage?) in the buildings can be explained by the use of these bones (e.g. metapodia) and horns (or hooves) for the production of tools, glue, or other utensils needed in the military or household (see also section dealing with the modifications). The (hand-retrieved) fish remains were reported only from the barracks interiors (Šimunková 2013, 56). This result is, however, distorted due to their sorting before the analysis and unfinished analysis (see below).

### The age and sex of domestic animals

The age-at-death of the main meat suppliers was recorded and evaluated by C. Ambros (1991b) and K. Šimunková (unpubl.). Ambros based his assessment on the dental eruption and attrition, however without indicating whether maxillary or mandibular teeth were considered and the method of quantification used (Table 3). He found that the caprines were slaughtered at various ages including the “young”, the adult as well as older individuals (Ambros 1991b, 4). According to the quantified cases, approximately 38% of sheep and goats died before reaching two years, half were killed between the second and second and a half year, and 12% died older than 5<sup>th</sup>–6<sup>th</sup> year (Ambros 1991b, tab. 5). This would mean a predominance of the young adult animals in or shortly after reaching the ideal meat yield, assumed

Table 3. Iža, Leányvár. The earth-and-timber camp. The dental ageing of main economic species. The legend of teeth eruption and wear stages: 0 = not erupted; + = light wear; ++ = medium wear; +++ = heavy wear (after Ambros 1991b, tab. 5).

| State of the tooth |        | Caprines | Pig | Cattle |
|--------------------|--------|----------|-----|--------|
| Pd4 +/-            | M1 –   | .        | 1   | .      |
| Pd4 +              | M1 +/- | 3        | 1   | .      |
| M1 +               | M2 –   | 4        | 1   | .      |
| M2 +/-             | .      | 3        | 2   | .      |
| M2 +               | M3 –   | 2        | 7   | .      |
| Pd unchanged       | .      | 3        | .   | .      |
| M3 +/-             | P +/-  | 7        | 7   | .      |
| M3 +               | .      | 29       | 20  | 1      |
| M3 ++              | .      | 6        | 1   | .      |
| M3 +++             | .      | 1        | 1   | .      |

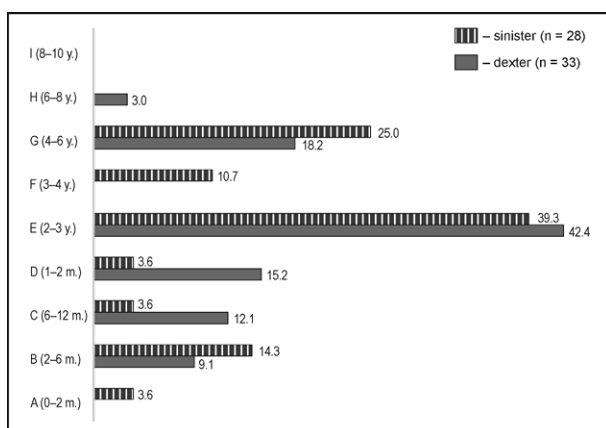


Fig. 7. Iža, Leányvár. The earth-and-timber camp. The mortality profile of caprines based on the Payne's classification (Payne 1973). Unpublished data (% of NISP) by K. Šimunková.

Table 4. Iža, Leányvár. The earth-and-timber camp. The sex determination of the most abundant domestic species (data from Ambros 1986, 1988; 1990a; 1990b; 1991a).

| Sex           | Cattle | Sheep | Goat | Pig | Chicken |
|---------------|--------|-------|------|-----|---------|
| Female        | 1?     | 5     | 4    | 50  | 7       |
| Male          | .      | 13    | 5    | 41  | 8       |
| Male/castrate | 1      | .     | .    | .   | .       |
| Castrate      | 1      | .     | .    | .   | .       |
| Total         | 3      | 18    | 9    | 91  | 15      |

(goats). The ratio derived from the sexually determined specimens, mostly horn cores (Ambros 1986; 1988, 1990a; 1990b; 1991a), suggested that in adult caprine, both male and female individuals were killed. The sex ratio was fairly balanced in goats, whereas in sheep males predominate (Table 4).

For cattle, the ageing and sexing data are scarce. A single assessed cattle molar indicated the killing of a subadult/adult individual between the 2<sup>nd</sup> and 4<sup>th</sup> year of age (Table 3). The occurrence of unfused epiphyses in cattle long bones, on the other hand, attests to consumption of tender meat of juvenile animals (e.g. Ambros 1986, 7; 1991a, 1, 3, 16, etc.). According to Ambros, measurable metacarpals represented one cow and one bull individual (Ambros 1991b). However, recent investigations in biometry of the Roman period cattle from southwestern Slovakia and adjacent areas have suggested that one of the metacarpals might belong to an ox and the other is questionable due to its extreme length reaching 230 mm (Ambros 1991b).<sup>10</sup> The only metatarsal bone was also big, comparable to the castrated Roman period oxen (Bielichová 2019b, fig. 17; 18). Pigs seem to be slaughtered mostly between their second and third year of life (Ambros 1991b, tab. 5). According to the quantified cases, approximately 46% of pigs were slaughtered before reaching their second and similar amount (49%) before reaching the third year of life (Ambros 1991b, 4). The remaining portion (5%) of the cull was older than three years.

In pigs, not only meat but also fat were important consumable products. The subadult or young adult pigs might have been purposely fattened up to suit the high soldiers' dietary demands. Such animals might have been a surplus of the local rural economies (e.g. Groot 2008; Groot et al. 2009) or feed in the military camp on food waste. The antique literary sources attest the cooked cured pork fatback (*lardum*; Fig. 8) was a popular military meat dish (more in Rzeźnicka 2014, 652). The information on the sex of pigs has been derived from the information on canine teeth (Ambros 1986; 1988, 1990a; 1990b; 1991a), attesting the presence of both, females and males in the assemblage. Their raw counts revealed a fairly balanced sex ratio, although the

in caprines between 1<sup>st</sup>–2<sup>nd</sup> years (Uerpmann 1973, 316). In archaeozoology, such a kill-off pattern points to meat-oriented husbandry or in the case of a military site, the seat of consumers. In the “production sites”, the multipurpose use of herbivores and bones of newborns is expected. In Iža, the bones of foetal and neonatal sheep and goats are absent. According to Ambros, the youngest sheep/goat individuals were killed between the 2<sup>nd</sup> and 6<sup>th</sup> month of age (Table 3).

A similar variable kill-off pattern is shown using Payne's criteria for dental ageing in caprines (Payne 1973). The unpublished data of 33 right and 28 left mandibles and isolated third molars, collected by K. Šimunková, attest predominance of adult caprines in the culled stock with the highest share (ca. 50%) of individuals killed between their second and third year (Fig. 7). However, the older animals, between their fourth and sixth year of age (ca. 20%) and the juveniles or subadults (ca. 25%) were also relatively frequent. According to this method, the infantile, younger than two months, and senile individuals older than 6 years occurred rarely. This points to a meat-oriented husbandry, with a possible exploitation of secondary products such as milk or wool. Considering a relatively high proportion of goat remains in the assemblage (ca. 40%), it can be hypothesized that the older animals could just represent the dairy females

<sup>10</sup> For the determination of gender in this particular specimen mentioned by Ambros, revision is needed in the future.

female pigs slightly predominated which is typical for rural “production” sites (Bökönyi 1984, 54). The higher occurrence of boars is interpreted as a well-organized and specialized system of pig breeding (Pucher 2008, 74–77).

