Ágnes Font

BONE WORKING IN BUDA BETWEEN THE FIFTEENTH–SEVENTEENTH CENTURY

MA Thesis in Comparative History, with a specialization
in Late Antique, Medieval, and Renaissance Studies.

Central European University Private University

Vienna

May 2022

Bone Working in Buda between the fifteenth–seventeenth Century

by

Ágnes Font

(Hungary)

Thesis submitted to the Department of Medieval Studies,

Central European University Private University, Vienna, in partial fulfillment of the requirements of the Master of Arts degree in Comparative History, with a specialization in Late Antique, Medieval, and Renaissance Studies.

Accepted in conformance with the standards of the CEU.

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Chair, Examination Committee

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Author's declaration

I, the undersigned, **Ágnes Font**, candidate for the MA degree in Comparative History, with a specialization in Late Antique, Medieval, and Renaissance Studies, with a specialization in Interdisciplinary Medieval Studies declare herewith that the present thesis is exclusively my own work, based on my research and only such external information as properly credited in notes and bibliography. I declare that no unidentified and illegitimate use was made of the work of others, and no part of the thesis infringes on any person's or institution's copyright. I also declare that no part of the thesis has been submitted in this form to any other institution of higher education for an academic degree.

Vienna, 18 May 2022

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Signature

Abstract

Excavations in the Buda Castle District have unearthed a large amount of worked osseous raw materials over the past half a century. This thesis examines the crafting activities associated with the use of osseous raw materials such as bone (including the separated horn cores indicating the use of horn) and antler in the area of the Castle District based on the finds from five excavations. In addition to the archaeological finds, written, documentary and visual sources also contain a vast amount of information, often in indirect form, which, when examined together, provide a comprehensive picture of medieval craftsmanship.

Through the analysis of the finds, the aim of this thesis is to map the specialization of the crafts present in medieval and early modern Buda and to investigate the range of various use, methods and processes of working the raw materials. Conversely, the interdisciplinary nature of the research and the combined use of different types of sources also offer the possibility of uncovering certain interconnections and additional information on medieval and early modern Buda craftsmen and their operation.

Acknowledgements

I would like to thank all of those in professional, academic and personal circles, who supported me throughout the thesis writing process.

This work would not have been possible without the constant support, guidance, and assistance of my supervisors. I would like to thank Alice M. Choyke and Katalin Szende for their endless patience and help, for their confidence and trust in me and my chosen topic, and for the constant encouragement and support, even though at times it seemed impossible to turn chaos into a coherent thesis.

I am also extremly grateful to Márta Daróczi-Szabó and László Daróczi-Szabó, who, in addition to giving me access to the material, I could turn to for professional help and advice at any time. Credits also must be given to Annamária Bárány and Zsuzsanna Tóth for their professional assistance and support.

I would also like to thank all the colleagues, collection managers and friends working in the Medieval Archaeological Collection and the Archives of the Budapest History Museum's Castle Museum (Adrienn Papp, Dorottya B. Nyékhelyi, Kata Éder, Ildikó Sándor, Zoltán Bencze, and György Terei) who provided me access to the materials, sometimes even last minute or under the most difficult circumstances.

Special thanks go to my family and friends, and to the CEU Medieval Studies 2019 cohort (Department of Potato Studies, Medieval Memeology), who supported me, listened to me, put up with me even when I would not have been able to.

I would like to dedicate this thesis to the memory of Eszter Kovács, whom I met in 2015, when I was still looking for an undergraduate thesis topic. Eszter was the first person to deal with

worked faunal material in the museum's Medieval Collection, and despite not having the opportunity to work with it later, she let me have the topic and discussed the artifacts, workshops and craftsmanship from the Buda Castle District and the surrounding suburbia with me on several occasions. The last time we met, she offered me some cake and I promised myself that the next time I saw her, I would bring her some in return for her kindness. Even if I could not keep my promise, I would like to dedicate this thesis to her memory.

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Introduction

Buda was one of the most important towns and the capital during the late medieval and early modern periods in Hungary. The fortified town itself is located on the north-south oriented hill (Castle Hill), which was founded as a planned town by King Béla IV. (1235-1270) after the Mongol Invasion. Buda's role was quite diverse in the Middle Ages. As a crossing point of the Danube, as a station of the transfer trade, it had a huge importance and power in terms of economic activities. Besides, the palace of Buda also became the prime royal residence from the 1410's onwards. The Castle District was integrally linked to the suburbs below it, and it included both the royal palace, the seat of the court and administration, and the civil quarter together with various ecclesiastical and civic institutions (Map 1.).[1]

Archaeological research in the medieval Buda Castle District over the last seventy years has brought to light thousands of finished, unfinished, broken, or repaired bone and antler objects as well as the raw materials and debris from their manufacture. These objects represent every stage of the working process. In my thesis, I focus on the raw materials and uses of animal bones and antlers involved in both regional and long-distant trade and in goods produced to meet local or regional needs.[2] Although numerous objects considered to be finished products were discovered during the excavations in Buda, this thesis is essentially concerned with those workshop waste materials, semi-finished objects, and finished products that can be associated with the crafts that appear in the written source material from the fifteenth to the seventeenth century. By examining the raw materials used by different craftspeople, I intend to identify certain local trends and the wider procurement, production and commodity contexts of

[1] For a brief summary, see Balázs Nagy et al., "Introduction," in *Medieval Buda in Context*, Brill's Companions to European History 10 (Leiden - Boston: Brill, 2016), 1–21.
[2] Further investigation of the rural environment of medieval Buda in the relations between the suburbium and the Castle District would be a further possibility, but the small and selected of finds recovered from the present-day area of the medieval suburbs surrounding the medieval Castle District does not allow it.

workshops. Understanding these practices make them tangible in terms of contemporary market production and larger-scale trade.

Research questions, aims

The aim of the thesis is to examine how faunal materials were utilized in the various crafts located within the borders of Buda Castle District. The basis of the research is partly formed by a thorough survey and evaluation of the primary sources, i.e., archaeological finds, and comparison of the written sources concerning urban crafts known to be parallels from this period (fifteenth – seventeenth century), studied from both archaeological and historical perspectives. This research also employs pictorial and visual sources from the fifteenth to seventeenth centuries that can provide information on several levels of interpretation about the guilds, craft workshops and craftspeople of the period.

The available archaeological materials, complementing or contradicting the written sources, provides evidence of several types of crafts in the medieval Buda Castle District. In this thesis, I will concentrate on those archaeological remains and historical sources that can be associated with diverse crafts using *hard osseous materials*[3] as well as other types of raw materials to produce the various (often composite, i.e. made of several elements, various raw materials) commodities.

The thesis is structured as follows: after the introductory chapter, I offer a short overview of the five excavations, that yielded the artifacts I am examining (Map 2.). The second chapter contains the methodological aspects of my research, in which the available types of sources (archaeological, written documentary, and pictorial) are reviewed, and their utility described in detail. In addition, the possibilities and limitations of this type of multi-disciplinary research

[3] See the explanation in the 'Glossary'.

are presented in the third chapter. The next (fourth) chapter focuses on the morphology, physical and chemical characteristics of hard osseous raw materials, the core of my primary sources. The issues surrounding their availability and processing are discussed as well. This is followed by an overview of the crafts and crafts-related materials found in the area of medieval Buda, mainly on the basis of data from archaeological and written sources, which were mostly examined in the past decades in the topographic context of the medieval Buda Castle District (Chapter 5).[4]

A summary of methodological observations will complement the previously mentioned chapters. Its focus is on the protocols for collecting, preserving, storing, and presenting worked hard osseous finds, mainly collected during the study of the different objects and while I was working in the Budapest History Museum – Castle Museum.[5]

The last, complimentary chapter is followed by a final summary. After that, an appendix comprised of several sections, including a glossary of terms that are relevant to my topic. The final art of my work is a catalog of illustrations, maps and plans, visual resources, and archaeological materials.

State of art

The excavated worked hard osseous materials from the Buda Castle District are currently in the medieval collection of the Budapest History Museum, although, no systematic, comprehensive inquiry or publication has been carried out so far. The overview publication of the objects was made first by the archaeologist Eszter Kovács and later by myself for my Bachelor's and Master's thesis concerned the worked hard osseous materials from the excavation of the Royal

[4] I am mainly using already published written sources from medieval and early modern Buda, which, as mentioned, originally served as the basis of the inquiry of the medieval and early modern topography of the town. András Végh, *Buda város középkori helyrajza [The topography of medieval Buda]*, vol. 2, 2 vols., Monumenta Historica Budapestinensia, IV. (Budapest: Budapesti Történeti Múzeum, 2006), http://mek.oszk.hu/09300/09315/pdf/buda1.pdf.

[5] The chapter was written in the context of the Cultural Heritage Studies Certificate Program.

Palace and the so-called Northern Courtyard [*Északi előudvar*].[6] In some isolated cases, certain objects considered as interesting, or objects that fit into different thematic projects were published together with other excavation materials from the museum.[7] As common for worked faunal materials, some objects were published in exhibition catalogues and summaries as more particularly interesting and 'valuable' objects resonating perfectly with research trends in the long history of antiquarian interest and research in archaeology.[8] Highlighting some of the conventionally "interesting" objects instead of a thorough analysis of all archaeological finds and assemblages still dominates in the field of archaeology in Central Europe.

The collections of the Budapest History Museum contain large quantities of worked objects that provide excellent data for studying the use of hard osseous raw materials in various craft activities and commodity production. I have had the privilege of collecting and thus thoroughly assessing some of the un-inventoried material with the help of Márta and László Daróczi-Szabó.[9] Thanks to their tireless work and expertise, the excavations of the last decades have revealed a much wider range of worked osseous raw materials mixed into the non-processed faunal materials, especially in comparison with the early phase of the excavations at Buda, where the collection of animal bone material was much less extensive and highly selective.[10]

[6] Eszter Kovács, "Remains of the Bone Working in Medieval Buda," in *From Hooves to Horns, from Mollusc to Mammoth. Manufacture and Use of Bone Artefacts from Prehistoric Times to the Present*, ed. Heidi Luik et al., Proceedings of the 4th Meeting of the ICAZ Worked Bone Research Group at Tallinn, 26th–31st of August 2003, (Tallin: University of Tartu, 2005), 309–16., Ágnes Font, "Középkori megmunkált és faragott csontok a budai vár ásatásaiból [Medieval worked and carved bones from the excavations of the Royal Palace of Buda]" (BA thesis, Budapest, Eötvös Loránd Tudományegyetem, 2017). and Ágnes Font, "13-17. századi megmunkált kemény állati nyersanyagok a budavári palota területéről [Thirteenth-seventeenth century worked hard osseous raw materials from the Buda Castle]" (MA thesis, Budapest, Eötvös Loránd Tudományegyetem, 2021).

[7] One example is the recent article by Adrienn Papp and Balázs Sudár, "Oszmán íjászgyűrűk a Budapesti Történeti Múzeum gyűjteményében [Ottoman archery rings in the collection of the Budapest History Museum]," *Budapest Régiségei* 51 (2018): 307–28.

[8] For more details on this topic see Chapter 6.

[9] The curator of the zooarchaeological collection is Dr. Márta Daróczi-Szabó, who currently works on a revision of the zooarchaeological inventory of the Castle Museum together with László Daróczi-Szabó.

[10] These various types of worked osseous objects, which serve as the basis for my thesis, and the documentation connected to them are located partly in the Medieval Archaeological Collection of the Budapest History Museum – Castle Museum, and partly in external storage facilities. "Medieval Archaeological Collection of the Budapest History Museum – Castle Museum," Home page, n.d., https://www.varmuzeum.hu/kozepkori-regeszeti-gyujtemeny.html.

In Hungary, there are two groups of scholars researching worked hard osseous materials. Either zooarchaeologists, often regardless of their own expertise or period of interest, or archaeologists who show some interest in a particular type of artefact made from hard osseous raw materials.[11] Unfortunately, to date, artifacts made from hard osseous materials are still often found only in an appendix or mentioned in passing as part of the processed excavated material in archaeological publications. Thus, the finds are categorized and catalogued, but not systematically investigated further.[12]

In addition, the bone tool studies is still dominated by the study of prehistoric and Roman worked hard osseous raw materials.[13] In addition to the identification and typo-chronological analysis of raw materials, the investigation of the production methods, the manufacturing chain (chaîne opératoire) and the use of objects by means of experimental archaeological methods has generally become more and more common in the last decade with the advent of microscopic study at high magnifications of manufacture and use wear patterns.[14] However, the number of

[11] Such examples are Annamária Bárány and Zsuzsanna Hajnal, "Agancsfeldolgozó műhely és csontfésűk Tiszagyenda-Lakhatom koraközépkori lelőhelyről [An Antler Objects Workshop and Bone Combs from Tiszagyenda- Lakhatom Early Medieval Site]," in *Csont és bőr: Az állati eredetű nyersanyagok feldolgozásának története, régészete és néprajza [Bone and Leather: History, Archaeology and Ethnography of Crafts Utilizing Raw Materials from Animals]*, ed. János Gömöri and Andrea Kőrösi (Budapest - Sopron: Magyar Tudományos Akadémia VEAB Soproni Tudós Társasága, 2010), 31–38., written by a zooarchaeologist and an archaeologist, or Péter Gróf and Dániel Gróh, "The Remains of Medieval Bone Carvings from Visegrád," in *Crafting Bone: Skeletal Technologies through Time and Space*, ed. Alice M. Choyke and László Bartosiewicz, BAR International Series 937 (Oxford: BAR Publishing, n.d.), 281–85., where both authors are archaeologists, with no particular background in zooarchaeology.

[12] A great example is by István Kováts, "Megmunkált csonttárgyak Visegrád, Birkl-telek lelőhelyről [Worked bone objects from Visegrád, Birkl-plot site]. Appendix.," *Archaeologiai Értesítő* 131, no. 1 (2006): 156–58., which was a two-page appendix isolated from the interpretation and overall analysis of an excavation site. Orsolya Mészáros, "Késő középkori ház Visegrád polgárvárosában - Fő utca 32. (Birkl-telek) [A Late Medieval Age House in the Civil Town of Visegrád Fő utca 32. (Birkl-plot)]," *Archaeologiai Értesítő* 131, no. 1 (2006): 145–68.

[13] At least in Hungarian academic context.

[14] Diane Gifford-Gonzales, *An Introduction to Zooarchaeology* (Cham: Springer, 2018), 503–30; Michelle J. Lefebvre and Christina M. Giovas, *Zooarchaeology in Practice: Case Studies in Methodology and Interpretation in Archaeofaunal Analysis* (Cham: Springer, 2018), 191–250; Zsuzsanna Tóth, "Régészeti kísérletek és a kopásnyomok elemzése két csontáron [Archaeological experimentation and use-wear analysis on two bone awls]," in *Csont és bőr: Az állati eredetű nyersanyagok feldolgozásának története, régészete és néprajza [Bone and Leather: History, Archaeology and Ethnography of Crafts Utilizing Raw Materials from Animals]*, ed. János Gömöri and Andrea Kőrösi (Budapest - Sopron: Magyar Tudományos Akadémia VEAB Soproni Tudós Társasága, 2010), 57–67; Oliver W. Hounslow et al., "An Introduction to ZooMS (Zooarchaeology by Mass Spectromtry) for Taxonomic Identification of Worked and Raw Materials," in *From These Bare Bones: Raw Materials and the Study of Worked Osseous Objects*, ed. Alice M. Choyke and Sonia O'Connor (Oxford: Oxbow Books, 2013), 201–7.

specialists working with this raw material and its technological analysis in Hungary, as elsewhere, is very small, and the financial resources for the full-scale modern examinations of finds from various excavations remain relatively limited. The interest in worked hard osseous material from the Middle Ages is developing slowly in Hungarian research. The objects and related research questions like the operation and establishment of workshops, their presence in local and long-distance trade as well as the development of the technological background to the manufacturing process has become increasingly popular. Despite this growing interest, research lacks established, independent methods, terminology and frameworks related to medieval worked bone and antler objects in Hungary. Methodologies are still based on previously established prehistoric and Roman approaches (the latter being especially relevant for setting up and interpreting technical manufacturing processes and typologies), and terminology. There is also a lack of consistency and customization of these earlier materials to the medieval context, and a tendency to emphasize only certain features (for example identifying local workshops and their importance based on sparse, inadequate evidence) rather than through thorough examination of the objects, their technical background, and the species and skeletal element choices made within the range of available raw materials.

The international literature on worked artefacts made of hard animal raw materials is quite rich and has grown in recent decades with increasing number of scientific publications on medieval and early modern artefacts. It is important to mention the activities of the ICAZ - Worked Bone Research Group, with which I have been involved in over the last few years, where fortunately increasing medieval research has been given a platform in recent years.

Chapter 1 – Excavations

The excavations in the Buda Castle District and Royal Palace area were carried out in several phases. A large number of finds made of hard osseous materials were recovered during these works although given the lack of sieving it seems clear that many small finds were lost forever. This thesis deals with the worked hard osseous materials from five excavations within the territory of the Castle District. The details of the excavations are described in the following paragraphs in chronological order.

Royal Palace of Buda

The first excavations in the Royal Palace in Buda were led by László Gerevich, an art historian, between 1948 and 1962, following the Second World War (Map 3.). This work also provided an opportunity for thorough research before the start of planned large-scale restoration works within the Castle District of Buda.[15] Excavations were preceded by a very thorough collection of written, visual and topographical sources. A total of 587 objects made of animal bone, antlers, or ivory were found in the area, of which 287 workshop waste materials are connected to various local craft activities. Most of the objects were recovered from the excavations carried out between 1950 and 1952. Several attempts have been made to locate the workshops, but their evaluation and interpretation must take into account the fact that most of the layers containing finds are fills indicating secondary burial or deposition and are probably associated with surface levelling connected to major construction periods, and thus, not necessarily with a specific historical period of long- or short-term on-site production. The material was partially published

[15]The results of the thorough research was published by László Gerevich, *A budai vár feltárása [The excavation of Buda Castle]* (Budapest: Akadémiai Kiadó, 1966).

by Mária G. Sándor, who was a pioneer in examining worked bone objects and their *chaîne opératoire* in the context of medieval Buda.[16]

The overall profile of the finds is diverse due to the large number and variety of objects.[17] In addition to representative, high-quality, first-class, consciously designed artifacts, there are also unique, contingent, worked objects, unfinished pieces, and objects that show signs of renewal or transformation, indicating that they had a special value to their owner. The materials considered to be workshop-related items consist of waste materials connected to urbanization as indicators of specialized crafts, such as button and bead making,[18] crossbow making and the production of various tool handles.[19]

Type	**N**
Weapons	23
Clothing accessories	29
Pins	5
Toiletries	7
Gaming pieces	10
Amulet	2
Musical instrument	2
Sun-dial	2
Comb (textile, toilet)	18
Handles	118
Cover plates	15
Bone workshop waste	17
Antler workshop waste	95
Bead/button making	144

[16] Mária G. Sándor, "Középkori csontmegmunkáló műhely a budai várpalotában [Medieval bone processing workshop in the Buda Castle]," *Budapest Régiségei* 20 (1963): 107–24.
[17] See Appendix A.
[18] Mária G. Sándor, "Adatok a középkori csontgomb- és gyöngykészítéshez [Data for medieval bone button and bead making]," *Folia Archaeologica* 13 (1961): 141–49.
[19] G. Sándor, "Középkori csontmegmunkáló műhely a budai várpalotában [Medieval bone processing workshop in the Buda Castle]."