Information on the chicken’s age and sex are scarce but can be derived from evidence of spur in tarsometatarsals and the measurements (Ambros 1986; 1988, 1990a; 1990b; 1991a). So far, the findings attest seven hens and eight roosters in the earth-and-timber assemblage (Table 4). According to ancient sources, Romans used to keep roosters in high numbers and use them also for cock-fighting – a popular pastime of the lower social strata (Bökönyi 1984, 94). Except for the spurs, the presence of females, the egg-laying hen, was indicated by the re-investigation of a couple of long bones stored in the laboratory of AI SAS in Nitra. Our revision revealed that two of four bones displayed a medullary bone typical for the female bird in lay.<sup>11</sup> The eggshell specimens, retrieved from the hand-collected samples also, showed a chicken-like thickness and size.<sup>12</sup> Based on their regular presence in the material and the presented medullary bone we can conclude that most possibly locally produced eggs formed a part of the soldiers’ diet.



Fig. 8. A popular military dish consisting of ring-shaped bread rolls (*buccellatum*), cooked cured pork fatback (*lardum*) and the mixed water-and-vinegar beverage with mint (*posca*). Source: <https://historicalitaliancooking.home.blog/english/recipes/the-diet-of-the-legionaries-buccellatum-lardum-and-posca/>.

### The morphology of domestic animals

The metric data from Iža were systematically collected and partly evaluated by C. Ambros and M. Fabiš. In addition, the non-metric, traits related to abnormal or pathological bone changes, were described and non-systematically recorded.

Based on the greatest length of the completely preserved bones reported by C. Ambros (1991, 5, 6) and M. Fabiš (2008), the withers’ height for horse, cattle, sheep, goat, and pig can be estimated (Table 5). Not surprisingly, most information has been collected for caprines and the sheep, which withers’ height ranged from ca. 57.7 to 75.6 cm, with an average of 67.5 cm (after Teichert 1975). Compared to sheep from Germanic settlements in southwestern Slovakia, where the scarce data on the withers’ height ranged from 68.8 cm to 69.6 cm (Fabiš/Bielichová 2014, 177), the adult sheep from Iža seems to be a bit smaller or representing the females. The sheep of similar or bigger size were reported for sheep kept in Pannonia (Bökönyi 1974). For instance, the sheep from TÁC-Gorsium had on average 69 cm in withers (Bökönyi 1984, 41). At the same site, a high percentage of hornless sheep was observed (27%), suggesting the import(s) of Italian-improved breeds and intensive cross-breeding in the provinces (Bökönyi 1984, 43). Interestingly, also in Iža the abundance of the hornless sheep was striking (Ambros 1987, 2, 46; 1988, 12, 27, 33; 1990, 21, 31), which can be considered as one of the results supporting the hypothesis of live animal supply from the opposite bank of the Danube.

For other species, the wither height estimation has been based on a much smaller number of measurable specimens – in goats eight elements indicated the withers height from 60.2 to 77.9 cm (after Schramm 1967) and for cattle, three measurements suggested the height between 126.4 and 138.3 cm, with the average of 131.9 (after Matolcsi 1970). Ambros stated the withers height of a horse is between 135.4 and 142.9 cm, with an

Table 5. Iža, Leányvár. The earth-and-timber camp. The estimation of the withers, heights of domestic mammals (compiled by the authors after measurements taken by Ambros 1991b; Fabiš 2008).

| WRH             | Horse | Cattle | Sheep | Goat | Pig  |
|-----------------|-------|--------|-------|------|------|
| Number of cases | 3     | 3      | 47    | 8    | 13   |
| Min. [cm]       | 135.4 | 126.4  | 57.7  | 62.9 | 63.5 |
| Max. [cm]       | 142.9 | 138.3  | 75.6  | 77.9 | 84.1 |
| Mean [cm]       | 140.0 | 131.9  | 67.4  | 71.3 | 74.4 |

<sup>11</sup> Bielichová, pers. observation.

<sup>12</sup> Bielichová, pers. observation. The list of hand-retrieved finds from all excavation seasons include also sorted out eggshell samples.

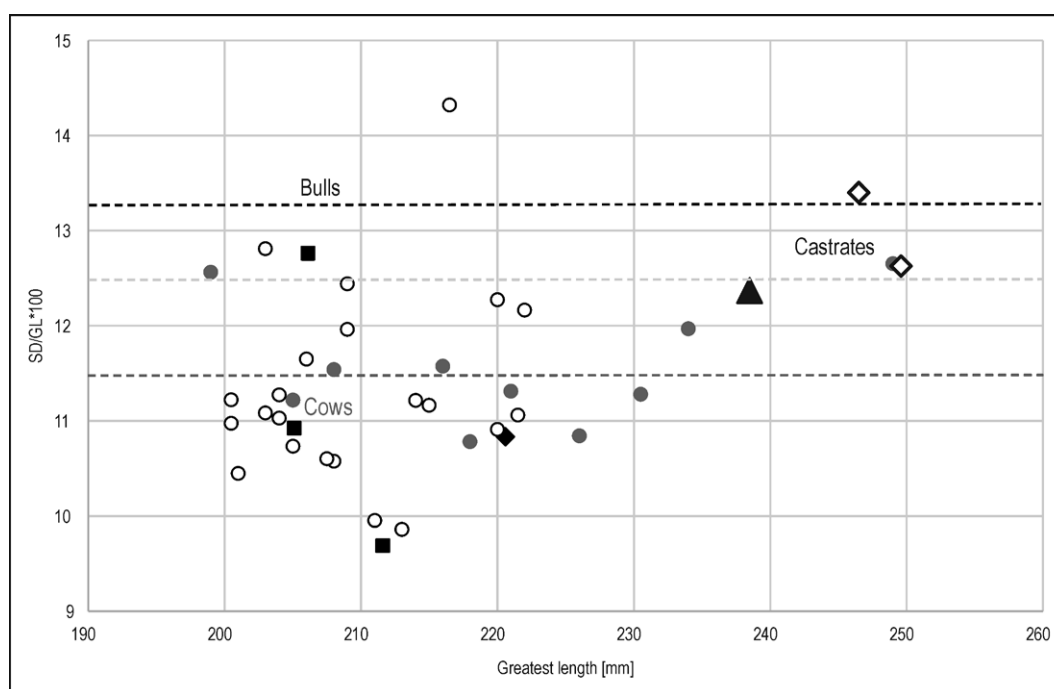


Fig. 9. The size of cattle metatarsals from selected Roman period sites. Legend: full triangle – cattle from Iža; white diamond – oxen from *villa rustica* in Nickelsdorf (Austria); other marks – individual from Germanic settlements in southwest Slovakia (for the names of the sites see original paper by Z. Bielichová). Dashed lines refer to the average size of a bull, a cow, and an ox from the Roman-provincial settlement at Tăc-Gorsium (Bökönyi 1984, 36). Abbreviations: SD – the smallest breadth of diaphysis; GL – the greatest length of the metatarsal. After Bielichová 2019b, fig. 18.