Tool handles	41
Other	45
Objects made of ivory/walrus tusk[20]	5
Total	**587**

Table 1. List of object types from the Royal Palace

Most of the objects were found scattered throughout the territory of the palace and throughout the excavation area, in a mixture of sealed objects and finds from less well-dated, secondary fill layers. Large accumulations of workshop waste were brought to light in two particular areas (Figure 2). One of the enclosed features is located next to the palace chapel (referred in the documentation as "Northern side", or "Next to the chapel") and the other was in the area around the eastern side of the so-called Incomplete Tower (*Turris Manca*).[21] The latter is particularly interesting, regards to the question of craft specialization and its location possibilities. In this area, a closed assemblage of worked antler finds were discovered in a cellar, partly carved into the rock surface, dated by a 1395 denarius of Queen Mary (1982-1395). The objects were examined by Mária G. Sándor, and in her opinion, the manufacturing of the artifacts happened in association with the construction works related to Sigismund of Luxembourg (1387 – 1437). The antlers were manufactured in order to cover the handles of tools for the construction of the Tower in a carpenter workshop located on the construction area.

However, in my opinion, the unclear stratigraphic context and historical background of the area may even suggest that the assemblage is a small local workshop, once belonged to civic buildings on the site, prior to the Sigismund palace construction, which was buried with the wine cellar when the (civic) house above it was demolished, and the denarius of Queen Mary,

[20] Present thesis does not focus on the analysis of finished objects, and objects made of locally not necessarily available raw materials, thus, ivory and walrus tusk.

[21] Unfinished defensive tower built under the reign of Sigismund of Luxembourg (1368 – 1437). Károly Magyar, "A budai középkori királyi palota építészeti együttesének változásai (1340–1440) európai kitekintésben [The Changing Architectural Face of the Mediaeval Royal Palace at Buda (1340-1437) with an Outlook to Europe]" (PhD dissertation, Eötvös Loránd Tudományegyetem, 2008), 88–91.

which helps to establish the chronological context, is related to the construction of the Tower rather than to the function of the building that stood there before.[22] However, all this can only be hypothesized due to the lack of documentation.

In addition, a number of scattered finds have been found, which, even if not linked to a specific site, are in any case indicative of serial production activities. All the finds that I have previously examined can be dated to the thirteenth-nineteenth centuries, but the workshop remains fall chronologically between the fourteenth and seventeenth centuries.

Northern Courtyard

The excavations of the Northern Courtyard, led by László Zolnay and later Károly Magyar, took place following the fieldworks and reconstruction works on the Royal Palace of Buda. As opposed to the excavations carried out in the territory of the medieval Royal Palace of Buda, the fieldwork lying close the North Courtyard was carried out in several phases, and were rather isolated and less systematic, so the finds must also be assessed in this light. Firstly, a small-scale excavation was carried out between 1967 and 1968, followed by excavations in 1972 until 1985 under the direction of László Zolnay.[23] Zolnay's work was continued by Károly Magyar between 1986 and 1987 (Map 4.).[24] During this excavation, fewer number of finds, overall 183 pieces of worked finds were recovered and the excavated material was characterized by less variable artifact types and the raw materials that they were made of. The waste material from these excavations comprises only 51 pieces, which, compared to the Royal Palace of Buda, shows a similar, but understandably less diverse picture both in terms of raw material preference

[22] Károly Magyar describes the context of this cellar, stating that the secondary filling within this feature contains pottery fragments from the thirteenth-fourteenth centuries. Magyar, 88–89.
[23] László Zolnay, "Előzetes jelentés a budai vár déli részén végzett 1975-1981. évi feltárásokról [Preliminary report on the 1975-1981 excavations in the southern part of Buda Castle]," *Budapest Régiségei* 26 (1984): 203–16.
[24] Károly Magyar, "Ásatások a Budavári Palota területén és annak északi előterében 1982-1991 között," *Budapest Régiségei* 29 (1992): 109–15.

and the palette of objects to be made, which is also indicated by the different nature and smaller size of the excavation which took place in a shorter timeframe.

Finds made from worked hard osseous raw material were scattered throughout the area, which may indicate the sporadic nature of the excavation and the way in which the finds were collected. In some cases, an accumulation of artefacts could be expected (feature 4, medieval house), but serious observations and conclusions could not be drawn due to the nature and quantity of the finds.

Type	**N**
Weapon	3
Clothing accessories	14
Toiletries	3
Gaming pieces	10
Musical instrument	3
Comb (textile, toilet)	13
Handles	44
Cover plates	7
Bone waste	6
Antler waste	17
Bead/button making	42
Tool handles	11
Other	10
Total	**183**

Table 2. List of object types from the Northern Courtyard

Zooarchaeological examinations 1.

In addition to the previously presented state of art regarding the worked material, the zooarchaeological processing of the non-worked faunal materials was carried out by two of the most eminent experts in Hungarian zooarchaeology. The faunal materials from the Royal Palace

were published by Sándor Bökönyi between 1958 and 1964.[25] The bones collected from the excavation of the Northern Courtyard were examined by János Matolcsi, only part of which has been published.[26] However, due to the excavation and collection methods of the time, the animal bone material was collected in a haphazard and highly selective manner, rather than systematically. Much more emphasis was placed on finds showing signs of working: in excavation diaries, reports, and summaries of excavation results, this type of finds is usually recorded more often as well as remarks on finds from more enclosed features, or more interesting pieces of a distinctive shape made from more valuable raw materials.

17. Dísz Square

Archaeological remains related to the medieval civil quarters of Buda were found between 1999-2000 underneath the building of the former Ministry of Defense, during the excavations led by Zoltán Bencze (Map 5.).[27] Although a large number of worked osseous raw materials have been recovered, I focus here on raw materials recovered from two closed archaeological features. Both of these were brought to light in the area of two excavated deep cellars. The excavation revealed two wells within these cellars. These layers, date to the sixteenth and seventeenth centuries and contain material associated with specialized workshop activity, that can be connected to documentary sources from the broader area of the site, providing evidence for the presence of workshops.[28]

[25] Sándor Bökönyi, "A budai várpalota ásatásának állatcsontanyaga [The zooarchaeological material from the excavation of the Buda Castle]," *Budapest Régiségei* 18 (1958): 455–86; Sándor Bökönyi, "A budai várpalota ásatásának állatcsontanyaga II. [The zooarchaeological material from the excavation of the Buda Castle II.]," *Budapest Régiségei* 20 (1963): 395–426; Sándor Bökönyi, "A budai várpalota ásatásának állatcsontanyaga III. [The zooarchaeological material from the excavation of the Buda Castle III.]," *Budapest Régiségei* 21 (1964): 369–74.

[26] János Matolcsi, "A budai királyi palota északi előudvarában feltárt XIV-XV. századi állatcsontok [Animal bones from the fourteenth and fifteenth centuries excavated in the Northern Courtyard of the Royal Palace of Buda]," *Budapest Régiségei* 24, no. 3 (1977): 179–98.

[27] Zoltán Bencze, "Régészeti kutatások a Dísz tér 17. sz. alatt. (Előzetes jelentés) [Archaeo logical excavations at plot 17 Dísz Square (preliminary report)]," *Tanulmányok Budapest Múltjából* 31 (2003): 191–203.

[28] Végh, *Buda I.*, 2006, 2:115.

Type	N
Knife handle (semi-finished)	23
Tool	1
Bead/button making	2
Bone waste	1
Total	**27**

Table 3 List of object types from the closed features (17 Dísz Square)

Teleki Palace

Like many other areas of the Castle District of Buda, the western side of Saint George Street was first excavated after the destruction wrought by the Second World War. The former so-called Teleki Palace together with other areas (a total area of 8000 square meters) were researched between 1998-2000 (Map 6.).[29] Similarly to the previously excavated area of the Northern Courtyard, the plots of the civil part of the medieval Buda Castle District and the first Jewish quarter in Buda were also excavated.[30] The area underwent a major transformation both in the Middle Ages and in the centuries that followed (partly due to the general building development typical of urban archaeological sites, but also due to military activity and destruction that affected Buda). The area should thus be assessed as a complex, multi-layered site.

Large quantities of worked osseous material, both in the form of workshop waste and finished objects or tools, have also been found scattered throughout the area.

Type	N
Gaming pieces	18
Comb (textile, toilet)	2

[29] Dorottya B. Nyékhelyi, *Középkori kútlelet a budavári Szent György téren [Finds in a medieval well at the Szent György Square]*, Monumenta Historica Budapestinensia 12 (Budapest: Budapesti Történeti Múzeum, 2003), 6–8.
[30] András Végh, "Buda város első zsidónegyedének emlékei az újabb ásatások fényében [The remains of the first Jewish quarter of Buda in the light of recent excavations]," *Régészeti kutatások*, 2005, 125–48.

Handles	14
Cover plates	1
Bone workshop waste	137
Bead/button making	19
Antler workshop waste	57
Tools	19
Total	**267**

Table 4 List of object types from Teleki Palace

The highest number of bone workshop waste was found, including a surprisingly high proportion of flat bones (See: 'Raw material preferences in Chapter 4), and the material is characterized by the surprising absence of worked antler materials, which were found in significant number on other areas of the Castle District of Buda.

Carmelite complex

The site of the former Carmelite monastery in Buda was excavated between 2014-2016 under the direction of Adrienn Papp (Map 7.).[31] Like the area of Teleki Palace described above, the site is extensive, multi-layered and divided into different units. In the southern area lies the modern Carmelite church (a church associated with the Franciscan order stood here in the Middle Ages). To the north of this structure lay a medieval palace (first belonged to János Szapolyai, then later to István Werbőczy), surrounded by small medieval civil dwellings.[32] This building served as the palace for the Ottoman pashas in Buda in the seventeenth century.[33] The building of the present day Carmelite monastery was erected here in the eighteenth century.

[31] Adrienn Papp, "Előzetes jelentés a Karmelita épületegyüttes régészeti munkáiról [Preliminary report on archaeological research in the Carmelite building complex in 2015]," *Aquincumi füzetek*, 2015, 60–67.
[32] András Végh, *Buda város középkori helyrajza [The topography of medieval Buda]*, vol. 1, Monumenta Historica Budapestinensia, IV. (Budapest: Budapesti Történeti Múzeum, 2006), 142–43, http://mek.oszk.hu/09300/09315/pdf/buda1.pdf.
[33] Adrienn Papp, "Rövid összefoglaló a budai pasák palotájáról [Succinct report on the pasha's palace in Buda]," *Budapest Régiségei* 46 (2013): 167–85.

Several plots of land were situated in the northernmost area, in the Middle Ages, with civilian dwellings and small residences.

Type	**N**
Tool	43
Gaming piece	11
Cover plate	5
Handle	4
Knife accessories	4
Comb (textile, toilet)	2
Jar	2
Clothing ornament	2
Musical instrument	1
Bead/button making	234
Bone waste	720
Antler waste	128
Total	**1157**

Table 5 List of object types from the Carmelite complex

The largest quantity of workshop waste material of all the excavations was found here (1082 pieces). The types of finished objects recovered are less varied, but the raw materials more so. Several types of tools were recovered for which no previous examples of worked osseous material are known from an archaeological context.[34]

Zooarchaeological examinations 2.

The faunal materials from the three further excavations described above were processed by Márta and László Daróczi-Szabó. They were able to isolate and highlight those worked finds that could be attributed to the early stages of processing, which would otherwise have been undetectable without thorough examination by an expert. The excavations of the territory of 17.

[34] See Chapter 5.

Dísz square, together with the materials of Teleki Palace and Carmelite building complex material presented below, increased the proportion of raw material in the finds I examined, as there were more flat bones displaying signs of working or use than in the earlier excavations, such as the excavation of the Royal Palace and the Northern courtyard described above. This observation means a wealth of new information is available about how and which raw materials were utilized to craft tools and ornaments from hard osseous materials during the medieval and early modern period, besides what we know from the already existing literature about it.

Chapter 2 – Methodology

The methods used in my thesis to process available archaeological worked bone and antler assemblages (both the actual finds and the documentation material connected to them) and historical source materials connected to several disciplines, give it an interdisciplinary character. There are many possible ways to combine approaches for a critical analysis and interpretation of the available historical and archaeological sources. However, there are also limitations to the relative comparability of the different sources, how and in what ways they reflect "historical reality" and local practices: in accordance with, complementing or even contradicting each other. In the following pages, I will present the possibilities and limitations of my research topic by source type, factors I kept in mind when examining the available material. Each individual source type represents a narrative, which, when compared to other ones, can provide different perspectives on a particular issue. Even apparent contradictions between archaeological results and contemporary written and visual evidence require explanations and produces useful information about bone and antler working in medieval Buda.

The main and most important "raw data", the archaeological finds (worked hard osseous finds and their context) were studied in detail. The aim was to establish a collection of zooarchaeological data (e.g. raw material identification, typological identification, details of completeness, preservation, taphonomic effects). The first step was to identify the raw material as thoroughly as the degree of manufacture processing and use wear allowed.[35] Identification, where possible occurs on the taxonomic (e.g. cattle – *Bos taurus*) and skeletal level (bone element or part of the bone, together with the necessary measurements), which reflects on the

[35] This is important to emphasize: it is essential to identify the raw materials as accurately as possible in order to understand different preferences and the diversity of the available raw materials. However, it often happens that the cleaning and working processes on the bones and antler their shapes, anatomical properties and characteristics that would allow precise identification are removed or heavily modified.

choices in available and actually used raw materials. The details of the archaeological context of the find as well as its dating is also presented in this database. Each object has its own ID number or code depending on whether it was inventoried or not. There is also a short description of each object, together with observed traces or marks of production techniques, use wear as well as various taphonomic impacts. This dataset combines the identification of the hard animal raw materials themselves together with assessment of the degree and extent of processing on individual specimens. This latter aspect is where the specimen can be placed into different work phases predetermined by the researcher.

Theoretical issues – the concept of workshops in archaeological (and historical) research

Craft specialization and the question of the establishment and operation of different workshops have been the subject of thorough research in both archaeology and history. In archaeological research, it is mainly the objects, various phenomena leaving traces in the soil, man-made remains, and artifacts found at different sites that serve as a basis for the study of various workshops. The materials associated with the different stages of craft specialization are used to identify the workshop, which provides the spatial framework for craft-related activity.

In the case of medieval craft workshops, Hungarian archaeological research has also often focused on workshop localization in the sense of specific spatial location, with much less attention paid to the fact that more abstract questions about medieval workshops and crafts may be posed, which can only be answered by the available sources in connection with theoretical constructs.[36]

In summary, the study of various types of craft-related spaces, called workshops here, can be approached from several different angles, one of which is the issue of spatiality, which seeks to

[36] James R Farr, *Artisans in Europe, 1350-1914* (Cambridge: Cambridge University Press, 2000), 10–43.

locate a workshop that was active and well defined in a particular place at a particular time, something which has been a central element of archaeological research in recent decades.

The question of identification and localization

Archaeological remains typical or characteristic of craft activities are buried in various ways, survive in different ways, and are excavated in the course archaeological research. In addition, field phenomena, features and material culture evidence of craft activity may vary depending on the timeframe, level, and intensity of the craft activity, the main profile and purpose of production, the raw materials utilized, and the tools, implements, and special objects needed to process them. In the case of craft specialization in the Middle Ages, one can count on highly characteristic remains coming from metalworking and glass working workshops, among others, which clearly indicate the presence of a workshop based on archaeological evidence.[37]

As it was already mentioned, the most common aim of archaeological research in terms of craft specialization is to identify the workshop spatially, although this is problematic in many cases and can be fraught with obstacles and questions. This is particularly true for worked osseous raw materials. Large quantities of bone and antler material from a medieval context, bearing traces or marks of processing or manufacturing, have been found in numerous excavations in the Carpathian Basin. The interpretation and substantial scientific investigation, and publication of these materials started in the 1950s. After the publication of a large amount of material from the excavations at the Royal Palace of Buda, a number of small and large-scale assemblages were published aiming at the investigation of the recovered worked osseous materials found, with the focus on identifying and localizing workshops. This latter, however, a very problematic

[37] Such an example is by Ilona Valter, "Árpád-kori (11-13. századi) üveghuta és kovácsműhely a pásztói monostorban [An Árpádian Age (11th-13th-century) glass foundry and smithy in Pásztó abbey]," *Archaeologiai Értesítő* 140 (2015): 195–228.

issue and not as clear-cut as the reader might think based on the archaeological publications of the last decades.[38]

First, the materials from early excavations (meaning from fieldworks after the Second World War) are heavily selected: they were either not collected at all, or not collected systematically, or mixed with unprocessed fauna material due to lack of attention, knowledge, or intent. Given these issues, the second major problem is the way worked hard osseous materials reflect on medieval crafts and related activities. As such, they have little chronological value *per se*, and (especially in a multi-layered, medieval, urban context) they do not necessarily reflect directly the exact location or spatial aspects of the craft activities, workshops.

According to a 2010 case study by Péter Csippán, a site or an assemblage must meet several criteria in the identification process to be considered a workshop. Such criteria include, for example, the presence of specific objects, tools, and implements related to the craft activity, the presence of accumulated (large quantities of) raw materials, the presence of finished products (made from them) in the find material, and the most important type of artefacts in archaeological terms, namely workshop waste.[39]

Written and visual sources can also be of great help in identification. However, the localization and analysis of animal raw material processing workshops are more complex issues, as the remains of leather and horn processing, for example, are preserved in much smaller proportions

[38] Besides worked osseous materials, a similar tendency is observed for other types of objects and their raw materials. Following the processing of the material from the Buda excavations, in the 1960s and 1970s, a real "trend" emerged to link certain objects or groups of products to a workshop or distinct craftspeople or geographical region, which, although of pioneering importance in the study of material culture, is a rather rigid way to study any archaeological material in my opinion. This approach became the basis for many later publications, and workshop identification is still a popular theme in archaeological publications despite its rigidity and limitations.
[39] Péter Csippán, "Az állati nyersanyagokat feldolgozó műhelyek azonosítási lehetőségei [Identification markers of workshops producing goods made from animal-derived raw materials]," in *Csont és bőr. Az állati eredetű nyersanyagok feldolgozásának régészete és néprajza*, ed. János Gömöri and Andrea Kőrösi (Budapest - Sopron: Magyar Tudományos Akadémia VEAB Soproni Tudós Társasága, 2010), 31–38.

than bone or antler objects, either as semi-finished or finished products.[40] Medieval bone and antler processing does not require special tools and implements that would not be found in any given household (knives, files, etc.), making the identification of these workshops much more difficult. The actual waste material, the raw material, and the semi-finished and discarded objects are therefore the most important, primary inputs for the research. However, it is not possible to rely on them with complete certainty either, as they are mostly found in secondary locations. Thus, they cannot confirm workshop activity or the exact location of a workshop, let alone the interconnections between spatially adjacent workshop locations.

This theoretical framework by Péter Csippán sets a helpful basis for the analysis of waste materials connected to craft specialization, but seems more limited in relation to the actual worked faunal materials, considering their complex utilization in the Middle Ages and later periods (or even earlier, with the continuous emergence of craft specialization, the segmentation, structural organization of various and often, increasing specialization of craft activities from the Roman period onwards and the parallel existing cottage industry, activity).[41]

[40]In the area of Teleki palace, a medieval well (No. 8) was recovered during the excavation works between 1999-2000, which contained vast amount of leather objects. B. Nyékhelyi, *Középkori kútlelet a budavári Szent György téren [Finds in a medieval well at the Szent György Square]*, 37–38.

[41] Felix Lang, "Lang, Felix (2011): Activity Not Profession. Considerations about Bone Working in Roman Time," in *Written in Bones. Studies on Technological and Social Contexts of Past Faunal Skeletal Remains*, ed. Justyna Baron and Bernadeta Kufel-Diakowska (Wroclaw: Institut Archeologii Uniwersytet Wroclawski, 2011), 295–303.

Chapter 3 - Sources

Archaeological data and its applicability

This thesis mainly deals with worked osseous materials showing signs of prior working or preparation, and objects displaying the different stages of the manufacturing process after preparation. These include discarded bone and antler fragments that can no longer be worked further worked, interpreted as workshop waste, pre-formed bone and antler objects, plates, that show advanced working but have not been finished, rough-outs, and the small number of finished products, which can be associated with local production. These finds are also connected to serial production as well as cottage industries or processed individually on a household level. These various contexts all include finished, semi-finished objects, objects broken during manufacture, and discarded, waste materials. Examining them can provide answer to many complex research questions, such as raw material preferences, preparation background, manufacturing methods and techniques (and changes in these) as well as final product aims etc.

Certain, often multi-step selection processes have a major impact on how easily this class of artefact can be investigated and are a limiting factor in my research, as well as generally in the applicability of archaeological data in the research into the archaeological traces left behind by craft specialization. Both human[42] and natural, taphonomic factors play a role in these processes.[43] These selection processes are associated with an unquantifiable loss of data and information, and it impacts the raw materials from the death of the animal, through the selection and processing of the raw material, preparation and the creation of the desired objects, its

[42] For further information, see Chapter 6.
[43] Lee R. Lyman, *Vertebrate Taphonomy*, Cambridge Manuals in Archaeology (Cambridge: Cambridge University Press, 1994), 404-433.

discarding or burial, until the excavation and after-excavation processing, together with the placement of the objects in collections or even exhibits up to the present day.

There is also a loss of information and selectivity in relation to archaeological documentation, especially in the case of early excavations. Indeed, some of the excavation documentation with respect to the by-products of antler or bone workshop activity is either incomplete, unavailable, or only provides negligible data useful for the study of hard animal raw materials, including no more exact find locations. Much more emphasis was placed on finds showing signs of working: in excavation diaries, reports, and summaries of excavation results, this type of find is usually found in larger quantities, within more define features. More interesting pieces with distinctive shapes or finds made from more valuable raw materials such as ivory.

The combination of a large amount of worked bone material among the archaeological finds and the documentation in the archaeological research on medieval craft specialization and workshop activities is associated with the problem of localization. Many researchers assumed that the location of these finds designates the place of a workshop, a conclusion which is highly debatable. The location of the deposit does not necessarily match the place of actual manufacture or production due to site formation processes such as building leveling, which were even more intense in urban contexts. In medieval and early modern Buda, these processes are evident in several ways. On the one hand, the continuously inhabited civil part of the town has undergone continuous development and destruction, and with the increased expansion of the Royal Palace on the southern part of the castle hill, many areas previously belonging to the civil part of the city were demolished and redeveloped. Another interesting feature of the finds from the Castle District of Buda is that several tools made of hard osseous material can be linked to these reconstruction works. Other parts of the Castle District were also altered or

rebuilt due to military actions that took place in the area, or at least affected it and which involved the demolition of buildings and levelling of different areas.[44]

Thus, these objects are usually found in secondary depositions, which cannot be interpreted as evidence of the existence of a workshop at a particular historical time and place, even when taken together with information from archaeological finds and related documentation. In addition, the manufacturing process for different products may have taken place in several differentiated stages, even in different places. Such finds may better reflect evidence of the coexistence and networking between various workshops and their craftspeople. However, such finds are also indications that workshop activity likely took place in the general vicinity of where these finds ultimately came to light.

Archaeological documentation is also of paramount importance in the interpretation of archaeological finds recovered from excavations, including worked bone and antler fragments from Buda. These sources provide spatial, topographical, and stratigraphic data required to place these objects in time and space. However, the loss or lack of information is also present in these documents, and this is particularly true for worked bones and antlers, for the early excavations in the 1950s. The large quantities of material recovered are only rarely mentioned in the field diaries and records, and often were stored without being inventoried or unrecorded for years or decades after excavation.

Written sources

The second source base comprises textual materials from medieval and early modern written sources (charters, legal documents, contracts, tithe lists, and the guild documents of the Buda butchers' guild, and more, which I use in their edited, published form. Very few and fragmented

[44] András Végh, "Buda város középkori helyrajza [The medieval topography of Buda]," *Urbs. Magyar Várostörténeti Évkönyv* 4 (2009): 37.

sources about the history of medieval and early modern Buda have survived to the present day. The medieval archives of Buda were destroyed, partly as the result of the Ottoman occupation after 1526, and as the result of the 1686 siege for recapturing the city from the Ottomans, as well as during the siege of Budapest during the Second World War, in the winter of 1944–1945. The remaining written sources, mainly charters were partially published.[45]

Two important, normative as well as pragmatic sources regarding the crafts dealing with animal materials have survived though, namely the *Ofner Stadtrecht*, or Buda Law Book from the early fifteenth century,[46] and one of the guild books as well as the charters granted to the German Butchers' Guild from Buda (1500-1529).[47] These provide a more direct understanding about different types of handicrafts and workshops via legal and financial regulations regarding them and their possible interconnections in the Middle Ages.

The Buda Law Book (*Ofner Stadtrecht*) was compiled in German between 1405 and the 1440s. It includes fundamental information about the economic life of the town: the market regulations, the topography of the town and its suburbs, athe legal status of its burghers, different professionals, and workshops operating within the borders of the town. Their primary function was to provide a written summary of various regulations and decrees for the notaries and the frequently changing elected members of the civic administration.[48]

[45]István Kenyeres, "The Fate of the Medieval Archives of Buda and Pest," in *Medieval Buda in Context*, ed. Balázs Nagy et al. (Leiden - Boston: Brill, 2016), 52–68.
[46]Károly Mollay, *Das Ofner Stadtrecht. Eine deutschsprachige Rechtssammlung des 15. Jahrhunderts aus Ungarn*, Monumenta Historica Budapestinensia 1 (Budapest: Magistratus Urbis Budapest – Akadémiai Kiadó, 1959).
[47] István Kenyeres, ed., "A budai mészárosok középkori céhkönyve és kiváltságlevelei – Zunftbuch und Privilegien der Fleischer zu Ofen aus dem Mittelalter," Források Budapest közép– és kora újkori történetéhez, 1/Quellen zur Budapester Geschichte im Mittelalter und in der frühen Neuzeit 1 (Budapest: Budapest Főváros Levéltára - Budapesti Történeti Múzeum, 2008).
[48] László Blazovich, "A budai jogkönyv és a magyarországi jogkönyvek [The Buda Law Book and Hungarian Law Books]," no. 1 (2006): 73–74.

The Buda Law Book was greatly influenced by the law codes that appeared and spread in the German territories from the fourteenth century onwards. The German law codes also contain statutes on property, inheritance, animal husbandry, hunting, public law, administrative and commercial regulations, numerous prohibitions, procedures, and penalties. The trade regulations in the town law books are of particular interest here. These regulations include the patronage of the local merchants and craftsmen, by protecting local production, crafts, and markets. The regulations obliged the burghers and other inhabitants of the town to uphold the obligations they had sworn to jointly undertake and to maintain peace in the town. In the regulations governing various tradespeople, several crafts can be identified that, in one way or another, are linked to the processing and industries exploiting raw materials of animal origin in the Middle Ages. Although the German law codes influenced the Buda Law Book, both in its language and in its contents, it can be considered a distinct, independent and locally relevant work since it was written down as the general, living Buda law of the time and place.[49]

A particularly important source material, mentioned earlier, is the surviving material of the guild of German butchers in Buda.[50] The guild's charters (i.e. the royal and municipal charters granted to the guild and the court rulings in their disputes with the local fishermen) and guild books are an important source for medieval Hungarian guild history, but even more interesting is that they relate to the hard animal raw materials in my thesis in a much more direct way than other written sources. One aspect may be the issue of raw material sourcing. This is influenced in part by the need for raw materials that are locally available, obtained relatively easily,

[49] László Blazovich and József Schmidt, *Buda város jogkönyve [Buda Law Book]*, vol. 1, Szegedi Középkortörténeti Könyvtár 17 (Szeged: Szegedi Középkorász Műhely, 2001), 6–11.

[50] The German butchers' guild of Buda played a prominent role in the life of the city, but according to András Kubinyi's research it can be said that despite its German character it also accepted Hungarian members.András Kubinyi, "A középkori budai mészároscéh [The medieval butcher's craft of Buda]," in *A budai mészárosok középkori céhkönyve és kiváltságlevelei – Zunftbuch und Privilegien der Fleischer zu Ofen aus dem Mittelalter*, ed. István Kenyeres, Források Budapest közép – és kora újkori történetéhez/Quellen zur Budapester Geschichte im Mittelalter und in der frühen Neuzeit 1 (Budapest: Budapest Főváros Levéltára - Budapesti Történeti Múzeum, 2008), 11–55.

predictably obtainable and rationally combined with the demands of local markets. Although the guild sources do not provide direct information on this, it can be assumed that local craftsmen obtained most of the bones used as raw material through the local butchers' guild or through some connection with them.

Other important types of written sources are the more pragmatic, documents (deeds, contracts and testimonials) related to rentals and other property transactions, in the Buda Castle District and its suburbs. This group of sources includes inventories, sources about land allocations, lease agreements for houses or land with information on the people who signed the contract are named, together with their professions.[51]

Although these sources have been studied in Buda mainly in terms of urban topography in recent decades, they can also provide information, even if fragmentary and indirect, on the distribution of occupational names and the content of the documents, in relation to medieval craft activities. The data on craftsmanship and topography (whether by type of occupation, "workshop" renting, hiring out), when combined with the archaeological record, provide new narratives on the types of objects produced at an organized level, in serial production in the territory of medieval Buda. In this context, I will consider contemporary source data from the published secondary literature, where data and models do exist about such workshop collaborations and networks in urban handcrafting among urban craftspeople. An example of a specialized, organized craft is the medieval and early modern profession of knife makers, for which both the London Cutlers' Company's (1416)[52] written source material and other fragmented sources from Steyr (a prominent center of knife making and trading)[53] provide

[51]A collection of all available documentary evidence can be found in: Végh, *Buda I.*, 2006.
[52] Charles Welch, *History of the Cutlers' Company of London and of Minor Cutlery Crafts, with Biographical Notices of Early London Cutlers* (London: Privately printed for the Cutlers' Co., 1916).
[53] Irmgard Hack, "Eisenhandel und Messererhandwerk der Stadt Steyr bis zum Ende des 17. Jahrhunderts" (Dissertation, Graz, Karl-Franzens Universität, 1949).,

examples of bone working, the procurement of raw materials (transaction records from the London Cutlers' Company)[54] and of knife-makers ordering their handles covered with bone plates by commissioned craftsmen for a piece price.[55]

However, the applicability of written sources has limits in the study of medieval handicrafts, especially for hard osseous materials, as regards raw material choices in serial production, particularly in medieval and early modern town of Buda. On the one hand, as already mentioned, the number of written sources available in the Buda context is rather small and fragmented. Such normative and pragmatic sources are more indirect in nature and less clearly linked to the productive specialized craft spaces and activities that certainly must have existed. Another issue is that, at the moment, there are no known written sources explicitly concerning medieval bone- and antler working. The written sources do not provide direct information on manufacturing techniques either. Only a few details exist that permit a certain level of connectivity to be inferred between different types of workshops. However, my aim in this thesis is to provide various narratives aimed at the resolution of problems resulting from gaps in source data.

Overall, based on the written sources, it can be assumed and outlined what crafts and workshops may have been present in the commercial life of the medieval and early modern Buda, how they influenced local market conditions, even though the sources presented do not directly reflect on production processes, the process of making the objects and the exact location of the workshops exploiting osseous raw materials.

[54] Welch, *History of the Cutlers' Company of London and of Minor Cutlery Crafts, with Biographical Notices of Early London Cutlers.* 174.
[55] Hack, "Eisenhandel und Messererhandwerk der Stadt Steyr bis zum Ende des 17. Jahrhunderts," 103–6.

Visual sources connected to artisans and handicrafts between the fifteenth – sixteenth centuries

The third of my base sources are the pictorial sources, which function both on a generic and more detailed level. These, on the one hand, can be illustrations of the inner life of the different workshops, the tools that were normally or occasionally used, technical stages in the manufacturing work. On the other hand, on a detailed level, visual sources can be useful to identify previously unknown uses of tools and techniques for manufacturing a variety of products.[56] My aim is to use visual sources rather as models than as direct analogies. Most of these visual expressions come from and represent different geographical areas and, in some cases, different periods. Thus, visual sources promote interpretation and complement incomplete knowledge concerning a better understanding of the operation of different workshops. In this respect, the so-called *Mendelschen und Landauerschen Hausbücher*[57] can perhaps be considered contemporary parallels for the subject of my thesis (medieval and early modern find materials). It is one of the basic, relevant visual sources dealing with crafts from beyond the Kingdom of Hungary. The foundation was established in 1388 and operated until 1806, without interruption. It can be thought of as a retirement home for 12 elderly Nuremberg artisans. The "society" provided them with accommodation and food. From 1425, every "Mendel brother" was portrayed with a full-page portrait in the House Book. The portraits represent the brothers at work, practicing their craft. The different manufacturing processes, workshop equipment, tools, and materials are visible and can be identified and compared with tools and other objects found during the various excavations in Buda Castle District. The visual

[56] A great example to illustrate this point (which can be connected to the tool handles from the excavations of Buda, manufactured locally) is: "Die Hausbücher der Nürnberger Zwölfbrüderstiftungen." Deutschen Forschungsgemeinschaft, https://www.nuernberger-hausbuecher.de/75-Amb-2-279-15-v (accessed May 15. 2022)

[57] "Die Hausbücher der Nürnberger Zwölfbrüderstiftungen." Deutschen Forschungsgemeinschaft, https://www.nuernberger-hausbuecher.de (accessed May 15. 2022)

sources in general are extremely useful for an understanding of production practice models, that is, how certain goods were produced or used.

Chapter 4 – Raw material selection and processing, and patterns of preference

Objects made from hard osseous materials range widely in quality, design, and use. The range of uses of the raw material is also quite complex: the objects reflect both the parallel, sometimes complementary, large-scale commercial production connected to urban areas as well as the individual household production of rural, and household, cottage 'industries'.[58]

Bones and particular skeletal elements from large domesticates were easily available and obtainable locally through predictable market channels and in larger quantities in the medieval Kingdom of Hungary. Bone and antler (obtained both by gathering the antler and through hunting of red deer (*Cervus elaphus*) stags) were often used as additional raw materials for composite, multi-material objects in the large-scale medieval urban workshop production.[59]

Raw materials: qualities, characteristics

Within the framework of this study, I will focus on two major raw material groups. Bones of large domestic ungulates (especially long bones and metapodials of cattle – Bos taurus), and red deer antler, which can be considered more specialized in terms of their physical structure and methods of acquisition. Their physical characteristics, procurement methods and uses are described below.

Bones and skeletal elements of large (domestic) ungulates

Of all the hard osseous raw materials of animal origin, the most commonly exploited were bones. The bones could come from both wild and domesticated species, but the most common

[58] László Bartosiewicz et al., "Animal Exploitation in Medieval Hungary," in *The Economy of Medieval Hungary*, ed. József Laszlovszky et al. (Leiden: Brill, 2018), 143–44.
[59] For a short overview, see Chapter 7 – Summary.

for late medieval and early modern urban settings are the bones of large domestic ungulates (typically cattle) and skeletal elements from various small domesticates (sheep, goats, pigs), with the processing of long bones predominating among the various bone fragments produced during various stages in the manufacturing processes.[60] The bone cortex of the diaphysis (or the long tubular bone between the joints) part of the bones is the main bone part used as raw material. Cattle diaphysis, especially the lower limb bones from metapodials, have relatively thick walls of compact bone with little spongy substance, make them ideal for manufacturing objects with various purposes.[61]

The physical properties of different raw materials have always been one of the more important factors in the way craftspeople selected raw materials in all periods. Bones perform several basic functions in the living organism: they form a solid skeleton that surrounds and protects the internal organs and body cavity, and they also serve to support the skeletal muscles. Bone is comparable to wood as a raw material: its structure is fibrous, often splintering, because of the linear nature of the Haversian canal structure in the compact walls of the bones.[62]

The bones most commonly (but not exclusively) used in medieval bone artefacts were the metacarpus and metatarsus of cattle, which were less meaty parts of the animal skeleton, thus less important part from the viewpoint of meat consumption, and therefore do not represent a major economic loss in the meat market. Their thick walls or compacta provides a solid block of raw material and can be shaped in a variety of ways. Their longitudinal structure can be a

[60] István Kováts, "Finds of Worked Bone and Antler from the Royal Palace of Visegrád," in *From Hooves to Horns, from Mollusc to Mammoth. Manufacture and Use of Bone Artefacts from Prehistoric Times to the Present,* ed. Heidi Luik et al., Proceedings of the 4th Meeting of the ICAZ Worked Bone Research Group at Tallinn 26th–31st of August 2003 (Tallin: University of Tartu, 2005), 302., Arvi Haak et al., "Worked and Unworked Bone from the Viljandi Castle of the Livonian Order (13th–16th Centuries)," *Lietuvos Archeologija* 38 (2012): 325.
[61] Bartosiewicz et al., "Animal Exploitation in Medieval Hungary," 143.,Alice M. Choyke, "Cut to Fit: Comparing Roman Period and Medieval Bone Workshop Debris from Urban Areas," in *Skeletons from the Cupboard Selected Studies from the Visegrád Meetings of Hungarian Archaeozoologists 2002–2009*, ed. László Bartosiewicz, Erika Gál, and István Kováts (Budapest: Martin Opitz Kiadó, 2009), 246.
[62] Arthur MacGregor, *Bone, Antler, Ivory and Horn. The Technology of Skeletal Materials Since the Roman Period.* (London: Routledge, 1985), 1–9.

guideline for cutting to size, which is a fundamental step in the processing phase (i.e. sizing). In the case of all hard osseous materials, including bones, it is worth stating and bearing in mind that the dimensions and anatomical shape of the raw materials have a significant influence on how the bone can be worked, and may even determine to some extent in advance what kind of object it can be made into. This also applies to objects that are individually worked and appear to be *ad hoc* in addition to objects systematically, consistently and serially produced from the same raw material in workshop settings.[63]

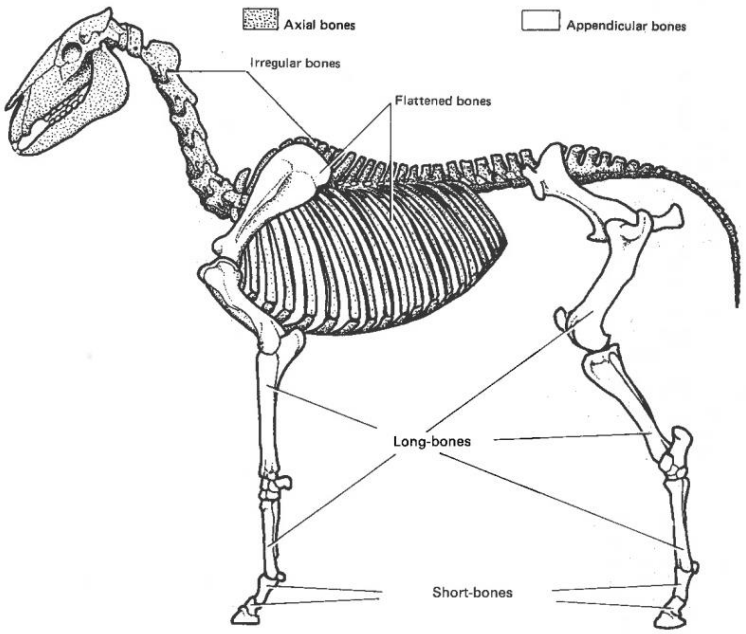


Figure 1 Main bone types, skeletal division

After MacGregor, *Bone, Antler, Ivory and Horn*, 7., Figure 6.