average of 140 (after Vitt 1952). A single pig metacarpus suggested the withers' height at 79.8 cm. A calculation based on the astragali (after Teichert 1969) enlarged the range from 63 to 84 cm, but this result needs to be taken with caution. Ambros compared his results with the data from the Roman-provincial sites located north of the Alps (e.g. Baas 1966; Bökönyi 1984; Dannheimer 1964; Kokabi 1982; Müller 1967; Piehler 1976; Sauer-Neubert 1968; Schmidt-Pauly 1980; Swegat 1976; Teichert 1990; Uerpmann 1977; Waldmann 1966) and stated that "domestic animals from Iža fall within the observed variation" (Ambros 1991b, 5). He also assumed that the livestock formed middle- to middle/large-sized animals, only "a bit larger than the average indigenous stock" (Ambros 1991b, 6). The research in Germanic domestic mammals from southwestern Slovakia (Bielichová 2019b; Fabiš 2003; Fabiš/Bielichová 2014) at least partly supported his observations. On the other hand, a comparison of metapodials showed that the cattle from Iža was significantly larger than the average barbaric cattle with the wither's height being estimated at 117 cm (Bielichová 2019b, tab. 10). A single cattle metatarsal from Iža fell within the range of castrated animals, being similar to the large-sized cattle form (or collections with predominant oxen) from the settlements in Štúrovo or Trnava (Fig. 9). This increase of the body size recorded at several Late Roman period sites from "the provincial-barbaric contact zone" is considered as a consequence of the improvement ("romanization") of Germanic lifestyle and husbandry regimes, which may include the import of new cattle breeds.

In horses, the original measurements are not available (Ambros 1991b, appendix), therefore it is hard to evaluate their size and morphology (Ambros 1991b, tab. 6). Nevertheless, the calculated withers height (135.4–142.9 cm) roughly corresponds to the small or mid-sized animals, which, however, seem to be larger than the horses of native populations (the average withers height at Veľký Meder settlement was 133.3 cm according to Fabiš/Bielichová 2014, 175), but smaller than a Roman military horse (the withers height from Al-bertfalva fort was 150–160 cm according to Lyubyanovics 2002). The size of the average horse in Iža (140 cm), however, corresponds well with an average horse of Tăc-Gorsium (139.1 cm according to Bökönyi 1984, 61).

Regarding the non-metric traits in animals other than caprines, Ambros reported several cases of dental anomalies in a pig, including oligodontia (Ambros 1986, 12; 1987, 8), a crowding of mandibular premolars



Fig. 10. Iža, Leányvár. The earth-and-timber camp. The wedge-shaped defect in the incisors of an adult cattle individual (after Ambros 1991b, abb. 1).

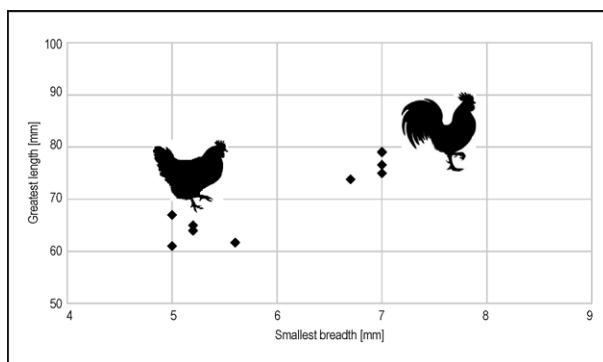


Fig. 11. Iža, Leányvár. The earth-and-timber camp. The sex and size of chicken. Compiled by authors on the basis of tarsometatarsals' measurements taken by Ambros 1991b and Fabiš 2008.

(Ambros 1987, 4, 14; 1990, 38) or further irregularities (Ambros 1987, 20). These used to represent inherited disorders related to the domestication process or advancement of the pig husbandry (Bartosiewicz 2013, 196, 197), but in Iža, the most important indicator for their evaluation within compared populations – the percentage of positive cases – was not yet reported. A single dental anomaly in cattle included the four isolated incisors of probably the same individual showing the wedge-shaped (cuneiform) defect (Ambros 1990, 16, 27). The teeth columns displayed deep grooves making them “look like intentionally shaped” (Fig. 10). According to Ambros, this condition is also frequently found in humans and can be classified as a developmental defect of dentin (Ambros 1991b, 5; Müller 1990).

The research at the Roman provincial sites in Hungary attested to the presence of two types of chicken – a smaller native one and an improved one, probably imported by the Romans (Bökönyi 1984, 93, 94). The knowledge of castration has been evidenced by the tarsometatarsal with rudimentary spurs, indicating the capons in the cull (Bökönyi 1984, 94). In Iža, a relatively large number of measurable bones allowed to assess the of chicken size and sex. There are two distinct groups, one representing hens and one rooster (Fig. 11). Comparing their size with the population in TÁC-Gorsium (Bökönyi 1984, fig. 44), it can be hypothesised that investigated specimens represent the smaller, native chicken type. Its provenance cannot be yet specified, as the data from so far analysed barbaric settlements within the region show only limited evidence on the consumption and keeping of chicken (cf. Bieličová 2019a; 2019b).

### The bone modifications

So far, the taphonomy of animal bone material from Iža has not been sufficiently studied. C. Ambros describes the bones in general as “mostly fragmented, some bearing the signs of butchery including the chop and cut marks” (Ambros 1991b, 1). On the nature of the unidentified portion of finds (44%), he adds that “most of the unidentified finds comprised the small fragments of ribs of mid-sized mammals such as sheep, goat and pig” (Ambros 1991b, 2). More specific notes on the butchered, gnawed, or burnt bones and teeth, however, can be tracked down in his unpublished reports (Ambros 1986; 1988, 1990a; 1990b; 1991a).

A special category included the worked bones and antlers sorted out from the samples before the archaeozoological analysis. These have been taxonomically and anatomically determined by J. Konč (1991), M. Fabiš (2006) and É. David (Hrnčiarik 2017, 17, 18; David/Hrnčiarik 2021). Nevertheless, several worked specimens were overlooked and identified only by archaeozoologists in the laboratory. These usually comprise semi-finished products, hardly recognizable in the field, but also cases of more distinctive implements such as an antler inlay of the composite bow (Fabiš, unpublished; Hrnčiarik 2017, 50–53).

M. Fabiš analysed 254 worked specimens recorded as artefacts and identified the species and type of the bone. He reported the goat (*Capra hircus*), sheep (*Ovis aries*), horse (*Equus caballus*), pig (*Sus domesticus*), great bustard (*Otis tarda*), unidentified bird and fish (catfish?), further the teeth of wild boar (*Sus scrofa*) and bear (*Ursus arctos*), as well as the antler of roe deer (*Capreolus capreolus*) and red deer (*Cervus elaphus*). He suggested that nearly half of the worked implements were made from ivory, but later microscopic expertise

of É. David did not approve it (David/Hrnčiarik 2021; Hrnčiarik 2017, 17). Instead, 81% of objects were made of animal bone and 19% of antler (Hrnčiarik 2017, tab. 2). This research focused only on the differentiation of bone, antler, and ivory, so the taxonomic and anatomic determination of artefacts can be only roughly based on the unpublished results of the Fabiš's analysis (Fabiš 2006).