It is very likely that the large-scale presence of refuse bone from workshop activities and selection of particular skeletal elements, the presence of bones implies that there was a close working relationship with the local animal husbandry, local butchers and tanners (since the metapodia are often retained in the skin before it is stretched) and therefore suggests there were close organizational links with the suburbs and surrounding (farming and market) towns and

[63] István Kováts, "Worked Antler Finds from the 16th-17th Century Part of the Lower Castle in Visegrád, Hungary," in *Skeletons from the Cupboard Selected Studies from the Visegrád Meetings of Hungarian Archaeozoologists 2002–2009*, ed. László Bartosiewicz, Erika Gál, and István Kováts (Budapest: Martin Opitz Kiadó, 2009), 264.

villages, from where the animals were probably driven up to Buda. The use of bones as raw materials always meant the killing of the animal and presumably the exploitation of its body parts to the fullest extent possible in general.

Although no direct link can be established between the artisans living and working in the Buda Castle District and the butchers who slaughtered animals, contemporary historical sources suggest the existence of comparable market networks in Buda. An example is the London Cutlers' Company, whose guild sources provide strong evidence that knife masters acquired and combined osseous raw materials with others to make knife handles according to demand, another is the example of the knife makers and hafters in Steyr.[64]

Red deer (*Cervus elaphus*) antlers

Antler (especially antler from male red deer) was used as raw material for a variety of tools and ornaments thanks to its many useful properties, particularly its resistance to shock from impact. As a specialized bone formation, antler is very similar to bone in its chemical composition, but its growth and nutrient supply is different. The antler stem is attached directly to the frontal skull bone. The various antler tines grow from the main stem or beam ending in the crown of the antler rack. The surface of the antler is covered with a blood-vascular-rich layer containing substances essential for its growth and development, which gives it its characteristic, lumpy surface called the beading. The growth of the antler is intermittent, the number of tines increasing every cycle of a stag's life, so that it has a less fibrous, spongy structure due to the variable intensity of its development and growth. For this reason, the physical properties of the antler are different: it is a flexible, less fissile raw material, which became the preferred raw

[64]Welch, *History of the Cutlers' Company of London and of Minor Cutlery Crafts, with Biographical Notices of Early London Cutlers*, 19–21. Hack, "Eisenhandel und Messererhandwerk der Stadt Steyr bis zum Ende des 17. Jahrhunderts," 57–58.

material for many tools.[65] In the territory of the Hungarian Kingdom, people would have had access to red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*), and very occasionally to moose (*Alces alces*).[66]

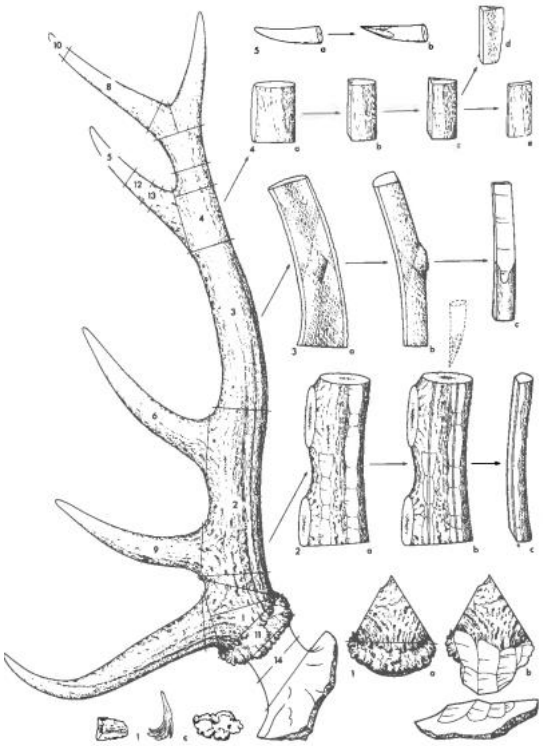


Figure 2 Antler sectioning methods

MacGregor, *Bone, Antler, Ivory and Horn*, 68., Figure 42.

The size and structure of antlers, like bone, also limits the repertoire of objects that can be made from them, but each element of the antler racks could be exploited, based on the requirements used as required in different historical periods. One indicator of the acquisition of raw material for antlers is the presence of the burr and medallion: when the antler is shed (each year), the burr and medallion separate from the frontal bone (the pedicle in early Spring), so it can be

[65] MacGregor, *Bone, Antler, Ivory and Horn. The Technology of Skeletal Materials Since the Roman Period.*, 9–14; László Bartosiewicz, *Régenvolt háziállatok [Domestic animals in the past: Introduction to zooarchaeology]* (Budapest: L'Harmattan Kiadó, 2006), 170–170.

[66] Bartosiewicz, *Régenvolt háziállatok [Domestic animals in the past: Introduction to zooarchaeology]*, 172; István Kováts, "A visegrádi Fellegvár megmunkált csont- és agancsleletei [Worked bone and antler finds from the Visegrád Citadel]," in *A visegrádi fellegvár [The Visegrad Citadel]*, ed. Gergely Buzás, A visegrádi Fellegvár Visegrád Régészeti Monográfiái 6 (Budapest: Magyar Nemzeti Múzeum Mátyás Király Múzeum, 2006), 169–70.

collected periodically after it is shed.[67] Antlers can also be obtained by hunting, a pursuit that was limited to the nobility and the King.[68] Even on objects where the burr and medallion are missing, collection may sometimes be indicated by the presence of gnawing marks (most often by rodents) on semi-processed objects or objects remaining as processing waste, which is not uncommon for antlers that have freshly fallen.

Figure 3 Gnawing marks from the Royal Palace 1.

Figure 4 Gnawing marks from the Royal Palace 2.

In many cases, however, archaeological finds do not contain such fragments, so it is not usually possible to determine whether the antler fragment under examination is the result of hunting or gathering.

Operational chain – raw material processing

The French term, chaîne opératoire includes the steps and processes ranging from acquisition of the raw material to the making of certain objects, their use until they are thrown away or

[67] MacGregor, *Bone, Antler, Ivory and Horn. The Technology of Skeletal Materials Since the Roman Period.*, 11–12., Bartosiewicz, *Régenvolt háziállatok [Domestic animals in the past: Introduction to zooarchaeology]*, 170–71.
[68] Dale Serjeatson, "Animal Remains and the Tanning Trade," in *Diet and Crafts in Towns. British Archaeological Reports International Series: 129-142*, ed. Dale Serjeatson and Tony Waldron, British Series 199 (Oxford: BAR Publishing, 1989), 129.

transformed into other objects as a kind of up-cycling.[69] With objects made from osseous materials, this operational chain starts with the death of the animal (except in the case of shed antlers) and, in my opinion, extends to the collections of various museums, since these processes, which go beyond the exploitation of the animal, affect the preservation and the degree to which it is possible to examine and study these objects. In the case of medieval artefacts, this process has often been neglected by researchers, but it is crucial to understand the artefacts themselves within their full context, natural, cultural, and present-day taphonomic constraints.

As mentioned above, all stages of the processing of both bone and antler can be found and examined in the artefacts from the area of the Buda Castle District. This includes finished goods, semi-finished and spoiled (damaged during manufacturing) products, as well as workshop waste, which is present in extremely high numbers. In addition, the range of objects excavated can be broken down into a number of functional groups and formal types, both locally produced and related to the commercial activity impacting the presence or absence of the objects found in excavations in the area of medieval Castle District, as for example knife and tool handles, combs, beads and buttons, or gaming pieces etc.

There is no fixed pattern of work in the processing of medieval worked bones and antlers, but rather certain trends are evident that can be studied at the level of case studies for each type of object. The steps in the production chain can, of course, be summarized in general terms, but this does not necessarily mean that the specific, known steps that the researcher can assume to be general on the basis of the scholarly literature, were carried out in practice in the same way in each case, for each type of object. In my previous Master's thesis, I examined these

[69] Aline Averbouh, "Technologie de la matière osseuse travaillée et implications palethnologiques. L'exemple des chaînes d'exploitation de bois de cervidae chez les Magdaléniens des Pyrénées I.Panthéon–Sorbonne, Párizs 2000." (PhD dissertation, Paris, L'Université de Paris, Panthéon–Sorbonne, 2000).

processing characteristics, the detailed steps of which can be summarized in outline and generalized as follows.[70] After the raw material was obtained, the preparation of the raw material takes place as an intermediate stage in the production chain, something that varies depending on the type of raw material. After preparation, the design phase is carried out, including the steps of sketching, drafting and preforming. Pre-forming is followed by the actual transformation process, where the selected raw material is cut to size and then shaped into its final form, first roughly and then using increasingly sophisticated tools and techniques. In many cases, decoration is not the last step, but was carried out at an earlier stage in the manufacture process, something that was entirely at the discretion of the maker. Marks of draft or sketch making is also visible on certain objects, thus, the designing process is also traceable.

The different steps in the production chain, the craftsmanship and their separation provide a wealth of information about the stages of object production, phases in the manufacturing process, the methods used to achieve the form of the final object, the nature of the craft in terms of variability, differentiation or specialization. The multi-stage differentiated processes also reflect the technical possibilities, the skills of the maker and the specific craft characteristics of the place and period.

Raw material preferences in medieval Buda

Based on my previous research and on the results from other excavations (which do not include different interpretations but are only published as a catalogue of material), there are clear preference shown for particular raw materials on the part of craftspeople and artisans operating in medieval Buda. The formal design and decoration of the objects from the excavations in Buda also confirms this: the original anatomical features and formal characteristics of the raw materials are fully exploited, integrated into the shape of the final object, sometimes even

[70] Font, "13-17. századi megmunkált kemény állati nyersanyagok a budavári palota területéről [Thirteenth-seventeenth century worked hard osseous raw materials from the Buda Castle]," 92–110.

emphasized. Thus, it can be said that the artisans working with hard osseous raw materials were well aware of their physical properties, anatomical characteristics and formal features. They consciously exploited these aspects during the various stages of processing to complement parts of a variety of commercial goods.

This trend was observed in the find group of knife handles, which I examined in detail previously.[71] On certain types of knives, a longitudinal running, indented decoration was observed, most often connected to the anatomical shape of the *sulcus longitudinalis* trench of the *palmaris* and *plantaris* planes of the original raw material, cattle metapodials. This shape could obviously have been artificially shaped, or in many cases, the original surface was modified and blended to a certain degree, but this trend also confirms what we know so far about raw material preferences.

Figure 6 Knife handle from the Royal Palace

BTM inventory number 52.3064

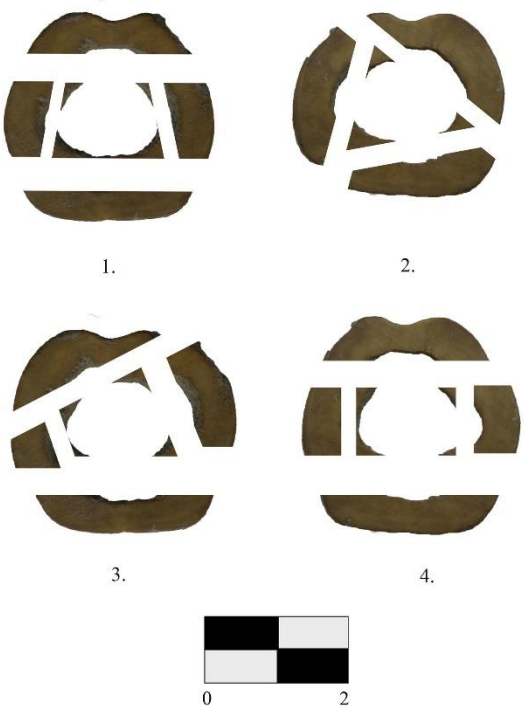


Figure 5 Reconstructed cutting planes based on workshop waste from the Royal Palace

[71] Font, 105–10.

In the case of objects made exclusively for decorative or everyday use, such as knives, the handles were made mostly from cattle metapodials. In contrast, the different handles for more heavy-duty tools were made almost exclusively from red deer antler.[72] This tendency clearly reflects the differing features and characteristics of the two raw materials: antler was used for activities requiring more energy and intensive work, tools which required greater resistance, flexibility and tensile strength. Bone was used as the raw material for more 'mundane' objects for lighter everyday tasks, since it was supposedly more readily available compared to antler and did not require the same physical characteristics and features.

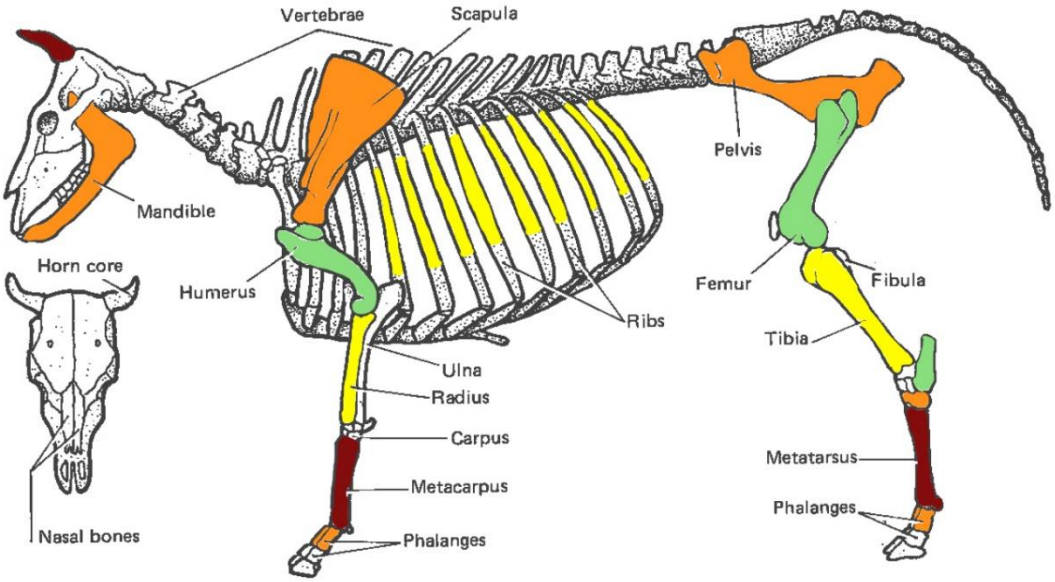


Figure 7 Cattle bones frequency in workshop waste from Buda

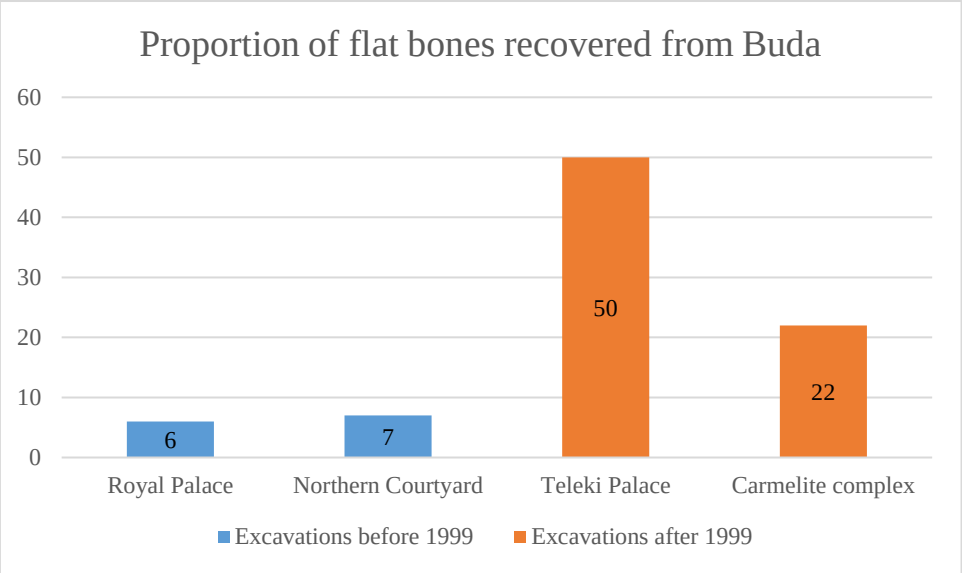
[72]G. Sándor, "Középkori csontmegmunkáló műhely a budai várpalotában [Medieval bone processing workshop in the Buda Castle]"; Font, "13-17. századi megmunkált kemény állati nyersanyagok a budavári palota területéről [Thirteenth-seventeenth century worked hard osseous raw materials from the Buda Castle]," 74.

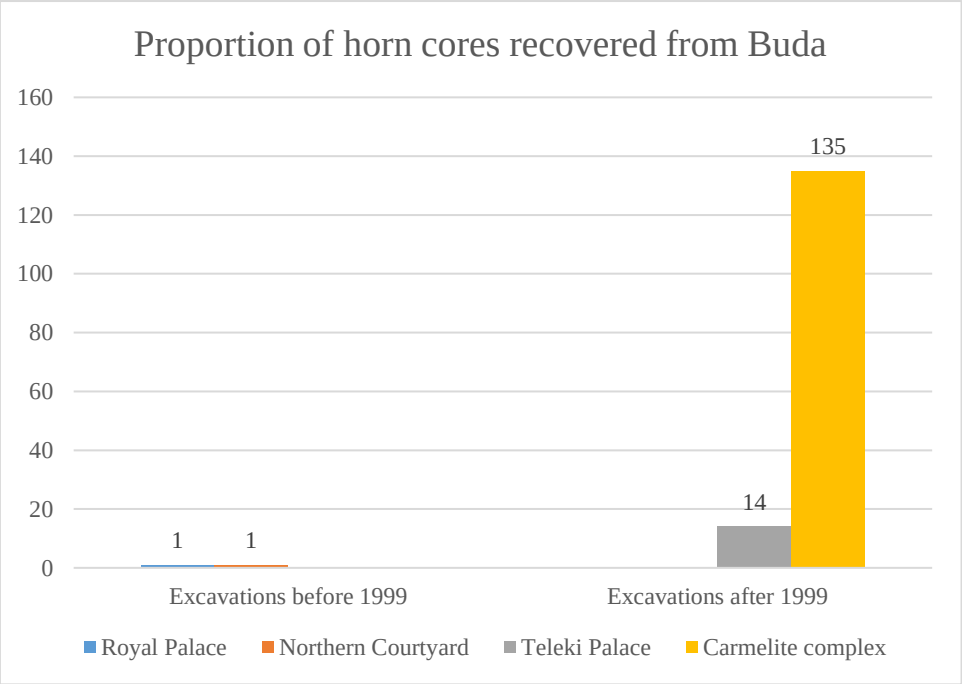
The utilization of flat bones in Buda (*mandible*, *costa*, *scapula* and *pelvis*)

The literature regarding medieval worked osseous materials focuses almost exclusively on the use and technological background behind long bone processing from large or small ungulates. One of the more surprising aspects of the worked bone materials from the Buda Castle District was the visible shift between the proportion of the types of raw materials used to produce different objects. There is an increasing tendency and utilization for various types of flat bone (mandibula, costa, scapula, pelvis) to appear alongside the long bones in bone working debris and finished products. This manufacturing trend would be unobservable when only the secondary literature or finds from the old excavation materials are considered.