The information on the butchery pattern in the assemblage from Iža remains limited. A brief look at the collection of measurable bones currently deposited in the laboratory, however, suggests diverse cut and chop marks. In some of the long bones and the scapulae so-called “shaving marks”, associated with the removal of the meat from bone, can be observed. The character of the butchery indicates that all steps of carcass processing can be documented in Iža – from initial portioning to the working of bones (on classification of butchery marks see more in Rixson 1988; Seetah 2006). In the reports, the butchery is noted mainly for the cattle and pig bones, although rather common were also recordings of the chopped caprine horncores (Ambros 1986; 1988, 1990a; 1990b; 1991a). This part of the butchery waste may have been used to obtain horn substance, which the soldiers could process in their spare time, similar to antlers.

The other types of bone modifications such as burning or carnivore gnawing, were scarce. Two isolated cases of burning (cattle talus in sample 244/85; Ambros 1986, 21) and of dog gnawing (cattle metacarpal in sample 102/85; Ambros 1986, 11) were reported.

### Fish and molluscs

Although systematically collected, the fish and mollusc remains from Iža have not yet been fully studied. The retrieval of both materials, however, was continuously discussed with the specialists and selected finds were forwarded for the analysis. During the excavations, fish and mollusc finds were sorted out from the original bone material and stored separately. In the past, selection of fish bones was screened by K. Hensel, who identified the large freshwater species, such as catfish (*Silurus glanis*), carp (*Cyprinus carpio*), and sturgeons (*Acipenser* spp.). Based on our observation, the pike (*Esox lucius*) is also regularly present.<sup>13</sup> Hensel and Balon considered the bones of the wild common carp in Iža the most abundant. In the study devoted to carp history and husbandry, Balon speculates about their early Roman keeping and breeding for gastronomic purposes (Balon 1995, 31). He argues that the military troops settled between *Carnuntum* and *Celemantia* (presumed name for Iža) triggered increased food demands and the carps were the natural target as they aggregated in high numbers in the waterbodies on the floodplains every spring for spawning (*ibid.*). He believes that the population of the Danube wild carp produced the individuals that “... were transported to the Roman Italy of the first and second century AD and began life in piscinae, where some were bred and cared for by their owners” (Balon 1995, 33). The Roman military activities may therefore relate to the early phases of the wild carp domestication as well as its introduction west of the Danube (Balon 1995; Benecke 1994, 406–411).

At the same time, freshwater fishing was an important source of fish for consumption. The fishing by the soldiers stationed in Iža is evidenced by finds of the fish hooks and the lead and clay sinkstones from rods or nets found during the excavations of the stone fort (Hajnalová/Rajtár 2009, 205) or recent underwater research (Daňová/Daňová/Murín, *this volume*). According to J. Rajtár, the fish hook(s) were large and suitable for catching large Danube species. The interest in large-sized fish is documented also by one of the identified fish bones which attest to the catch of a capital wels catfish during the existence of the stone fort (Hensel 2004). Using the annual growth rings, it has been estimated that the largest vertebra belonged to a catfish older than 33 years, reaching a body length of 256.5 cm (Fig. 12: 1). This catfish had approximately one hundred kilograms of live weight that must have been much appreciated item to feed the army (Hensel 2004, 201). The other vertebrae under the study belonged to the large individuals aged between 15+ and 18+ years (Hensel 2004, 193). However, it is impossible fully assess the importance of fishing and species assortment without identification of the larger bulk of the material. It is also possible that, the remains of a smaller fish form part of the not studied flotation samples (e.g. Hajnalová 1986; Hunková/Hajnalová 1991; Hajnalová/Hunková/Mihályiová 2000).

A selection of the hand-retrieved molluscs – six samples from the area of the earth-and-timber camp – have been analysed by J. Šteffek (1991). He identified the shells and valves of the freshwater (*Unio crassus*; *Planorbis planorbis*) and terrestrial species (*Cepaea vindobonensis*). Of interest was the finding of a concentration of

<sup>13</sup> Bielichová; pers. observation 2024.

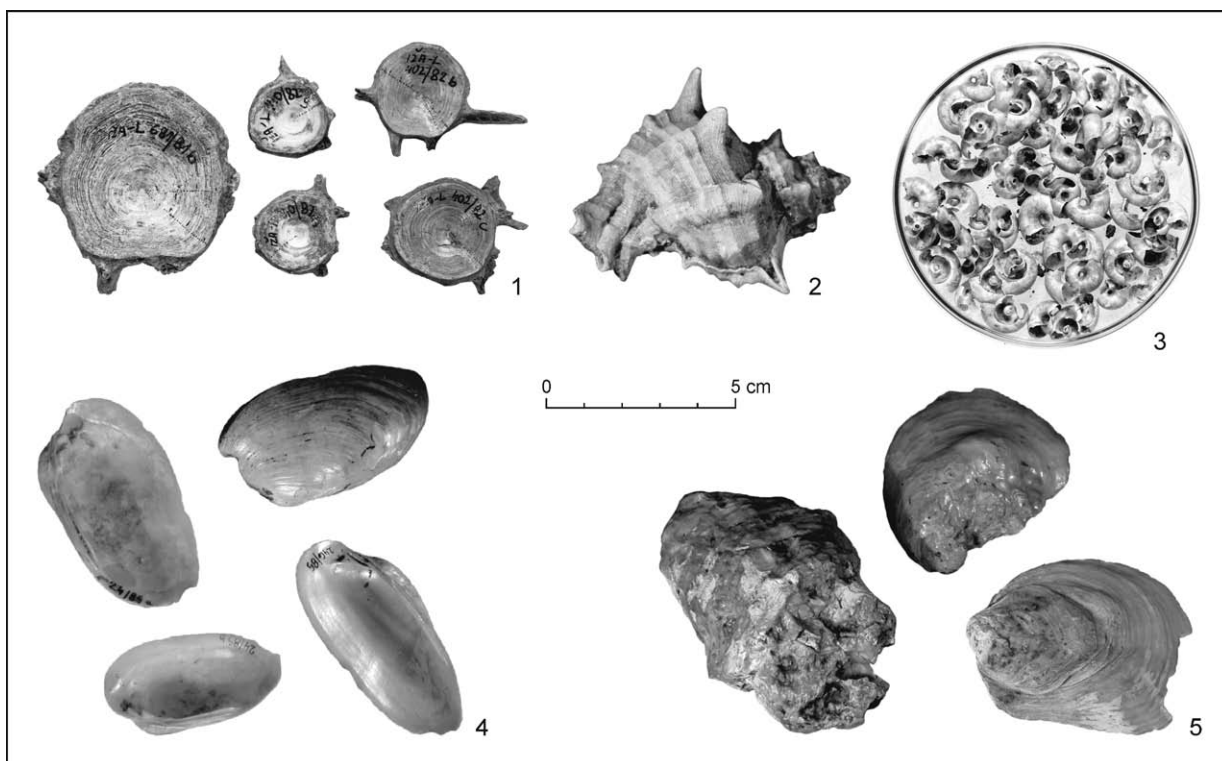


Fig. 12. Iža, Leányvár. Selection of the fish and shellfish remains from the earth-and-timber camp and the stone fort. 1 – a vertebrae of elderly, large-sized wels catfish (*Silurus glanis*); 2 – a banded dye-murex (*Hexaplex trunculus*); 3 – shells of the Eastern heath snail (*Xerolenta obvia*); 4 – a thick-shelled river mussel (*Unio crassus*); 5 – a European flat oyster (*Ostrea edulis*). Photo by Z. Bielichová, J. Rajtár, and P. Červeň.