This trend, however, is more a reflection on the various selection processes and the lack of professionals dealing with bone materials from the earlier excavations than on contemporary preferences in terms of raw material selection. Indeed, since the 2000s, more and more animal derived raw materials and bone fragments collected in excavations have been included in the worked category, objects which did not appear in assemblages from earlier excavations conducted in Buda. This is a perfect example of results distorted by the absence of expert's eye and professional analysis as well as the inadequacy of the methods of collecting finds at the time. Fortunately, thanks to the zooarchaeologists at the Budapest History Museum's medieval department, these types of raw materials have been preserved and information about them has now filtered out into research on more recent finds, revealing a much more colorful and varied range of raw materials.[73]

[73] The results of the zooarchaeological analysis is presented in Appendix A





Chapter 5 – Handicrafts and workshops in medieval and early modern Buda

The historiography of medieval Hungarian towns has generally presented a relatively clear and comprehensive picture of economic life, trade and crafts in medieval Hungary, including Buda.[74] Generally, there are several primary written sources, both direct and indirect, as well as pictorial representations, which provide insights into the everyday life of workshop or craft activity, and its various organizational structures. These data may be contrasted with medieval archaeology, which provides a different picture of the activities of workshops from the period and can add further information to the present picture.

Previous research on the handicrafts in the territory of Buda mainly concentrated on the activities connected to goldsmiths,[75] and textile/cloth making, butchers,[76] millers and bakers[77] based on written sources and topographical research. As mentioned, the Buda Law Book is a really important source, which includes large number of crafts, practiced in Buda.

As the goal of this thesis is, in part, the mapping of crafts, workshops, and trade goods using worked osseous raw materials in the Buda Castle District, I will start with an introduction to the crafts and related workshops in this area based on a combination of written sources and archaeological materials.

[74] Imre Holl, "Középkori városi topográfia és a kézműves műhelyek (Die mittelalterliche städtische Topographie und die Handwerkerstätte) [Medieval urban topography and craft workshops]," in *Régészet és várostörténet tudományos konferencia.*, ed. Ákos Uherkovich, Dunántúli Dolgozatok. Történettudományi Sorozat 3 (Pécs: Janus Pannonius Múzeum - Budapesti Történeti Múzeum - MTA Pécsi Akadémiai Bizottság, 1991), 33–38; Judit Benda, "Merchants, Markets and Shops in Late Medieval Buda, Pest and Óbuda," in *Medieval Buda in Context*, ed. Balázs Nagy et al., vol. 255–277 (Leiden - Boston: Brill, 2016).

[75] Holl, "Középkori városi topográfia és a kézműves műhelyek (Die mittelalterliche städtische Topographie und die Handwerkerstätte) [Medieval urban topography and craft workshops]," 34.

[76] Judit Benda, "A kereskedelem épületei a középkori Budán II. Mészárszékek háza, zsemlyeszékek háza, árucsarnok [Commercial buildings in medieval Buda II. The house of butcheries, bakeries, market hall]," *Tanulmányok Budapest Múltjából* 37 (2012): 7–43.

[77] Judit Benda, "Malmok, pékek és kenyérszékek a későközépkori Budán [Mills, bakers and bread-stalls in late medieval Buda]," *Tanulmányok Budapest Múltjából* 38 (2013): 7–31.

Overview of handicrafts using hard osseous materials

There are several ways in which osseous raw materials can be found in medieval crafts. Tools or ornaments made from bone and/or antler were used as general, multipurpose implements or, in some cases specially designed tools to make a variety of products and commercial good. They can also appear as raw materials for a craft product or some of its components. This chapter focuses on the latter option in terms of the utilization of hard raw materials of animal origin. Several of the medieval and early modern crafts were involved in the processing of different skeletal elements and red deer antlers. The choice of raw material to make various objects varies from region to region, from town to town, depending on local traditions, availability and market demands. Archaeological finds from various urban and rural contexts indicate the importance of the processing of these raw materials, despite them being rarely mentioned in written sources, historical records and not even that much in scholarly publications on medieval archaeology.[78]

Nevertheless, this latter group of sources does provide evidence of the large-scale acquisition and processing of hard osseous raw materials, especially in the production of knives, toiletry and textile combs, figurines, rosary beads, dress fittings, and accessories of weapons in the Middle Ages. These following general object categories are based on typological observations.

The Buda Law Book mentions the following crafts, which can be connected to the utilization of osseous raw materials:

- Comb makers[79]

[78] Magdalena Konczewska, "Bone, Horn and Antler Working in Medieval Wrocław," in *Written in Bones. Studies on Technological and Social Contexts of Past Faunal Skeletal Remains*, ed. Justyna Baron and Bernadeta Kufel-Diakowska (Wroclaw, 2011), 305–11; Haak et al., "Worked and Unworked Bone from the Viljandi Castle of the Livonian Order (13th–16th Centuries)."

[79] The selling of combs was restricted under 200 pieces, based on this information, I assume that it served as protection of local comb-makers. Article 423, Mollay, *Das Ofner Stadtrecht. Eine deutschsprachige Rechtssammlung des 15. Jahrhunderts aus Ungarn*, 196.

- Saddle makers[80]
- Bow makers[81]
- Knife makers[82]
- Lathe turners.[83]

Further information is available in the wine-tithe lists from Buda from the first third of the sixteenth century, which, although connected to the suburbs of Buda, might reflect on bone and antler and horn working. Two names listed there appear to be directly linked to faunal raw materials. One of them is Ambrosius Chontws ('Boney'),[84] the other is Michael Olwasogyartho (Hungarian term presumably for Paternosterer).[85] A third name may be associated with button making: Gregorius Gombos.[86] However, the occurrence of these names may not necessarily mean that their bearers were actively involved in the manufacturing of osseous raw materials.[87] Based on the archaeological finds I have examined, the following crafts can be considered or be assumed to be relevant to the processing of hard raw materials of animal origin in the town of Buda.

Bow and arrow-making

Among the crafts practiced in the territory of the medieval Castle District of Buda, there exist fragmentary source material on the craft of bow and arrow-making. Several elements of bows (which can be of different types based on their construction and structure) as well as arrowheads

[80]Unfortunately, only the title of the paragraph has been preserved in the manuscripts, not the full article about the rights of saddle-makers. Article 124, Mollay, 106.
[81]The rights of bow and arrow makers, Article 121, and On the rights of archers, turners and joiners, Article 122, Mollay, 105–6.
[82]About the knife makers see Article114, Mollay, 104. Unfortunately only the title of the article is preserved in the manuscripts.
[83]On the rights of archers, turners and joiners, Article 122, Mollay, 106. Only the title is preserved.
[84] Ferenc Szakály and Jenő Szűcs, eds., *Budai Bortizedjegyzékek a 16. Század Első Har Madából [Wine-Tithe Lists from Buda from the First Third of the Sixteenth Century]* (Budapest: Magyar Tudományos Akadémia Történettudományi Intézete, 2005), 83. and 99.
[85] Szakály and Szűcs, 88.
[86] Szakály and Szűcs, 95.
[87] Kovács, "Remains of the Bone Working in Medieval Buda," 311–12.

that could be made of made of bones or antlers as well as other hard materials such as wood or metal. As for long bows and crossbows, the winding nuts of the crossbows were made almost exclusively made from antler.[88] Various bone or antler covers or inlay plates were also used (although not exclusively) for bows that served both functional and decorative purposes.

There are several records concerning craftspeople making bows and arrows in the Buda Castle District. These records take the form of various property sales contracts, although this data does not provide much information beyond verifying their presence and their profession within the town scene at different periods in its history.[89] In addition to topographical information, there is also data on how they influenced trade in the city: The Buda Law book clearly shows that products of this kind brought from the countryside could only be sold or bought by local or 'foreign' buyers under the supervision and with the permission of local craftsmen and masters. Strict regulations also applied to the products of non-local craftsmen, who were only allowed to sell certain quantities of these items at weekly markets.[90]

Arrowheads and the tools used to make arrowheads in the archaeological record may also be considered in the study of local arrow-making craft. Arrowheads made of bone and antlers have been present in the archaeological record since prehistoric times. However, arrows made from osseous material are rarely encountered in the area of the medieval Kingdom of Hungary. Their use and presence are largely associated with the Mongol invasion and the traces of Far Eastern weaponry in this period. At the medieval site of Szank-Kápolna, during the excavation of the church of a settlement destroyed during the Tatar invasion, a bone arrowhead was found which

[88] MacGregor, *Bone, Antler, Ivory and Horn. The Technology of Skeletal Materials Since the Roman Period.*, 160–61.
[89] Two bow maker were located in the mid-fifteenth century in the medieval Szent György Square, in close proximity to the waste materials related to knife-makers: Heinrich and Georg. Végh, *Buda I.*, 2006, 1:180. Two other artisans associated with bow making were located in the northern part of the Castle District, Martinus in the second half of the fifteenth, Ladislaus during the first half of the sixteenth century.Végh, 1:291. and 298.
[90]Mollay, *Das Ofner Stadtrecht. Eine deutschsprachige Rechtssammlung des 15. Jahrhunderts aus Ungarn*, 105–6.

was later published.[91] This kind of arrowhead was also found in the material culture of the Mongol incursions: at Hajdúböszörmény from the excavation of an Arpad-period village, in the early medieval cemetery of Petőfalva, and in the area of Benevár, in a fifteenth century archaeological context.[92]

A bone arrowhead came to light during the excavations in the Buda Castle District, László Zolnay excavated in Northern Courtyard of the royal palace area. The arrowhead found among the remains of a thirteenth-century burgher's house linked by the excavator, László Zolnay to the Mongol invasion in 1241-1242. Nevertheless, there is not enough information available to properly interpret this projectile point, nor to determine whether it was made locally or simply buried here.

Relatively little information is available on the use of medieval bone arrowheads altogether. Balázs Tóth suggests that these arrowheads, which are cheaper and easier to produce than iron arrowheads, were primarily intended for hunting.[93] The question of whether bone or antler arrowheads were used for hunting or possibly in more serious clashes has also been examined for other historical periods. Until more medieval bone arrowheads are recovered from archaeological contexts, we can only speculate on this issue.

A special type of arrow-making tool, preserved in the archaeological record are small objects that function as planchets, with a distinctive shape and usually a rough design. They were generally used to smooth the surface of the arrow shaft to even them out. Only a small number of these objects have been identified and published in the archaeological literature on worked

[91] Szabolcs Rosta and István Pánya, "'A szanki ellenállók' ["The resistance in Szank"]," *Határtalan Régészet* 3, no. 1 (2018): 52.
[92] Balázs Tóth, "Észak-magyarországi várak vas-, és színesfémleletei. Zólyom, Benevár, Szanda, Salgó [Iron and non-ferrous metal finds from fortresses in Northern Hungary. Zólyom, Benevár, Szanda, Salgó]" (MA thesis, Budapest, Eötvös Loránd Tudományegyetem, 2016), 85–86.
[93] Tóth, 85.

bone materials, but experimental archaeological and ethnographic data have made it possible to identify and reconstruct the use and method of use related to these types of objects.

The bolt shaft planer made of antler recovered from Buda was found in the Great Courtyard of the Royal Palace. Based on stratigraphic observations, although medieval ceramics were also found in the vicinity of the object, it should be dated to the sixteenth or seventeenth century. The uniqueness and contingency of the object can be linked to both workshop activity and to a unique, individualized working process (i.e. a temporary craft activity that was created at a particular moment in time, and not necessarily a highly organized workshop). Analogous archaeological finds were also found in essentially the same context: in castles in crisis, it is not unusual to need quick and simple methods to produce ammunition, and arrows are a perfect example of this.[94]

The last group belonging to these type of craft products are crossbows and those of their elements made from hard osseous materials.

The production of this type of weapon may have been started as early as the fourteenth century by master bow makers in the Kingdom of Hungary, mainly in Košice [Kassa], Bardejov [Bártfa], Banská Bystrica [Besztercebánya] Banská Štiavnic [Selmecbánya] and Sibiu [Nagyszeben]: the name of the craft can be found in many armories and account books.[95] There are also documents from Buda, which provide an overview of the land situation at the time. Craftspeople were usually tenants of plots or houses in church hands. The Buda Law Book also contains passages on the rights of bow and arrow makers, as well as strict regulations on foreign

[94] Erika Gál, "Late Medieval Bone and Antler Working at the Residence of the Archbishop of Esztergom (Northern Hungary)," *Archaeologia Lituana* 21 (2020): 79–96.
[95]Crossbows are called in latin sources *ballista*, it appears as *zomoserig* in Hungarian sources. The craft itself is referred to as *ballistarius, arcufex, armbroster, bogner*. János Kalmár, *Régi fegyverek [Historical Hungarian weapons]* (Budapest: Natura Kiadó, 1971), 139.

merchants and the sale of their wares, which protected the interests of local craftsmen and merchants.[96]

Several artifacts related to crossbows and crossbow making (Figure 16.) and use have been found during excavations in the Buda Castle District, but two unfinished, spoiled artifacts indicate the presence of local manufacturing activity. The two objects were recovered during excavations in the territory of from the Royal Palace. The archaeological context dates them to the fifteenth – sixteenth century.

We also know of documents from Buda in which, in an overview of the land situation at the time, crossbow makers appear, usually as tenants of plots or houses. [97] Although present both in written sources and based on finds scattered throughout the archaeological record, serial production cannot be demonstrated with absolute certainty in fifteenth – sixteenth century Buda.

Figure 8 Crossbow maker from Frankfurt

SLUB Dresden, "Eygentliche Beschreibung Aller Stände auff Erden" (1568), http://digital.slub-dresden.de/id278811973/167.

[96] Mollay, *Das Ofner Stadtrecht. Eine deutschsprachige Rechtssammlung des 15. Jahrhunderts aus Ungarn*, 105–6.
[97]Stephanus Zamzerigyarth or Igiarth Végh, *Buda I.*, 2006, 1:291.

Comb-making

Written sources about comb-making and selling exist in the Buda Law Book.[98] During the medieval and early modern periods, combs were often made from osseous raw materials (ivory, bone, antler, and horn) as well as wood, as can be seen from archaeological finds. However, no detailed information yet exists about the exact production process and location in the context of the Buda Castle District.

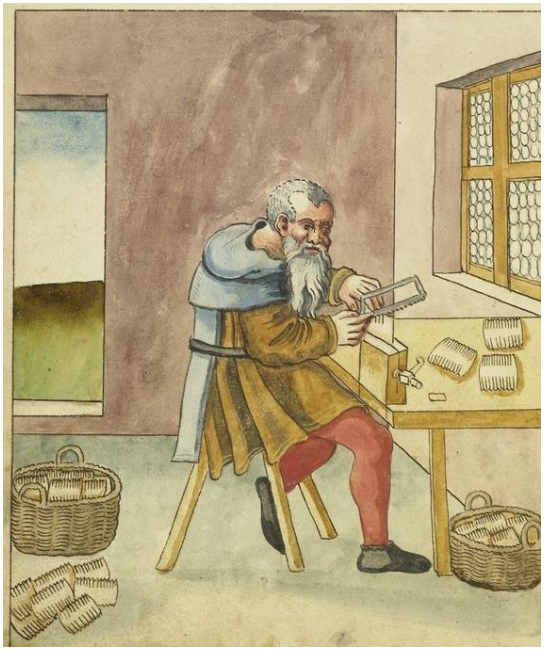


Figure 9 Comb maker

Die Hausbücher der Nürnberger Zwölfbrüderstiftungen, Amb. 317.2° Folio 15 verso (Mendel II) https://www.nuernberger-hausbuecher.de/75-Amb-2-317b-15-v accessed 17.05.2022

Among the raw materials of animal origin, the use of horn has been the most important in our case. In fact, no worked horn material or objects were found during the excavations at Buda, which is related to the taphonomic processes affecting the finds and to the soil conditions, which in most cases are not suitable to the preservation of horn materials. However, one of the most significant by-products of horn processing is waste material, connected to removing horn from the boney core of the horn. Sawn or cut-off pieces of cattle, sheep and goat horn core bases have been recovered from excavations in recent decades.[99] Visual sources also support the extensive use of horn in comb-making. The use of raw materials and working methods have not changed significantly over the centuries, as the pictorial sources show. In the depiction of a comb-maker in the Nuremberg Hausbücher (Figure 10), the sawed-off horn ends and cores, the

[98]Based on the regulation of the limit on sales by foreign traders, one can perceive this act as a protection the interest and existence of local craftspeople (the limit is set at 200 pieces): *"Jtem von kämmen vntter II^{c} kemmen."* Mollay, *Das Ofner Stadtrecht. Eine deutschsprachige Rechtssammlung des 15. Jahrhunderts aus Ungarn*, 196.
[99] See the "Workshop waste" section in this chapter.

raw materials and waste materials, the smaller pieces from the manufacturing process are clearly visible in the background. The fire burning, in my opinion, could be a direct reference to the preparation of the horn by heating.

Figure 10 Comb maker working with horn.

Die Hausbücher der Nürnberger Zwölfbrüderstiftungen, Amb. 279.2° Folio 51 verso (Landauer I) https://www.nuernberger-hausbuecher.de/75-Amb-2-279-51-v accessed 17.05.2022

An additional source for the latter is a master horn maker who can be seen in his workshop preparing horns for further processing. The straightening of the boards is then done by pressing.