the snail shells found in the alleyway between barracks 9 and 10 (Fig. 12: 3). This species is an Eastern heath snail (*Xerolenta obvia*), that became part of the Slovak fauna only about 800 years ago, i. e. in the 13<sup>th</sup> century when it spread with the advancing Wallachian colonization from the more southern areas.<sup>14</sup> The thermophilic species originally had a pontic range, which in historic times began to increase abruptly from the southeast into central Europe and further westward and northwestward (Ložek 1964). Today it lives in a variety of steppe to alternate pseudo-steppe habitats, and prefers anthropically influenced habitats such as quarries, embankments, lawns around buildings, fallow fields, etc. (Horsák *et al.* 2013, 136). Its flattened and small globular shell (diameter max. 22 mm) with dark brown to black spiral stripes is of minimal flesh content, therefore we may suspect its modern (intrusive) origin or an unintentional or intentional introduction to the camp by the Romans. A non-dietary use (including collecting of shells by the camp visitors for ornamental or medicinal purposes) can be also presumed to other terrestrial and aquatic mollusks, except for thick-shelled river mussels (Fig. 12: 4). The accumulation of its valves (ca. 20–40 pieces)<sup>15</sup> has been uncovered by the wall inside in one of the barracks (Building 1) which suggests that the mussels were most possibly collected and consumed.

Among remarkable finds are also the solitary shells of the marine molluscs, retrieved from the closely unidentified area of the stone fort. Although this material was not available at the moment of writing this paper, based on the photos acquired from J. Rajtár the banded dye-murex (*Hexaplex trunculus*; Fig. 12: 2) and the European flat oyster (*Ostrea edulis*; Fig. 12: 5) can be determined. Both have wider natural distribution – *H. trunculus* lives in the Mediterranean Sea and the Atlantic coasts of Europe and Africa (Spain, Portugal, Morocco, the Canary Islands, Azores) and *O. edulis* ranges along the western and southern shores of Europe from Norway to Morocco, including the British Isles and the Mediterranean coast – thus their provenance remains unknown. Since both are edible and considered a delicacy (Andrews 1948; Marzano

<sup>14</sup> Čejka; pers. comm.

<sup>15</sup> The information kindly provided by J. Rajtár.

2013, 143–195), it can be hypothesised that they were brought (in a fresh state?) to the site for consumption. However, besides gastronomy, the murex shell could be found in the fort for many other reasons, including ornamental, medical, religious, and emotional (e.g. *Nongmaithem et al. 2017; Veropoulidou 2012*). Its laxative, diuretic, anti-inflammatory, muscle-relaxing, and pain-relieve properties known since antiquity, using the mollusc broth, boiled flesh, hypobranchial gland, or pulverized operculum (*Voultsiadou 2010, 242, tab. 3*) can all be considered in a military camp.

## CONCLUSIONS AND FUTURE PERSPECTIVES

For many years, the results of the archaeozoological research of the Roman military fort at Iža in southwestern Slovakia (Fig. 1) have been unavailable to the professional community. The main aim of this paper was therefore to collect all archival research reports and unpublished manuscripts or thesis projects that touch on the subject and to provide a first comprehensive overview with a preliminary evaluation. The numerous plant and animal remains from Iža, which have received systematic attention thanks to the head of the excavations J. Rajtár, are the primary evidence of subsistence strategies and the supply of food to the Roman army on the borders of Pannonia. Through their precise analysis, interpretation and integration with other archaeological sources, they can shed more light not only on the military diet but also on cultural and economic influence of the Romans on the development and the way of life of the local populations of the Germanic Quadi. Among other things, archaeozoological finds help to reconstruct the appearance of animals and the natural environment of a site and the region. The text of the paper is divided into two parts, one presenting a complete history of the archaeozoological investigation of the site and the other providing the reader with a summary evaluation of the available data, including the assortment and relative abundance of the identified taxa and their body parts, the sex and mortality profiles of the livestock species, the metric and non-metric characteristics on bones and the way of bone modifications by humans.

The importance of the archaeozoological material from Iža is underlined by the quantity and good preservation of the finds, but also by the fact that the analysis and interpretations can be based on a representative number of data (Fig. 2: 2; Table 1). Between 1986 and 1996, several researchers from the Slovak Academy of Sciences and the Comenius University in Bratislava were involved in the analysis of more than six thousand mollusc, bone and shell specimens (Fig. 2: 1). The hand-collected animal bones were determined by C. Ambros, M. Fabiš, J. Konč, K. Hensel, and K. Šimunková, the mollusc shells were analysed by J. Šteffek and T. Čejka. The bulk of the finds (ca. 80–90%) represents food waste and remains of the carcasses discovered in the interiors and exteriors of military buildings (barracks) of an earlier, earth-and-timber camp dating to a short period between 175 and 179 AD (Fig. 1: 3; 2). The remainder is a refuse from later phases of the site's occupation when a stone fort was constructed and rebuilt many times on the same site in the 3<sup>rd</sup>–4<sup>th</sup> centuries AD (Fig. 1: 2; 3). The results of the research so far can therefore be interpreted mainly in the context of the earth-and-timber camp, destroyed in a fire by the end of the Marcomannic Wars.

Through various quantification approaches, it was possible to confirm that the diet of the local military garrison was dependent on the supply of meat from domestic livestock, primarily small ruminants (Fig. 3; Table 1). Overall, sheep (*Ovis aries*), goats (*Capra hircus*) and pigs (*Sus domesticus*) were the most numerous in the assemblage. Cattle (*Bos taurus*), chicken (*Gallus domesticus*), horse (*Equus caballus*), donkey (*Equus asinus*), dog (*Canis familiaris*), and wild mammals including the hare (*Lepus europaeus*), wild boar (*Sus scrofa*), deer (*Cervus elaphus*) and roe deer (*Capreolus capreolus*), occurred to a lesser extent (up to 10% of the total NISP). The butchery marks recorded show that, in addition to the commonly consumed meat, more unusual types such as donkeys may appear on the soldier's table. However, small ruminants dominated the local meat diet (55.5–66% of the total NISP; Fig. 4; 5), with a fairly balanced representation of mutton/lamb and goat meat (NISP abundance of the two species was 9.8 : 6%). The age structure shows a mixed slaughter, with an emphasis on young adults, slaughtered between the second and fourth year of age (Fig. 7; Table 3). However, some of the bones represented younger (*infans* to *subadultus* category) or older (*adultus/senilis*) individuals, indicating flexibility in the use of available meat resources (and producers) or different preferences of camp residents. Interpretation of caprines age at death is further complicated by the fact that the categories include two different species that are difficult to distinguish in the fragmentary material. Hypothetically, then, the older individuals may represent females (of goats?) raised (in the camp?) for milk production. Sex information is

limited, but suggests a balanced representation of females and males in the goat and a predominant slaughter of males in the sheep (Table 4).