Similar panels can be seen on a late seventeenth century workshop drawing, which also specialized in comb-making. The manufacturing techniques do not seem to have changed in the tools and techniques depicted. There is a wealth of ethnographic information and memories of horn-making,[100] and even today there are still craftsmen actively working with horn.[101]

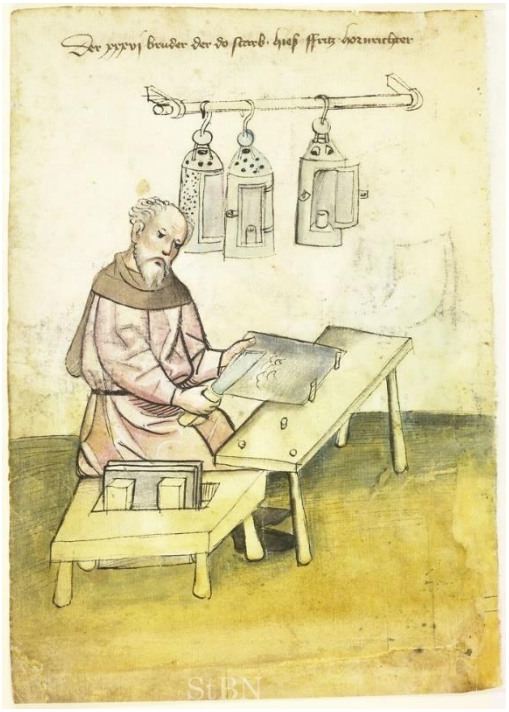


Figure 11 Craftsman working with horn

Die Hausbücher der Nürnberger Zwölfbrüderstiftungen, Amb. 317.2° Folio 15 verso (Mendel I) https://www.nuernberger-hausbuecher.de/75-Amb-2-317-15-v accessed 17.05.2022

Figure 12 Comb making workshop in the late seventeenth century

Abbildung der gemein-nützlichen Haupt-Stände von denen Regenten und ihren so in Frieden- als Kriegs-Zeiten zugeordneten Bedienten an bisz auf alle Künstler und Handwerker / von Christoph Weigel, 144 https://gallica.bnf.fr/ark:/12148/btv1b8553025f/f156.item.zoom accessed 17.05.2022

[100] Péter Csippán, "Eighteenth Century Cattle Horn Core Finds from the Víziváros District of Buda," in *Skeletons from the Cupboard Selected Studies from the Visegrád Meetings of Hungarian Archaeozoologists 2002–2009* (Budapest: Martin Opitz Kiadó, 2009), 195–202.

[101] "Abbeyhorn & the Craft of Horn Working | Merchant and Makers," Merchant & Makers, April 27, 2018, http://www.merchantandmakers.com/abbeyhorn-the-craft-of-horn-working/.

Besides the finds considered workshop waste, significant numbers of finished ivory combs were recovered from the excavations in the medieval Castle District. In the case of the Kingdom of Hungary, there is no evidence that ivory as a raw material was ever worked there. Rather those combs must have arrived to Hungary as finished objects from German territories, or as commercial as well as individual, personal objects associated with the Ottoman occupation of Buda.[102]

Bead and button-making

The presence of bead and button makers is clearly visible through the excavation materials recovered from the territory of medieval Buda. Based on the large quantities of waste materials typical of the manufacturing of beads and buttons, bead makers must have been actively participating in the craft life of medieval and early modern Buda. The waste material consists of perforated, drilled out bone (and rarely) antler plates, varying in terms of raw materials, sizes and thicknesses.

The distinction between beads and buttons is essentially based on their form, but without the examination and presence of finished objects it is not necessarily possible to distinguish clearly between the two groups of objects on the basis of the formal characteristics of workshop waste alone. The flat, cylindrical and spherical final products could have been used both as clothing ornaments or to produce rosaries for religious, devotional purpose, a key part of medieval life. These objects had a wide range of uses, regardless of differences in form, based on both archaeological and pictorial sources.

[102] Alice M. Choyke and István Kováts, "Tracing the Personal through Generations: Late Medieval and Ottoman Combs," in *Bestial Mirrors: Using Animals to Construct Human Identities in Medieval Europe.*, ed. Aleksander Pluskowski et al., Animals as Material Culture in the Middle Ages Series 3 (Vienna: VIAVIAS - Universität Wien, 2010), 115–27.

Bone or antler beads and buttons belong to a group of objects that can be made from a wide variety of raw materials, which may also reflect the diversity and segmentation of demand. Beads can be made from wood, bone, antler, mother-of-pearl, amber, coral, ivory, glass, non-ferrous ferrous and precious metals. The latter material is associated with jewelers and jewelry-makers.[103]

In terms of the hard osseous raw materials used in Buda, this group of objects has the most diverse profile of all known workshop waste. In addition to long bones from large ungulates, there are also flat bones (mandible, scapula, rib) used extensively.[104]

The choices made concerning the raw materials may reflect the degree of workshop organization. In Konstanz, debris material associated with bead and button making was uncovered during excavation works. Based on the analysis of the more than 300,000 pieces of waste material, the raw material choices were clearly separable between different periods of the established craft specialization. Based on this observation, the organization, standardization and rationalization of production went hand in hand with the standardization of raw material choices.[105]

The manufacturing of these objects and the context and circumstances are clearly visible in the pictorial sources from the fifteenth and seventeenth centuries. Furthermore, various experimental archaeological methods also aid in the reconstruction of the production processes. One of the most important elements in serial manufacturing is the use of the lathe. Traces of

[103] Anna Gotschall, "Prayer Bead Production and Use in Medieval England," *Rosetta* 4 (2008): 4.
[104]An interesting example for the exclusive use of ribs in button making: Vesna Bikić and Selena Vitezović, "Bone Working and the Army: An Early Eighteenth–Century Button Workshop at the Belgrade Fortress," in *Close to the Bone: Current Studies in Bone Technologies*, ed. Selena Vitezović (Beograd: Institute of Archaeology Belgrad, 2016), 57–65.
[105] In the case of Konstanz, this process meant the extensive use of cattle metapodials. Thomas A. Spitzers, "Late Medieval Bone-Bead Production: Socio-Economic Aspects on the Basis of Material from Constance, Germany," in *Material Culture in Medieval Europe. Papers of the "Medieval Europe Brugge 1997" Conference,* ed. Guy de Boe and Frans Verhaege, Instituut Voor Het Archeologisch Patrimonium Rapporten (Zellik: Instituut voor het Archeologisch Patrimonium, 1997), 147–54.

lathing can be observed and studied both on the surface of the finished and debris waste finds as well as in the contemporary, medieval and early modern pictorial source material.

The cleaned, prepared, sized and shaped raw material is drilled through with a drill head (which can be three or five-pronged) using a vertical bow drill or horizontal lathe. The pictorial sources provide additional information and the accompanying experimental archaeological data confirm the details of the production techniques of the object type, in addition to the traces that can be observed on the archaeological finds.[106] It is worth noting the different fixing techniques used for the lathes that can be found in the pictorial sources. While in the case of objects with a cylindrical form (e.g. turned tool handles, furniture accessories, clothing items) the raw material itself is fixed (most often from two sides), in the case of illustrations of beadwork the tool (the drilling/profiling head) is fixed, and the raw material is either resting against a flat surface, laid on top of it, or is held freely by the maker at a suitable angle. The advantage of vertical support on a flat surface is partly stability and partly the possibility that the solid surface prevents the drill head from cutting through the raw material any further than desired (if there is double-

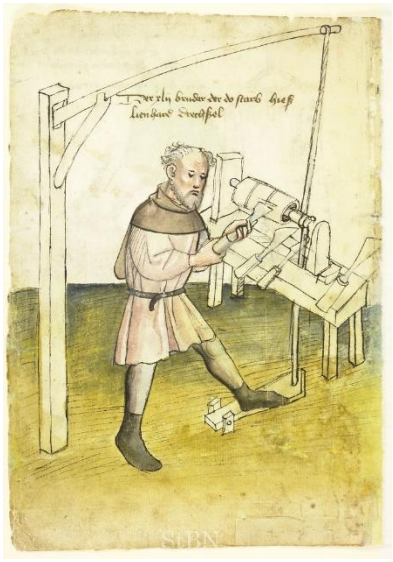


Figure 14 Turning with the raw material fixed at both ends

Die Hausbücher der Nürnberger Zwölfbrüderstiftungen Amb. 317.2° Folio 18 verso (Mendel I)https://www.nuernberger-hausbuecher.de/75-Amb-2-317-18-v accessed 15. 05. 2022

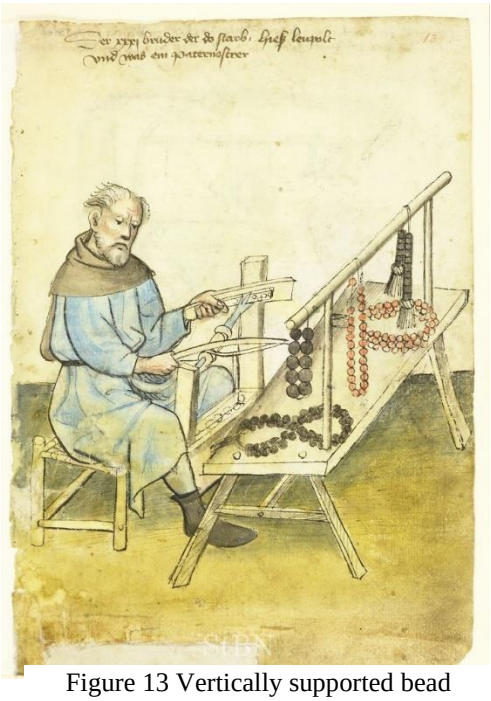


Figure 13 Vertically supported bead

Die Hausbücher der Nürnberger Zwölfbrüderstiftungen Amb. 317.2° Folio 18 verso (Mendel I)https://www.nuernberger-hausbuecher.de/75-Amb-2-317-18-v accessed 15. 05. 2022

[106] Ádám Vecsey, "Utilization of Animal Skeleton Elements," in *Bone Objects in Aquincum*, ed. Mária T. Bíró et al., Az Aquincumi Múzeum Gyűjteménye 2 (Budapest: Budapesti Történeti Múzeum, 2012), 65–66.

sided drilling). Even with freely held pieces, there is the need for some support (whether it is the seating surface or the maker's thigh, for example) and the appropriate angle of the drilling can be easily adjusted or even changed by freely moving the raw material.

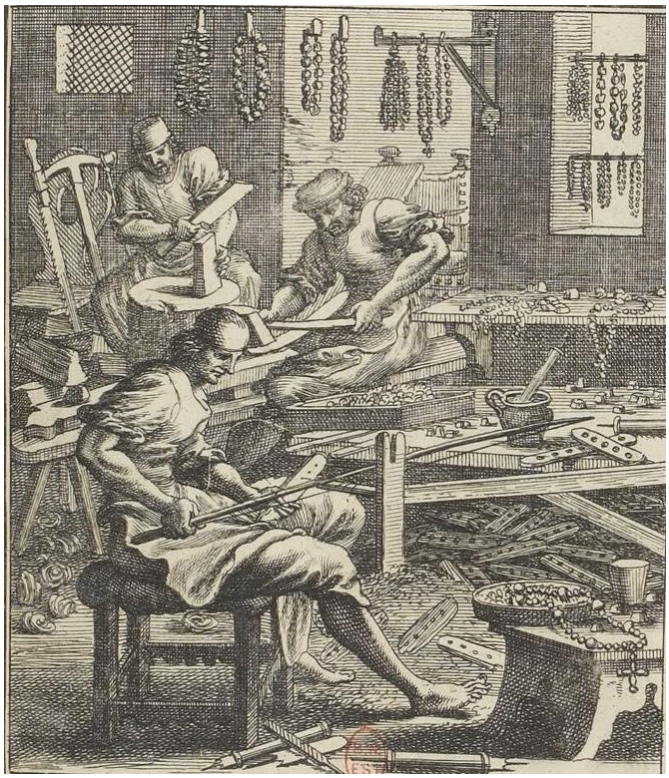


Figure 15 Bead making without fixed support

Abbildung der gemein-nützlichen Haupt-Stände von denen Regenten und ihren so in Frieden- als Kriegs-Zeiten zugeordneten Bedienten an bisz auf alle Künstler und Handwerker / von Christoph Weigel, 146 https://gallica.bnf.fr/ark:/12148/btv1b8553025f/f158.item.zoom

In the case of the materials from the excavations of Buda, drilling through from both one and two sides was observed on the refuse materials. In the latter case, two phenomena can be highlighted: a characteristic small elongation on the surface of the raw material, which can be clearly observed when the raw material is not drilled through from both sides across its full thickness, and a characteristic surface which remains when the raw material is drilled through from both sides but completely (in this case, the finishing work can be shortened, as it does not necessarily leave a surface to be reground). The resulting discs and spherical shapes could then be reground to the desired form.

Button and bead-makers can be connected to two groups of occupations that were important for the medieval economy based on the raw materials used (besides worked bones). Their presence

are associated with craftspeople involved in woodworking and textiles.[107] A more specialized group is the so-called *paternosterer*, who are associated with the production of rosaries in the Middle Ages. Their presence can be linked to the close proximity of ecclesiastical buildings and communities, although this connection cannot always be shown.[108]

In the case of Buda, three craftsmen associated with bead making (?) are known from the early sixteenth century. One of them, Vsvaldus Gyöngfüzü in the street named after the goldsmiths, the other was Farkas gymyfisor, who lived in close proximity to the Dominican monastery in Buda, and the third craftsman, Petrus gemmifisor, who lived next to the Parish Church of Our Lady in the Castle District.[109]

The other "sector" is linked to the specialized textile industry, in connection with button-making, whose presence in the craft spectrum of the period can be traced mainly from written sources. In the Hungarian context, the activity of button-makers, who formed guilds in several medieval and early modern towns, is noteworthy. Although rarely mentioned in medieval written sources, a large amount of source material on this craft survives from the seventeenth and eighteenth centuries.[110]

As a guild unit, the button-makers' occupation is mainly represented in historical research on handicrafts as a sub-sector of the textile industry and as a 'sister' sector to the cord-makers, but this does not exclude the use of other raw materials, such as organic raw materials, i.e. wood or osseous materials. The button-makers worked mainly with textiles, yarn, but flat, round discs

[107] Examples of rosary workshops can be found mainly in Northern and Western Europe: Konstanz, Strassbourg, etc. Spitzers, "Late Medieval Bone-Bead Production: Socio-Economic Aspects on the Basis of Material from Constance, Germany," 157–58.
[108] Other artifact groups are similarly found most often in urban contexts and more rarely in rural or monastic contexts.
[109] András Végh, *Buda I. Kötet, 1686-Ig / Part I. to 1686 Buda*, vol. 1, Magyar Várostörténeti Atlasz - Hungarian Atlas Of Historic Towns 4 (Budapest: Archaeolingua, 2015), 48.
[110] Zoltán Nagy, *Körmend mezőváros kézművesei a XVII-XIX. században [Craftsmen of Körmend in the XVII-XIXth centuries]*, Fontes Castriferriensis 2 (Szombathely: Vas Megyei Múzeumok Igazgatósága, 2004), 192–93.

made of wood and bone and antler could be used as the basis for buttons covered with textiles and yarn. In archaeological contexts, a few such bone buttons, still covered with thread or textile, have been found, mostly from later seventeenth and eighteenth-century contexts.[111] The scarcity of these finds may be related to the fragility of the textile material after it was deposited in the earth as garbage, a lost item or buried as part of the clothing of the deceased.

Coming back to the written source material from areas of western Hungary, if not from Buda, guild documents have survived that refer partly to the organization of crafts and partly to the raw materials used, and certain dynamic relationships between various craft activities. One example is the renewal of the Guild Charter of button-makers in Sopron, with two additional articles (compared to the original charter from 1630). The twenty-second article declares that knife-makers were prohibited from making **bone** buttons and selling those bone buttons to merchants in the town.[112]

To date, this is the only written, early modern source from Hungary that clearly shows osseous raw materials being used in early modern craft specialization in a guild context, which makes this little detail particularly important in terms of bone and antler working.

Saddle-making

Saddle-makers are mentioned in the Buda Law Book, although, there is no description of this occupation or the legal rights of these craftspeople.[113] Saddle-making involved processing diverse raw materials (wood, raw materials of animal origin such as leather, bone, antler and

[111] Bikić and Vitezović, "Bone Working and the Army: An Early Eighteenth–Century Button Workshop at the Belgrade Fortress."
[112] "*Az mint az Kés-csinaloknak az* ***Csont Gombok****nak csinalása, és az Kalmároknak való eladása, és igy az Kalmároknakis, vélek valo kereskedése; Hasonloképpen az Rézmiveseknek is, az Réz Gomboknak csinálása, illien Conditioval engettetet megh*[…]" Ottó Domonkos, "A soproni gombkötő céhszabályzata 1633-ból [The guild rules of button-makers in Sopron from 1633]," *Soproni Szemle* 9, no. 1–2 (1955): 120.
[113] Mollay, *Das Ofner Stadtrecht. Eine deutschsprachige Rechtssammlung des 15. Jahrhunderts aus Ungarn*, 106.

various metals) due to the composite nature of these objects.[114] Archaeological excavations have preserved fragments of curved, elongated, trapezoidal, or rectangular panels of antler that could have served as edging or frame elements for finished saddles, but there is no evidence for a local, major use or production of this material, apart from a few fragments (which could have come from finished saddles not made locally, or from other types of finished commodity goods). Rivets for saddles were often also made from bone or antler. Distinguishing between the two materials cannot be determined more precisely due to their small size and high degree of manufacturing. Similar finds have come to light in Sátoraljaújhely, but there is no evidence of local processing.[115]

Knife handles

One of the best examples of specialized urban crafts, cooperative organization between medieval manufacturing activities and the parallel or complementary use of different raw materials is the case of medieval knife-making. This craft branch is one of the most tangible results of the specialization process that started in the fourteenth century, as supported by written sources, and which is due to the development of the blacksmith's trade and, the development and consolidation of the division of labor, and the development of transport facilities. Knife-making began to become independent from the thirteenth to fourteenth centuries and, with continued specialization, developed into an individual craft.[116] The knives belonged to a composite group of material culture, which had several stages of manufacture, but these stages were not limited to a single site or a specific geographical location: as a transit

[114] A more distant source supporting the use of hard osseous materials is from the guild of saddle makers in Prague. In 1451 it was regulated that decorations on saddles must be made of antlers. Winter Zikmund, *Dějiny Řemesel a Obchodu v Čechách v XIV.a v XV.Století* (Prague: Nákladem České akademie Císaře Františka Josefa pro vědy, slovesnost a umění, 1906), 864, https://archive.org/details/djinyemeselaobc00wintgoog.
[115] Ágnes Font, "A sátoraljaújhelyi vár megmunkált csont- és agancsleletei [Worked bone and antler objects from the castle of Sátoraljaújhely]" (Manuscript submitted for publication, 2017).
[116] Imre Holl, "A középkori késes mesterség [The medieval craft of knife-making]," *Archaeologiai Értesítő* 122 (1995): 159.

trade product, one manufacturing stage could have taken place in another location, since these products were also part of large-scale trade throughout Europe in the Middle Ages and early modern period.

The knife handles were usually made by a specialized craftsman (*hafter*) and the finished product was assembled by the master knife-maker (lat. *cultellarius* – *cultellus*:maker and seller of cutting instruments), who often also sold the knives.[117] Although rare, there is written evidence that in many cases the master craftsman himself was involved in more than one single process, but the great degree of division of labor described above, allowed increases in production. According to Imre Holl, these instructions resulted in an increase in the quality and variety of finished products, which had an impact mainly in the various urban centers, [118] but the opposite is also possible.

While the knife blade is made of metal, the raw material and the technical background of the knife handles are very varied. Written sources and archaeological material include pieces made of wood, raw materials of animal origin (namely bone, antler, or ivory) and metal accessories, often combined or substituted for more expensive raw materials.[119]

The production of medieval knives in Europe took place in several areas. In England, most of the information we have is from the London Cutlers' Company, whose guild letters and books have survived, so that much information is available about the internal structure of the organization, its rules, and the masters themselves.[120] Further afield on the continent, it is important to mention Amsterdam, where knife-making became dominant in the seventeenth and eighteenth centuries, as reported in several sources. Another feature of London and

[117] Welch, *History of the Cutlers' Company of London and of Minor Cutlery Crafts, with Biographical Notices of Early London Cutlers*, 1; Welch, 19.
[118]Holl, "A középkori késes mesterség [The medieval craft of knife-making]," 159.
[119] According to a charter from 1470, bones of cattles were mentioned as required raw materials for handle-making.
[120] Welch, *History of the Cutlers' Company of London and of Minor Cutlery Crafts, with Biographical Notices of Early London Cutlers*, 106–45.

Amsterdam knife-making is the extensive use of ivory (a luxury article from Hungarian point of view), to make handles.[121]

The role of Nuremberg as a center of trade in German regions is noteworthy, together with Austrian towns, such as Steyr, Steinbach and Wien.[122]. Distinct knife types that have survived in archaeological material in Hungary have been named after Steyr. They are characterized by their distinctive decoration with copper engravings, which have been found not only in archaeological research but also in huge quantities in illegal metal detecting.[123] Although it has not yet been fully demonstrated, based on my observations, the engraved or pressed metal decorations on the wooden core were often imitated by carving bone knife handles. The handles were most often made of wood, but archaeological evidence is rare and extant examples are usually very badly deteriorated. Wooden handles were popular because they were cheap and easy to work. Several regulations for their use have survived.[124]

The trade routes led in several directions, which in the case of the southern German territories and Austria in particular, were mainly along the Danube and its tributaries. The Kingdom of Hungary was an important transit area for the long-distance trade in knives in the Middle Ages and, with the country's division into three parts, throughout the sixteenth and seventeenth centuries. Regensburg, Ingolstadt, Vienna, and Bratislava, Győr and Buda or Pest are among

[121] Marloes Rijkelijkhuizen, "Knife Makers and Knife Handle Production in 17th and 18th Century Amsterdam," Cahiers Landarc Vol. 24 (2017): 4-5.," *Cahiers Landarc* 24 (2017): 4–5.

[122] Gerhard Folke Wulf Holtmann, "Untersuchung zu mittelalterlichen und frühneuzeitlichen Messern. Dargestellt am Beisppiel von archäologischen Funden vornehmlich aus dem weiteren Kustenbereich von Nord- und Ostsee bis zur Mittelgebirgszone [Study of medieval and early modern knives. Examples of archaeological finds from the wider coastal area from the North Sea and Baltic Sea to the low mountain zone.]" (PhD dissertation, Göttingen, Fachbereich Historisch-Philologische Wissenschaften der Georg-August-Universität zu Göttingen, 1993), 510.

[123] An excellent thesis about the Steyr-type knives from illegal metal detecting activities: Krisztián Balogh, "Teríték és világítás a középkor végén. Fémleletek a Magyar Nemzeti Múzeum két gyűjteményéből [Cutlery and lighting at the end of the Middle Ages. Metal plates from two collections of the Hungarian National Museum]" (BA thesis, Budapest, ötvös Loránd University, 2016), 11–22. and 34-45.

[124] There are several mentions in the London Cutler's Company rules prohibiting the coloring of wooden handles. Welch, *History of the Cutlers' Company of London and of Minor Cutlery Crafts, with Biographical Notices of Early London Cutlers*, 175.

the most important towns along the Danube involved in knife production or trade. The routes in Upper Austria continued north and northeast (towards Bohemia, Moravia, and Silesia) and south along the river Inn.[125] An important stop on the Danube route was Vienna, which, according to written sources and customs logs, was a popular central location for long-distance traders seeking to supply the eastern part of Hungary, Transylvania, and the Balkans. In addition to knives, other Western goods were also exported (the goods cleared through customs included large quantities of textiles, post and linen, and other metal objects), while livestock, hides and other goods were exported from the other side.[126]

The affiliation of those involved in long-distance trade in the Kingdom of Hungary, such as those who bought knives or knife blades in bulk, provides interesting information on the evolution and shifting of the country's economic axis and center of gravity during the sixteenth century. Due to the various military activities, the economic center of gravity shifted from the central area of the country to the cities on the periphery of the Great Plain, where newly settled merchant citizens (e.g., former Buda residents) arrived, such as Oradea and Debrecen.[127] Other important stops on the Balkan trade routes were Barič, Sibiu and Braşov, where hundreds of thousands of imported knives were also registered as customs items. The most frequent traders came from the region east of the Tisza River (Debrecen, Oradea, Satu Mare, Bátor) and Upper Hungary (Košice, Prešov, Levoča, Patak and Miskolc). The task of continuous exports to the East was to supply the market fairs of the larger cities (such as Debrecen and Oradea) and the surrounding micro-region, and to transport certain products to even more distant market centers.[128] According to the various customs records, between 1457 and 1458, more than 1.6

[125] Lajos Gercsényi, *Gazdaság, társadalom, igazgatás. Tanulmányok a kora újkor történetéből [Economy, society, administration. Studies in the history of the early modern period]* (Győr: Győr-Moson-Sopron Megye Győri Levéltára Győr Megyei Jogú Város Levéltára, 2008), 236–37.
[126] Gercsényi, 236–38.
[127] Gercsényi, 238.
[128] Gercsényi, 278.

million knives entered the country and flow through on the trade routes of the Kingdom of Hungary. In 1503, 2,400,000 knives were recorded in Brasov alone, being sent southwards. In Vienna, Oradea (726,360 pieces) and Debrecen (257,330 pieces) together also acquired more than a million knives for resale in 1546, so although we do not have sources for all years and places, it can be said that knives were extremely prominent among the goods cleared through customs.[129] In Buda, the Ottoman account books records 381.950 pieces between April and November of 1571, and 230.450 pieces (and additional, unknown amount, since the unit of measurement called 'barrel' instead of the exact volume) between February and June in 1572.[130]

However, an important detail regarding the trade in knives is whether it was the finished products themselves or the high-quality metal blades that were sold in such large quantities. This is often unclear from written sources, and archaeological data do not provide sufficient evidence to make this distinction. In the case of Amsterdam, information on where the blades were made comes from the eighteenth century local craftsmen imported them from Solingen and Gouda. Other sources indicate the import of Spanish and Portuguese blades, but there is little published information on the knife-making activities in these areas.[131]

In addition, there is evidence of small-scale cottage industry production to meet local needs, which, alongside the guild craftsmanship typical of organized, urban life, was a constant feature of the Middle Ages and early modern times. Certainly, small-scale trade at the local level was carried out by local knife-makers craftsmen. In many town books, information can be found on restrictions to protect the interests of local craftsmen were placed on various imports and wholesale goods, including knives.[132]

[129] Gercsényi, 234.
[130] Based on the records of Lajos Fekete and Gyula Káldy-Nagy, *Budai török számadáskönyvek, 1955—1580 - Rechnungsbücher Türkischer Finanzstellen in Buda (Ofen) 1550–1580* (Budapest: Akadémiai Kiadó, 1962).
[131] Rijkelijkhuizen, "Knife Makers and Knife Handle Production in 17th and 18th Century Amsterdam," Cahiers Landarc Vol. 24 (2017): 4-5.," 11.
[132] Holl, "A középkori késes mesterség [The medieval craft of knife-making]," 159–60.

In the context of medieval Buda, there is little data for local production of knives. and it is also questionable which part of the manufacturing process took place locally, within the Castle District, and which elements of the products arrived to medieval Buda in a finished state. As regards Buda knife craft, the sources suggest that the work stage differentiation mentioned above may become established practice quite early (between general blacksmiths and specialized knife makers), as early as the first third of the fourteenth century. The first written record dates to 1322, when a citizen of Pest sells his house to János Hatvani, a knife-maker.[133] Similar sales are known from several places in the Buda Castle District (e.g., several plots in the medieval Saint George Square), and the amounts involved (since the tenants were mostly craftsmen) suggest that knife-making provided a good income.

There are no street names associated with the craft in medieval Buda, however, so beyond the fact that the number of knife-makers is unknown, it can be assumed that they were not concentrated in one area.[134] In addition, the Buda Law Book also contains some data on knife-making, although it is rather limited: knife-makers and sword-makers appear within the recorded trades, but the titles of the chapters on their rights are found in only two of the three surviving manuscripts, the Bratislava and Cromer manuscripts, and not even the title in the one from Budapest.[135] An additional detail is the limited amount of knives allowed to sell in the fairs of Buda, established in 500 pieces.[136]

Another interesting group of finds can be connected to the processing of hard osseous materials, especially horns. These are bladed objects, larger in size, thus, they can be considered as weapons rather than knives. Information about their local production can be found in the guild book of the swordsmiths' guild of Pest, on the opposite bank of the river from Buda. Indirect

[133] Végh, *Buda I.*, 2006, 1:292.
[134] Holl, "A középkori késes mesterség [The medieval craft of knife-making]," 161.
[135] Mollay, *Das Ofner Stadtrecht. Eine deutschsprachige Rechtssammlung des 15. Jahrhunderts aus Ungarn*, 104.
[136] Mollay, 195., "Item von messern14 vntter V hundert."

information about the blacksmiths and knife-makers of Buda is given by the provision in the regulations that in addition to local craftsmen, people from Buda were also allowed to sell in the market of Pest.[137] The guild rules also mention the use of horn as a special animal material, which makes it even more valuable.[138]

However, the text on foreign merchants gives us a clear picture of what they were allowed to sell at the Buda fairs, which protected the interests and work of local knife-makers. This supports the assertion that Buda's role in (long-distance) trade was primarily that of a relay station to the markets of the eastern regions, something confirmed by a source from 1498 in which two Buda merchants sell a large number of knives to other merchants.[139]

A large number of knives with bone and in some cases, antler handles from medieval and early modern archaeological contexts were found in the Buda Castle District. From a formal point of view, the knife handles are varied, ranging from the plate and spike types to simpler, richly decorated forms.[140]

Certain groups of knife handles reflect serial production, an inference supported by the large quantity of workshop refuse. Examination of the debris has confirmed the choice of a functional, practical and consciously chosen material. The cover plates of the knife handles were mainly made from the long bones of large ungulates, typically bovine metapodials (most commonly metatarsus). The manufacturing background also displays a relatively uniform background, possibly linked to workshops, in which individual features can be observed within

[137] András Kubinyi, "Bicellus: adatok egy középkori fegyverfajta meghatározásához [Bicellus: contributions to the determination of a medieval weapon]," *Budapest Régiségei* 23 (1973): 189.
[138] "*sed alios Biccellos similes longos quorum manubria non teguntur, sed simpliciter cum* ***cornubus*** *juxta modum veterem laborantur"* – the other kind of dagger, with a hilt of the same length, but not covered with leather, but simply with horn, according to the ancient custom. Kubinyi, 192.
[139] András Kubinyi, -*Budapest története a későbbi középkorban Buda elestéig (1541-ig) [The history of Budapest in the late Middle Ages until the fall of Buda (1541)]*, ed. László Gerevich, vol. 2 (Budapest: Budapest Főváros Tanácsa, 1973), 52–55.
[140] Font, "13-17. századi megmunkált kemény állati nyersanyagok a budavári palota területéről [Thirteenth-seventeenth century worked hard osseous raw materials from the Buda Castle]," 76–87.

both single objects or group of objects, but which is largely based on a systematic method of manufacture and a consistent choice of raw materials.

Although knife handles and handle covers were found in all the sites I examined, large quantities of archaeological material relating to manufacture were recovered from two closed assemblages. A well (27/2) and a two-storey cellar (25/5) were recovered during the excavations at 17 Dísz Square led by Zoltán Bencze contained bone (handle) plates from the sixteenth-seventeenth century based on the stratigraphic data, prepared for further processing.[141] In the topography of medieval Buda, this is relatively close to two plots (13-14 Dísz square) which, according to written sources, can be linked to knife-making masters.[142]

In this topographic area, there are diverging opinions on medieval craft activities. Without criticizing the results of the early topographical research by Vidor Pataki,[143] Imre Holl, (projecting the results of the early topographical research onto the city's craftsmanship), argues that no single workshop operated for long (or even several generations), and that crafts and people associated with those changed relatively quickly, especially in this area of medieval Buda (around the present-day Dísz Square – south side of the medieval St. George's Market).[144] András Végh's research has pointed out the errors in the interpretation of medieval sources from Buda associated with topographical research. According to medieval sources the occupation of the citizens living in the area and renting property was mainly related to metalworking and weapon-making: in the mid-fifteenth century, two bow-makers (Heinrich and Georg), Peter a knife-maker, Andreas a spur-maker and Peter a saddler could be found in the area operating at

[141] Bencze, "Régészeti kutatások a Dísz tér 17. sz. alatt. (Előzetes jelentés) [Archaeo logical excavations at plot 17 Dísz Square (preliminary report)]."
[142] 1464.: Petrus *cultellifaber* owns the property, 24. April 1487: Johannes *cultellipar*, son of Procopius cultellipar sells his property on today's Dísz tér. Jolán Balogh, *A művészet Mátyás király udvarában* I. [Art at the court of King Matthias] (Budapest: Akadémiai Kiadó, 1966) 584.
[143] Vidor Pataki, "A budai vár középkori helyrajza [The medieval topography of Buda Castle]," *Budapest Régiségei* 15 (1950): 239–99.
[144] Holl, "Középkori városi topográfia és a kézműves műhelyek (Die mittelalterliche städtische Topographie und die Handwerkerstätte) [Medieval urban topography and craft workshops]," 34.

almost the same time, according to source data. Their livelihoods were presumably highly dependent on the needs of the royal court, which was located close to the area.[145]

Three knife-maker, masters, Péter, Prokop and János, are associated with this area of Dísz Square, and in András Végh's opinion they worked together as members of a family or a community of workshops. They are joined by four other tin-pot makers and two saddle-makers. This suggests the active presence and activity of craftsmen in the area (at least until 1526), associated with metalworking and other crafts.[146]

In my opinion, the excavations at 17 Dísz Square and the workshop debris found scattered in the area, if not directly, then within a topographically narrower radius (50-120 meters), can be interpreted as linking the craftsmen described above to the processing of hard osseus raw materials and to the active craft and mercantile life in this corner of medieval Buda. The evidence from this supposed 'workshop area' suggests within a spatial and conceptual unit, which excavators today identify as a workshop, several types of raw material processing took place, together with several manufacturing processes and a high degree of cooperation between craftsmen.

Tools, tool handles

As mentioned already, antler was extensively (if not exclusively) used as handles for heavy-duty tools in the territory of medieval and early modern Buda. This group of finds includes the cylindrical, hollow handles, the solid, spiked type, as well as the three-pronged pieces made from the branches of the red deer antler rack. All of these handle types were combined with

[145] Végh, *Buda I.*, 2006, 1:180.
[146]Another interesting detail as an addition to metal working crafts in the area is a decorated, rare tin vessel from the excavations of 17 Dísz Square. Zoltán Bencze, "Ónpohár a budai várnegyed egyik középkori kútjából-Dísz tér 17. (Tin cup from a medieval well in the Castle District of Buda)," *Budapest Régiségei* 50 (2017): 159–71.

other raw materials (such as wood for the base of hollow objects, and metals for the heads of the different tools) and only rarely comprised entire objects.

In one of the excavations, a closed archaeological feature with a high concentration of antler associated in various stages of the manufacturing sequence was found in the palace area.[147] In the area known as the Incomplete Tower, a closed assemblage of worked antler finds were discovered in a cellar, partly carved into the rock surface. It was dated by a 1395 denarius issued during the reign of Queen Mary of Hungary (r. 1382-1395). The find material was examined by Mária G. Sándor, and in her opinion, the manufacturing of the tools was connected with the construction works related to Mary's husband, Sigismund of Luxembourg (1387–1437). The antlers were worked in order to cover the handles of tools used in the construction of the Incomplete Tower. However, in my opinion, the unclear stratigraphic context and historical background of the area may even suggest that the assemblage is a small local workshop that once was part of civic buildings on the site, prior to Sigismund's palace construction. The workshop, if existed, was buried with the wine cellar with its debris material when the (civic?) house above it was demolished. Another option is that a mixed material, which included manufactured antler remains were used as a secondary filling when levelling the site prior to construction. Thus, the denarius of Mary, which helps to establish the chronological context, is related to the construction of the Incomplete Tower rather than to the function of the building that stood there before. However, all this is only speculation.

Generally, toolmakers are intimately associated with the craft of blacksmiths, but are linked to other crafts as well as cottage industry. An interesting detail is that in the seventeenth century, in the western part of the Transdanubian region of Hungary (i.e. the region west and south of the Danube), blacksmiths formed a common guild with wheelmakers in several towns. Within

[147] G. Sándor, "Középkori csontmegmunkáló műhely a budai várpalotában [Medieval bone processing workshop in the Buda Castle]."

the Buda district, there is no detailed information on how toolmaking as a specialized blacksmithing activity (*Zeugschmid, Zirkelschmid*) was integrated into or participated in the craft and trade life of the town.[148]

Three particularly interesting manufacturing tools (Figure 21) made entirely of osseous raw materials were recovered from the excavations. One of these is related to ceramics processing by analogy, and two to leather processing, one from the excavation of the Carmelite complex and the other from the excavation of the Teleki Palace. In relation to the former, it can be assumed that a shoe maker or leather processing workshop operated in the area during the Middle Ages, confirming the collaboration of different craft activities and the widespread use of different raw material cores for multiple purposes.[149]

Gaming pieces

Several areas of excavation in the Buda Castle District contained toys, chessmen, discs and dice, but only within the archaeological record have there been traces of medieval game-making in the form of waste materials associated with the manufacture of dice. Dice made from bone or antler were already common and known in Roman times. There are many historical sources for medieval games other than archaeological finds: for example, there are several ecclesiastical written sources, banning the use of dice, and games associated with it,[150] which are also included in several articles of the Buda Law Book.[151] In addition to the simple profane meaning

[148] "Fém- És Fémfeldolgozó Ipar | Magyar Néprajz | Kézikönyvtár [Metal and Metalworking Industry]," accessed May 18, 2022, https://www.arcanum.com/hu/online-kiadvanyok/MagyarNeprajz-magyar-neprajz-2/iii-kezmuvesseg-25ED/a-kezmuvesseg-szerepe-a-falu-anyagi-kulturajanak-alakitasaban-2605/feldolgozo-iparagak-2661/fem-es-femfeldolgozo-ipar-banyaszat-kovacsolas-vashamoros-kovacs-ciganykovacs-patkolokovacs-2684/.
[149] Papp, "Előzetes jelentés a Karmelita épületegyüttes régészeti munkáiról [Preliminary report on archaeological research in the Carmelite building complex in 2015]," 63.
[150] Bartosiewicz et al., "Animal Exploitation in Medieval Hungary," 144; Gróf and Gróh, "The Remains of Medieval Bone Carvings from Visegrád."
[151] Article 190: Mollay, *Das Ofner Stadtrecht. Eine deutschsprachige Rechtssammlung des 15. Jahrhunderts aus Ungarn*, 126., and Article 345: Mollay, 173–74.
László Blazovich and József Schmidt, *Buda város jogkönyve [Buda Law Book]*, vol. 2, Szegedi Középkortörténeti Könyvtár 17 (Szeged: Szegedi Középkorász Műhely, 2001), 419. and 497, Article 190 and 345.

of dice for entertainment, they also appear in other contexts, including grave goods in Roman, medieval and early modern burials.[152] The waste material from dice-making produces one of the most characteristic medieval bone-working refuse materials known from numerous excavations in Hungary and abroad.[153] Their shapes vary, both in the design of their sides, surfaces, edges (concave, straight) and their numbering, which was typically formed with simple drilling and carving, or with the use of lathe.[154]

In addition to these more formally manufactured objects, decent quantities of small ungulate astragali and cattle knuckle bones were discovered in the Castle District. These were probably gaming pieces or toys based on their traces of use (rounding, glossy surfaces), but their serial, formal production cannot be demonstrated.