The representation of pigs (19.2–34.1% of total NISP) and cattle (6.6–11.6%) was significantly lower compared to the caprines, indicating that pork and beef were consumed less frequently (Fig. 4; Table 1). The pigs' mortality profile showed a focus on the slaughter of young adults in their second and third year of life following the needs for ideal meat and fat yield (Fig. 8; Table 3). Available analyses suggest a balanced sex distribution within the culled animals, with a subtle predominance of female pigs (Table 4). In the case of cattle, sex and age data are even more limited, but at least document consumption of meat of young adult and immature animals (veal). Sex could be determined by osteometry in only three cases, documenting the predominance of castrated males among adults (Fig. 9; 10; Table 4). The representation of the domestic chicken in Iža was relatively high (especially in terms of DZF and MNI quantification results; Fig. 3; 5), with a surprisingly high proportion of males (Fig. 11; Table 4). In addition to the popularity of chicken and rooster meat, adult hens were an important producer of eggs, consumption of which was evidenced by numerous records of eggshells in both hand-collected and flotation samples from the earth-and-timber camp area.

Important findings from Iža include the occurrence of all body parts of livestock including the meatless limb bones and the horn-cores (Fig. 6; Table 2). It points to the fact that the consumed individuals were brought to the camp whole, apparently alive, and killed on the spot. However, we cannot yet say whether and which species were kept at the site and for how long after they were supplied, stolen, or purchased. However, some of the results, also presented in the thesis, support the hypothesis of camp provisioning from the opposite Brigetio. For example, the sheep from Iža show a relatively high proportion of hornless individuals, similar to some Roman settlements in Pannonia (Tác-Gorsium). Evaluation of osteometric data also shows incomparably larger cattle sizes at Iža compared to the sites of native populations, which may be related to the importation of new types of animals or the increasing need for draught animals (Fig. 9). A clear import animal is represented by domestic donkey (*Equus asinus*), which ranks among the earliest records of originally African species in the region. The vertebrae determined by C. Ambros display clear signs of chopping and thus can be interpreted in the context of local food (Fig. 2: 3). Regarding long-distance trade and the involvement of Iža in the wider military logistical network, the isolated shells of the Mediterranean molluscs *Ostrea edulis* and *Murex trunculus* are noteworthy, but these were recovered from the stone camp layers (Fig. 12: 2, 5). So far, the results from this phase of the fort's existence suggest that the Danube and the riverine habitats have been an important (seasonal?) food resource for the garrison. Few specimens identified so far showed that the diet was enriched with the meat of large-sized freshwater species including the Wels catfish (*Silurus glanis*; Fig. 12: 1), common carp (*Cyprinus carpio*), the Northern pike (*Esox lucius*) or the thick-shelled river mussels (*Unio crassus*; Fig. 12: 4). The isolated finds of other wild taxa also attested that except for the hare (*Lepus europaeus*), the game did not play a role in the soldiers' diet (Fig. 3; Table 2).

In conclusion, while some of the results can be considered indicative of typically Roman culinary traditions (e.g., preference for pork and chicken, an increased proportion of goat and rooster meat), others, such as the low proportion of beef and higher consumption of caprines point to dietary differences within the military camps in Pannonia and the western provinces. This underlines the importance of further archaeozoological research in Iža and its evaluation in the wider geographical context. Future research should focus on completing the determination of the fish and shellfish collection, including materials from flotation samples. Further, through a detailed analysis of the butchery pattern, it would be possible to complete the information of how the animal carcasses were processed, whether the meat was cured or fresh, and where or to what extent the waste from consumed carcasses (horn, bones) was processed and deposited. An important part of future investigations should be the employment of modern research techniques, especially isotope (strontium, sulfur or oxygen) and genetic (aDNA) analysis, through which the origin and the husbandry regimes of animals can be specified. More precise methods in assessing tooth wear and morphology of domestic animals would be beneficial (e.g. Stallibrass/Thomas 2008).

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## Archeozoologický výskum rímskeho tábora v Iži (JZ Slovensko)

### História a súčasné poznatky

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### Súhrn

Napriek rozsahu a významu súboru archeozoologických náleзов z rímskeho tábora v Iži (obr. 1) boli až dosiaľ výsledky jeho výskumu neprístupné odbornej verejnosti. Primárnym cieľom tejto štúdie bolo preto zhromaždiť všetky existujúce pramene vrátane nepublikovaných výskumných správ, študentských záverečných prác či rukopisov, ktoré sa venovali analýze a vyhodnoteniu náleзов zvyškov zvierat a poskytnúť prvý ucelený prehľad ich výsledkov. Počas dlhoročného archeologického výskumu v Iži sa odberu vzoriek ako aj spracovaniu zvieracích kostí venovala a dosiaľ venuje náležitá pozornosť, predovšetkým vďaka neutíchajúcemu záujmu a erudícii archeológa J. Rajtára. Tieto nálezy sú primárnymi dokladmi subsistenčných stratégií a zásobovania rímskej armády vysunutej na hraniciach ríše v Panónii. Vďaka interpretácii a integrácii poznatkov archeozoológie s archeologickými a historickými prameňmi poskytujú svedectvo nielen o stravovaní vojakov, ale aj o kultúrnom a hospodárskom vplyve Rimanov na spôsob života miestnych (kvádskych) populácií sídlících v tom čase na území juhozápadného Slovenska. Čiastočne tieto nálezy pomáhajú aj pri rekonštrukcii úrovne chovateľstva vrátane vzhľadu zvierat a približujú prírodné prostredie lokality a regiónu.

Štúdia je rozdelená do dvoch častí, pričom prvá prezentuje doterajšiu históriu archeozoologického výskumu v Iži a druhá poskytuje prehľad jej najdôležitejších výsledkov, vrátane sortimentu zvierat a výskytu anatomických častí v rámci skúmaného priestoru tábora, informácií o pohlaví a veku konzumovaných druhov, morfológie a veľkosti domácich zvierat a spôsobu ich využitia človekom.

Význam archeozoologického súboru z Iže podčiarkuje nielen množstvo a dobrá zachovalosť náleзов, ale aj fakt, že načrtnuté interpretácie sú založené na reprezentatívnom počte prípadov (obr. 2: 2; tabeľa 1). V rokoch 1986 až 1996 sa na analýze viac ako šesťtisíc vzoriek kostí a chránok mäkkýšov podieľali viacerí poprední bádatelia zo Slovenskej akadémie vied a Univerzity Komenského v Bratislave (obr. 2: 1). Ručne vytriedené kosti zvierat boli postupne determinované C. Ambrosom, M. Fabišom, J. Končom, K. Henselom, a K. Šimunkovou, chránky mäkkýšov analyzovali J. Šteffek a T. Čejka. Treba podotknúť, že prevažná

časť nálezov (80–90 %) reprezentuje odpad z prípravy potravy a mŕtvych tiel zvierat objavených v interiéroch a exteriéroch vojenských objektov (barakov) staršieho, drevozemného tábora datovaného do krátkeho obdobia medzi rokmi 175 a 179 n. l. (obr. 1: 3; 2). Zvyšnú časť (10–20 %) predstavuje odpad z neskorších fáz osídlenia lokality, kedy bola v 2.–4. storočí n. l. na rovnakom mieste vybudovaná a mnohokrát prebudovaná kamenná pevnosť (obr. 1: 2, 3). Výsledky doterajšieho výskumu možno preto interpretovať predovšetkým v kontexte fungovania drevozemného vojenského tábora, zničeného požiarom na konci markomanských vojen.

Hoci sú doterajšie výsledky bádateľov v Iži založené na rôznych metódach kvantifikácie nálezov, ukazujú na rovnaký trend zloženia živočíšnej stravy miestnej vojenskej posádky. Tá bola závislá na mäse (a pravdepodobne aj iných produktoch) domácich hospodárskych zvierat, predovšetkým malých prežúvavcov (obr. 3; tabela 1). V súbore boli najčastejšie prítomné kosti a zuby oviec (*Ovis aries*), kôz (*Capra hircus*) a ošípaných (*Sus domesticus*). V menšej miere (do 10 % z celkového NISP) sa objavuje hovädzí dobytok (*Bos taurus*), kura (*Gallus domesticus*), kôň (*Equus caballus*), osol (*Equus asinus*), pes (*Canis familiaris*), a voľne žijúce cicavce ako zajac (*Lepus europaeus*), diviak (*Sus scrofa*), jeleň (*Cervus elaphus*) a srnec (*Capreolus capreolus*). Známy mäsiarskeho spracovania – záseky a zárezy svedčia o tom, že okrem bežných druhov sa na stole vojakov objavovali aj netradičnejšie typy mäsa, napr. oslie a divina. V jedálničku však jednoznačne prevládali malé prežúvavce (55,5–66 % z celkového NISP; pozri tiež obr. 4 a 5), a to v pomerne vyváženom meradle baranina/jahňacina aj kozlaci (celkový pomer oviec a kôz bol 9,8 : 6 %). Veková štruktúra poukazuje na porážku zvierat v rôznom veku, s dôrazom na mladé dospelé jedince medzi druhým a štvrtým rokom života (obr. 7; tabela 3). Časť kostí však predstavovala mladšie (kategória *infans* až *subadultus*) alebo staršie (*adultus* až *senilis*) ovce/kozy, čo poukazuje na flexibilitu vo využívaní dostupných zdrojov mäsa (a producentov) alebo rozličné preferencie obyvateľov tábora. Interpretáciu veku v čase smrti komplikuje aj fakt, že kategórie zahŕňajú dva rôzne, vo fragmentárnom materiáli ťažko rozlíšiteľné druhy zvierat. Hypoteticky teda môžu starší jedinci predstavovať samice (azda kozy), chované (v tábore?) na mlieko. Informácie o pohlaví sú sporé, no naznačujú vyvážené zastúpenie samíc a samcov u kozy a prevažujúcu porážku samcov u ovce (tabela 4).

Zastúpenie ošípaných (19,2–34,1 % z celkového NISP) a hovädzieho dobytku (6,6–11,6 %) bolo oproti ovciam a kozám výrazne nižšie, čo naznačuje, že bravčové a najmä hovädzie mäso bolo málo frekventované a tvorilo doplnok stravy (obr. 4; tabela 1). Ošípané vykazovali zmiešanú vekovú štruktúru dožitia, s dôrazom na mladé dospelé jedince medzi druhým a tretím rokom života, pravdepodobne v nadväznosti na potreby ideálneho výťažku mäsa ale aj tuku (obr. 8; tabela 3). Dostupné analýzy naznačujú vyvážené zastúpenie pohlaví v rámci porážky, s miernou prevahou samíc (tabela 4). V prípade hovädzieho dobytku sú údaje o pohlaví a veku limitované počtom prípadov, dokladujú však konzumáciu mäsa mladých dospelých aj nedospelých jedincov (teľacieho mäsa). Pohlavie sa podarilo určiť na základe osteometrie iba v troch prípadoch dospelých zvierat, dokladujúc prevahu kastrovaných samcov (obr. 9; tabela 4). Relatívne vysoké bolo zastúpenie kury domácej v Iži (najmä z pohľadu DZF a MNI kvantifikačnej metódy; obr. 3 a 5) s prekvapivo výrazným podielom kohútov (obr. 10; tabela 4). Okrem obľuby kuracieho a kohútieho mäsa, boli sliepky významným producentom vajec, o ktorých konzumácii v tábore svedčia početné záznamy vajecných škrupín v ručne zbieraných i flotačných vzorkách.

K dôležitým poznatkom z Iže patrí prezencia všetkých typov kostí a častí tiel hospodárskych zvierat (obr. 6; tabela 2). Poukazuje na fakt, že skonzumované jedince boli do tábora prinesené vcelku, zrejme živé a zabité až na mieste. Nevieme však zatiaľ povedať, či a ktoré druhy boli na lokalite držané a ako dlho po tom, ako boli privezené, ukoristené či zakúpené. Niektoré výsledky archeozológie však podporujú hypotézu o zásobovaní tábora z protihľého Brigetia. Ovce z Iže napríklad vykazujú pomerne vysoký podiel bezrohých jedincov, veľmi podobný ako na niektorých rímskych sídliskách v Panónii (Tác-Gorsium). Vyhodnotenie osteometrických údajov tiež ukazuje na neporovnateľne väčšie rozmery hovädzieho dobytku v Iži v porovnaní s germánskymi lokalitami, čo môže súvisieť s importom nových typov zvierat alebo potrebou využívania ťažných zvierat (obr. 9). Jednoznačný import reprezentuje osol domáci (*Equus asinus*) – pôvodne africký druh, pravdepodobne dovezený z niektorej z provincií. V tomto prípade je zaujímavé, že jeho kosti niesli stopy po sekaní a teda možno ho interpretovať v kontexte stravovania vojakov (obr. 2: 3). Pokiaľ ide o diaľkový obchod a zapojenie Iže do širšej vojenskej logistickej siete, pozoruhodné sú zatiaľ ojedinelé schránky mäkkýšov stredomorského pôvodu *Ostrea edulis* a *Murex trunculus*, avšak získané z mladších vrstiev súvisiacich s existenciou kamenného tábora (obr. 12: 2, 5). Početné, ale zatiaľ nie úplne preskúmané pozostatky mäkkýšov a rýb z Iže môžu v budúcnosti poskytnúť ďalšie podobné príklady. Zdá sa, že Dunaj a riečny biotop bol pre vojenskú posádku pomerne dôležitým (sezónnym?) zdrojom potravy. Niekoľko dosiaľ identifikovaných exemplárov svedčí o tom, že strava bola obohatená o mäso miestnych sladkovodných druhov ako sumec (*Silurus glanis*; obr. 12: 1), kapor (*Cyprinus carpio*), štika (*Esox lucius*) alebo korýtko (*Unio crassus*; obr. 12: 4). Ukazuje sa tiež, že okrem zajaca poľného (*Lepus europaeus*) voľne žijúca zver zohrávala v stravovaní posádky drevozemného tábora bezvýznamnú úlohu (obr. 3; tabela 2).

Na záver možno konštatovať, že kým niektoré výsledky z Iže svedčia o typicky rímskych stravovacích zvyklostiach (napr. pravidelná konzumácia bravčového a kuracieho mäsa, zvýšený podiel kozieho a kohútieho mäsa), ďalšie, ako napr. nízky podiel hovädzieho mäsa poukazuje na stravovacie odlišnosti v rámci vojenských táborov v Panónii a v západných provinciách. To zdôrazňuje význam ďalšieho archeozologického bádania nielen v Iži, ale aj na okolitých barbarských sídliskách. Budúci výskum by sa mal zamerať na dokončenie analýz bohatej kolekcie rýb a mäkkýšov vrátane nálezov z flotačných vzoriek. Prostredníctvom analýzy mäsiarskych zásahov je možné doplniť informácie o tom, ako boli telá zvierat v Iži spracovávané, či bolo mäso konzervované, a kde, prípadne v akej miere sa odpad z živočíšnych tiel (rohovina, kosti) spracovával a deponoval. Dôležitou súčasťou budúceho výskumu by mala byť aplikácia moderných analýz, najmä geochemických (izotopy stroncia, síry, alebo kyslíka) a genetických (aDNA), prostredníctvom ktorých by bolo možné overiť pôvod zvierat v tábore. V tomto smere by mohli byť tiež prínosom precíznejšie metódy a porovnanie zubného veku a morfometrických znakov zvierat z rímskoprovinciálnych a domácich kvádskych lokalít (viac napr. *Stallibrass/Thomas 2008*).

- Obr. 1. Iža, Leányvár. 1 – poloha vojenského tábora v predmostí rímskeho Brigetia; 2 – letecký pohľad na zvyšky tábora (národná kultúrna pamiatka a pamiatka UNESCO); 3 – pôdorys kamenného tábora a časti drevozemného tábora (plochy vyplnené čiernou farbou, zdroj: MZVaEZ SR a archív AÚ SAV).
- Obr. 2. Iža, Leányvár. 1 – plán drevozemného tábora s vyznačením archeozoologicky analyzovaných plôch. Uvedené je meno archeozoológa, počet spracovaných vzoriek (n) a rok výkopu; 2 – pohľad na výber merateľných kostí; 3 – stavec osla nájdený v interiéri jedného z barakov (hviezda; zdroj: archív AÚ SAV a ArchéoZoothèque, foto Z. Bielichová).
- Obr. 3. Iža, Leányvár. Drevozemný tábor. Zastúpenie identifikovaných taxónov v súbore na základe rôznych kvantifikačných metód (pozri tabuľku 1). Legenda: a – domáce cicavce; b – domáce hydina; c – divoké cicavce (kosti drobných hlodavcov a parohy nezapočítané); d – ryby/mäkkýše.
- Obr. 4. Iža, Leányvár. Drevozemný tábor. Zastúpenie hlavných domácich zvierat v súbore na základe rôznych kvantifikačných metód (pozri tabuľku 1).
- Obr. 5. Iža, Leányvár. Drevozemný tábor. Priestorové rozloženie kostí dôležitých domácich druhov zvierat v barakoch a uličkách medzi nimi (podľa Šimunková 2013, obr. 11). Legenda: a – ovca/koza; b – ošípaná; c – hovädzí dobytok; d – kura domáca.
- Obr. 6. Iža, Leányvár. Drevozemný tábor. Priestorové rozloženie skeletových elementov kostrovej oviec/kôz indikujúce kvalitu konzumovaného mäsa. Legenda: a – najlepšia; b – stredná; c – slabá kvalita mäsa. Nepublikované údaje K. Šimunkovej.
- Obr. 7. Iža, Leányvár. Drevozemný tábor. Mortalita oviec/kôz podľa S. Payna (1973). Nepublikované údaje (% NISP) K. Šimunkovej.
- Obr. 8. Oblúbené jedlo rímskych vojakov pozostávajúce z chlebových žemlí v tvare krúžku (*bucellatum*), vareného údeného bravčového chrbta (*lardum*) a miešaného nápoja z vody a octu s mätou (*posca*). Zdroj: <https://historicalitaliancooking.home.blog/english/recipes/the-diet-of-the-legionaries-bucellatum-lardum-and-posca/>.
- Obr. 9. Veľkosť metatarzálnych kostí hovädzieho dobytku z vybraných lokalít doby rímskej. Legenda: plný trojuholník – jedinec z Iže; biely kosoštvorec – kastrované býky z *villa rustica* v Nickelsdorfe (Rakúsko); ostatné značky – dobytok z germánskych sídlisk na juhozápadnom Slovensku (názvy lokalít pozri pôvodnú publikáciu). Prerušované čiary sa vzťahujú na priemernú veľkosť germánskeho býka, kravy či kastráta z rímsko-provinciálneho sídliska Táb-Gorsium (*Bökönyi* 1984, 36). Skratky: SD – najmenšia šírka diaľky; GL – najväčšia dĺžka kosti. Prevzaté z Bielichová 2019b, obr. 18.
- Obr. 10. Iža, Leányvár. Drevozemný tábor. Klinovitý defekt na rezákoch dospelého jedinca hovädzieho dobytku (prevzaté z Ambros 1991b, Abb. 1).
- Obr. 11. Iža, Leányvár. Drevozemný tábor. Pohľadá štruktúra a veľkosť kury domácej na základe metriky tarsometatárnych kostí (dáta prevzaté z Ambros 1991b; Fabiš 2008).
- Obr. 12. Iža, Leányvár. Výber nálezov zvyškov rýb a mäkkýšov z drevozemného a kamenného tábora. 1 – stavec veľkého a starého sumca (*Silurus glanis*); 2 – pásavka farbiarska (*Hexaplex trunculus*); 3 – ulity slimáka vresovca východného (*Xerolenta obvia*); 4 – lastúrník riečny s hrubou ulitou (*Unio crassus*); 5 – ustrica plochá (*Ostrea edulis*). Foto Z. Bielichová, J. Rajtár, P. Červeň.

Tabela 1. Iža, Leányvár. Drevozemný tábor. Zastúpenie identifikovaných druhov podľa autora analýzy a použitej kvantifikačnej metódy. DZF – počet fragmentov s diagnostickou zónou; NISP – počet identifikovaných nálezov; MNI – minimálny počet jedincov; WISP – hmotnosť identifikovaných nálezov (podľa Ambros 1991b; Fabiš 2008; Šimunková 2013).

Tabela 2. Iža, Leányvár. Drevozemný tábor. Zastúpenie skeletových elementov a kvalita konzumovaného mäsa hlavných hospodárskych druhov (podľa Ambros 1991b, tab. 4).

Tabela 3. Iža, Leányvár. Drevozemný tábor. Dentálny vek hlavných hospodárskych druhov. Legenda: 0 = zuby neprerazané; + = ľahko obrúsené; ++ = stredne obrúsené; +++ = silne obrúsené (podľa Ambros 1991b, tab. 5).

Tabela 4. Iža, Leányvár. Drevozemný tábor. Pohľadá štruktúra najdôležitejších hospodárskych druhov. Zostavila Z. Bielichová podľa dát uvedených v prácach Ambros 1986; 1988; 1990a; 1990b; 1991a.

Tabela 5. Iža, Leányvár. Drevozemný tábor. Odhad kohútikovej výšky domácich zvierat. Zostavila Z. Bielichová podľa metrických dát zaznamenaných C. Ambrosom (1991b) a M. Fabišom (2008).

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