Other crafts activities associated with osseous materials

In addition to the above-mentioned types of objects and associated crafts, several other finished objects related to and indicating the presence of craft specialization have been found in the Buda Castle District: One group is linked to the wood-working industry and the other to textile and clothing production. In contrast to the object types described above, no direct waste material indicating local production has been found that could be linked to them, nor is there any written source material to support this. One can only rely on conjecture.

[152] Mária T. Bíró et al., *Bone Objects in Aquincum*, Az Aquincum Múzeum Gyűjteménye 2 (Budapest: Budapesti Történeti Múzeum, 2012), 27.
[153] Gróf and Gróh, "The Remains of Medieval Bone Carvings from Visegrád," 163–64; István Kováts, "A középkori csontmegmunkálás [Medieval bone working]," in *Gazdaság és gazdálkodás a középkori Magyarországon: gazdaságtörténet, anyagi kultúra, régészet*, ed. András Kubinyi, József Laszlovszky, and Péter Szabó (Martin Opitz Kiadó, 2008), 114. In Visegrád, one of the characteristic products of medieval bone working were the dices, and associated manufactured materials, which were found in various stages of processing: in the form of square, sawn bone sticks, semi-finished, finished and discarded pieces.
[154] Vecsey, "Utilization of Animal Skeleton Elements," 56–59; Sándor Petényi, *Games and Toys in Medieval and Early Modern Hungary* (Krems: Medium Aevum Quotidianum, 1994), 58.

Woodworking and osseous materials

The following crafts can be linked to woodworking: furniture-makers, carpenters and turners, wheelmakers etc. The use of lathes as a connecting feature used both osseous and other materials is well documented through both pictorial sources and archaeological finds.

The activities and location of the turners known from Buda were examined in detail by Eszter Kovács. However, there is much more information on the Buda turning guilds located in the suburbs below the Castle District than in the Castle District itself, suggesting that the commercial, economic and craft dynamics between the Castle District and the suburbs were extremely strong during the Middle Ages and the Early Modern period. The turners of Buda also appear in the topography of the urban suburb (*Ezthergaros wcha* - Turner's Street), although their exact location is not known. The turner's guild in Buda became a *fraternitas* in 1465, and they were granted a charter of privilege in 1514. In 1692, after the recapture of Buda (1686), the first guild to return was that of the turners, who were re-organized and granted a charter of privilege.[155]

Although not organically related to the subject of this thesis, while researching Hungarian guild organizations, I found the following quote collected by István Lüllik from the first half of the nineteenth century, which also refers to the diversity of the turning craft by an unknown apprentice.

About the turners: "And I have chosen the craft of turners, which, having learned, I should most like to make of wood, bone, ore, and stone, little pyxides, rooks, barrels, pipe-casks, ball-

[155] Kovács, “Remains of the Bone Working in Medieval Buda,” 311.

bearings, buttons, and many such things, with its revolving machine and its various shaped knives, it can very soon round out."[156]

Textile and leather industry

The bag/purse makers, strap-makers and belt-makers in Buda are associated with the textile industry and leather processing. Several items of medieval clothing may have been made of ivory, bone and antler, in addition to the buttons described above, but there is no archaeological or other source material connected to local production of items and accessories made from osseous raw materials.

From the archaeological record and materials, certain parts were made from osseous raw materials in the Middle Ages and early modern period, which mainly became buried in the form finished objects. These play both a functional and decorative role. As decorative elements, these are often square or round, more or less, ornamented plates attached to belts and straps as well as the buckles and strap ends of belts and straps, which are ornamented both in shape and surface. Also, more important from a functional point of view, are the stiffening bars/rods used for the more specialized waist belts.

The most striking aspect of the costume elements is the way their presence reflects interactions between the various craftsmen working in different raw materials, the use and availability of raw materials and the characteristic elements of the art of the period. Linked is the tendency for certain raw materials to replace or substitute each other, depending on what was in demand,

[156] The original text: "Az esztergályosokról: Én pedig esztergályos mesterséget választottam, melynek a mesterségét megtanulván nékem legjobban kedvem volna ki is a fából - csontból - ércből és kőből is pixiseket, rokkákat, hordótsapokat, pipaszárokat, golyóbisokat, gombokat, és több efféle esztergályos míveket forgó masinájával és több formájú véseivel, igen hamar ki tud kerekíteni" The quotation can be found in István Lülik's seven-language textbook on handicrafts from around 1830, which has been used in several publications on handicrafts. Nagy, *Körmend mezőváros kézművesei a XVII-XIX. században [Craftsmen of Körmend in the XVII-XIXth centuries]*, 90.

needed and available for use as raw materials. In the case of decorative elements, there are similarities in decoration between metal ornaments made from metal, pressed, embossed or engraved, and those copies made in bone or antler. The motif is also present in other media of representation important in the Middle Ages, such as the decoration of plant elements found on stove tiles with floral motifs. The question remains open as to where and how the "original prototype" influenced the craft and how they interacted.

In the case of functional elements, practicality and accessibility may, in my opinion, have determined the choice of raw material made by the craftsman at the time. In the case of the belt-stiffening rods, both metal (cast, bronze) and bone (and rarely ivory) pieces have been found in the Buda area, the latter in greater numbers, according to my observations. This can be confirmed by the information from the Buda Law Book, which specifies the quantity of goods that foreigners selling in Buda should and should not sell - one item is listed: "under 25 pieces of horn-decorated belts". This may also be one of those rare source materials that refer to raw material of animal origin although it is not clear whether the reference is to horn or antler.[157]

The activities of purse and bag-makers may also involve the processing of hard osseous raw materials. From a functional point of view, an essential element here is the design of the closures of bags and purses, for which bone or antler may have been used. Such elements are rarely found or, at least, identified, in the archaeological record, and written sources only provide information that bag and purse makers were found or worked in Buda, but how and with what raw materials they worked can only be conjecture.[158]

[157]Károly Mollay, *Das Ofner Stadtrecht. Eine Deutschsprachige Rechtssammlung Des 15. Jahrhunderts Aus Ungarn [TheBuda Town Law. A German-Language Collection of Law of the Fifteenth Century from Hungary]*, Monumenta Historica Budapestinensia 1 (Budapest: Magistratus Urbis Budapest – Akadémiai Kiadó, 1959), 196., Article 423, the term *painen*

[158] In the Buda Law Book, the glove, bag, purse, belt and trouser-string makers are listed under one article. Their activity is described as "to make their goods as they should" and to sell them in the regular order on the market. Article 130., Blazovich and Schmidt, *Buda város jogkönyve [Buda Law Book]*, 2001, 2:380.

Refuse materials associated with craft specialization

Other universally worked hard raw materials of animal origin are presented and grouped below. These are artifacts, which, although they clearly bear traces of manufacture, cannot be clearly linked to specific craft activities, nor can their use be defined. It also cannot be determined exactly what kind of object they were used to make. These universal workshop scraps are separated by type of raw material.

Parts of long bones

Among the remains of medieval bone-working in Buda, the largest number are metapodium fragments. These skeletal elements provided the basis for manufacturing a wide variety of objects and yield a characteristic waste material associated with workshop activity. The epiphyses and diaphyses of cattle metapodials are found in various worked, segmented forms in the materials from each of the excavations. They can be divided into several groups according to the bone parts:

- Proximal epiphyses
- Distal epiphyses
- Diaphysis fragments

The various stages of processing, such as cutting to size and in some places preforming, are visible on these finds. Presumably, the bones were collected, cleaned and prepared for further processing. Traces of grinding can be observed on some specimens. Sometimes combined traces of splitting/chipping, sawing and breaking were observed on them. The most characteristic mark of manufacture is sawing and breaking from one direction, an action which leaves a characteristic surface on the finds. Horse metapodial diaphyses with breaks and sawing marks are also present in the material, but only in isolated cases.

In the case of diaphyses, after the removal of the epiphyses, the different cortical bone surfaces and anatomical planes were separated longitudinally. This was done by filing and sawing or, in a few cases, by notching or carving and then further splitting at the groove. This latter technique was rarely very precise. There are also instances of diaphysis being cut into rings and severed at the edges, but this technique is also rarer. The processing of longitudinally cut bone plates or rods was carried out by different methods (splitting, cutting, sawing), depending on the desired shape of the objects to be produced. A number of objects have survived from the pre-forming phase of the plate/rod and the subsequent finer manufacturing processes. They provide a clear indication of the design process, during which finds suggestive of sketching have been preserved. By shaping the detached longitudinal plates and bone fragments into flat surfaces and rods, a variety of objects could be made, which is why I consider them to be universal materials and workshop debris, due to their wide range of objects they could be used to make. The longitudinal rods could be used to make writing tools, needles and other objects, or after being shaped into a square cross-section, dice. The sheets of bone could be used as blanks for decorative and cover plates, inlay as well as other flat objects.

Horn cores

In addition to long bones, a large number of horn cores and skull fragments indicating intensive use and working of cattle and sheep/goat horn, also came to light during the excavations. Within the archaeological material, characteristic cutting, sawing and fragmentation marks on the remains of cattle, sheep and goat horn cores and skulls are evidence of extraction of the horny sheath used in making combs and other objects.

The evidence for horn processing is confirmed not only by archaeological but also in ethnographic sources. In addition to the Buda Castle District, a sealed artefact assemblage from the suburbium below the castle hill, found during excavations on Szalag Street, was found

which dated to the eighteenth century. It comprised buried waste material from a horn-processing workshop.[159]

The removal of the horns can be linked to the activities of butchers and butchers' guilds in Buda. There are no written sources, materials or other tangible data from the Middle Ages and the early modern period, but it is likely that there was direct cooperation with butchers to procure a predictably reliable source of metapodials or other long bones, especially those bones that are "irrelevant" for meat consumption. The butchers were authorized, not only to slaughter animals and sell meat, but also to sell tallow, wax and leather. Although there is no direct evidence or source mention of the sale or processing of horn in Buda, the guild book of the German butchers of Buda contains mention of a connection with horn and the test for becoming a master butcher. In fact, the tests for becoming a master in the guild include the condition that the horn must be cut off and removed in a single cut.[160]

Flat bones (mandible, scapula, costa, pelvis)

A large number of flat bones with manufacturing marks were identified in the faunal material from excavations. Most commonly these are mandibles and scapulae. They found in quite varied ways in in both button and bead-making waste and as remains of the making of other, in my opinion, sheet or plate-like objects for various shapes, discs, covers and decorative plates. Traces of cutting to size are also clearly visible, but the most striking is the use of sketching and pre-drawing and the traces from these techniques that were left behind. These lines, made by incising and carving, were used to help achieve the desired shape during the design process. The large number of flat bones in the worked bone and antler finds, as described earlier, were

[159] Csippán, "Eighteenth Century Cattle Horn Core Finds from the Víziváros District of Buda."

[160] *Vier und zwaintzigistens. […] die hörner iedes auf einen hieb undt den kopff auff einem schlag zersparten…[…]* - From 12 August 1696, in Kenyeres, "A budai mészárosok középkori céhkönyve és kiváltságlevelei – Zunftbuch und Privilegien der Fleischer zu Ofen aus dem Mittelalter," 405., Appendix.

largely identified thanks to the knowledge and expertise of experts who had previously worked with the material, thus, extending the available information on the choice and preference for hard osseous raw materials in the Middle Ages.

Red deer antler

The artifacts include a significant number of waste from red deer antler workshops. The material also includes pieces that indicate how the antler was acquired. The greater proportion of antlers came from antler gathered in the early spring when stags shed their antlers. Other antlers, still attached to the skull of the deer plainly come from animals killed during hunting. Most processed antler fragments, however, lack the medallion and rose portion of the base and therefore it is impossible to say which manner of procurement was more prevalent in the context of medieval and early modern Buda.

All the elements of the processing phase are represented in the antler waste finds and it is clear from these fragments that all parts of the antlers (except the medallion and rose) were used as fully and efficiently as possible by those who processed the raw material. Traces of sawing, splitting and breaking can be observed in the processing and cutting of the antler racks.

Chapter 6 – From the field to the collection: worked osseous materials as cultural heritage

In this chapter, I will summarize the research and institutional attitudes towards the recovery and curation of worked faunal materials with an emphasis on objects from the medieval and early modern period in Hungary. My focus is on the various practices and protocols surrounding this class of archaeological finds: How can they be better integrated into the "mainstream" of archaeological finds, thus, expanding the history of material culture and everyday life in medieval and early modern Hungary.

General introduction

Animal bones are one of the largest groups of artifacts recovered from archaeological excavation sites associated with various human settlements and activities. Zooarchaeology, the study of animal remains from archaeological sites forms an intermediate, interdisciplinary field between the natural sciences and the humanities, nature, and culture. Faunal assemblages from archaeological sites provide information on the fauna, husbandry, hunting practices, diet, and lifestyles of the period, to name but a few examples. This field of study, complemented with the objects made of hard osseous materials, promotes a better understanding of archaeological finds and phenomena. In addition, it also helps the reconstruction and understanding of systemic relationships, processes, and interactions in the past between humans and their natural and social environments, providing more information about local lifeways.

Worked and processed bones both reflect the fauna of the period (as available raw materials) and provide information on the acquisition of raw materials, the culturally determined raw material preferences of the societies using them, the evolution of how tools were made or the technical background behind them, changes in technical and decorative styles, connections of these objects with the crafts or trade in each period to name just a few things. The interpretation

of animal bones and objects made from them is inseparable from their cultural context. In this regard, precise collecting methods, control of excavation provenance and analysis of technologies are crucial to interpret and date the worked animal bone material found in archaeological excavations.

Ecofacts vs. Artifacts

Non-worked faunal materials are and were in the past mostly considered *ecofacts* in archaeological research, largely interpreted from a biological point of view. This first stage in analysis mainly involves the identification of species, age and sex determination, pathologies, butchering and food processing marks as well as other primary biological information based on gross bone morphology.[161] From this point of view, bones are the direct result of human consumption and production of human behavior to a certain degree [162] They provide information about the fauna and environment characteristic different historical periods.[163] Their study is important for answering several research questions and in the holistic interpretation of the excavated site together with other types of archaeological finds, but faunal materials also have certain interpretive limitations. Non-worked faunal materials only have a limited dating value in themselves, they cannot be interpreted without context and specialized expertise similarly to other types of archaeological finds.

Worked hard osseous finds form an interesting borderline class of artifacts between archaeology and the study of faunal materials recovered from excavations, characterized by a number of controversial approaches in the perception of certain professional circles. As opposed to faunal

[161] About the differences between *artifacts* and *ecofacts*, see Colin Renfrew and Paul Bahn, *Régészet. Elmélet, módszer, gyakorlat* [Archaeology. Theories, Methods and Practice] (Budapest: Osiris Kiadó, 1999), 45.
[162] Richard Thomas, *Behavior behind Bones: The Zooarchaeology of Ritual, Religion, Status and Identity*, ed. Sharyn Jones O'Day, Wim Van Neer, and Anton Ervynck (Oxford: Oxbow Books, 2005).
[163] See Simon J. M. Davis, *The Archaeology of Animals* (London: Routledge 1987) as a general overview, and Preston Miracle and Nicky Milner, eds., *Consuming Passions and Patterns of Consumption* (Cambridge: University of Cambridge, 2002) regarding the patterns of human consumption in archaeological context.

materials, worked osseous materials are considered *artifacts*, treated separately from the rest of the faunal materials most of the time, which also results in a kind of de-contextualization from the very beginning of their study. Since many worked bones and antler are not recognized in the field but are only recovered by zooarchaeologists during identification work, this often results in two different assemblages of worked bone that often never meet.

However, worked and processed bones both reflect aspects of the fauna of the period (as available raw materials – just as the finds considered ecofacts do) and provide information on the acquisition of raw materials, the raw material preferences of the societies exploiting them, developments in tool and ornament manufacture, their technical background behind them, changes in technical and decorative styles and, their connections with the crafts or trade in a given period. They are essentially a type of raw material that is widely available and easily accessible, but in many cases, they are used to make objects that have added cultural or spiritual value at a personal level and the level of larger cultural communities.[164]

The evaluation of faunal finds from archaeological contexts and general research attitudes are closely linked to the changes and paradigm shifts in archaeology and the circumstances of acquisition of the objects during excavation. Medieval and early modern objects made of worked hard osseous raw material can thus be divided into two major groups in terms of their collection.

The majority of medieval and early modern objects currently exhibited in several museums and collections have an added cultural value derived from aspects such as their raw material (nobler, more precious materials such as ivory, walrus tusk, etc.), their techniques of production, or their type of object (ecclesiastical, liturgical, representative). Most of these objects were never buried

[164] An excellent handbook about the importance of the analysis of worked hard osseous materials: Arthur MacGregor, *Bone, Antler, Ivory and Horn. The Technology of Skeletal Materials Since the Roman* Period, (London: Croom Helm Ltd., 1985)

but survived in religious and private collections, in connection with antiquarian interests which influences current trends in collecting and exhibiting medieval and early modern objects made of hard osseous materials. Moreover, these objects represent the ones most often published in early archaeological and art historical publications. [165]

At the other end of the "working" scale, archaeological finds can also comprise processed pieces of hard osseous materials, a transitional category between faunal materials and worked objects and fully worked finds. It is generally difficult to categorize and separate them from unworked or butchered bone materials, especially archaeologists, technicians, and volunteers, without any background zooarchaeological training and knowledge. Remains associated with individual and serial object production, related to the early stages of the working phase/chain, often require specialized background knowledge and careful observation to enable specialists to separate them from unworked or butchered osseous raw materials. They often remain unrecognized, thus lost as information in a void created by a lack of awareness or knowledge of a type of material that is subject to increased impact in various selection processes.

The result of both tendencies is the general practice is the removal of worked osseous materials from their archaeological and unworked surrounding material contexts vis a vie the faunal material. They are categorized based on the type of collection, currently ongoing research, or personal interest. General research on medieval worked hard osseous materials in Hungary has focused primarily on outstanding but rare objects, generally made from elephant ivory, preserved in ecclesiastical and private collections or discovered during excavations in the last decades.

[165] György Ráth, *Az iparművészet könyve [The Book of Applied Arts]*, vol. 2 (Budapest: Athenaeum, 1905), 55–166.

Zooarchaeology education in Hungary

The growing interest in faunal analyses and the consideration of faunal materials as archaeological ecofacts is linked to the paradigm shifts in the field, starting around the 1960s–1970s.[166]

Thus, the role of animals and different species in human societies, and human behavior and attitudes toward animals gained more attention. Recently, an increasing number of students choose this field of study. Professional zooarchaeologists encounter artifacts primarily as museum staff, often with a background in archaeology or biology.[167] In the case of Hungary, zooarchaeology courses are currently only offered as a supplementary subject at three universities with faculties of archaeology, but it is possible to study zooarchaeology as a specialization in or outside of archaeology as a thesis topics-related research by individual specialists.[168] Zooarchaeology courses are offered both on undergraduate and graduate (and Ph.D.) levels at the Institute of Archaeological Sciences, ELTE (Budapest) as individual subjects,[169] and finally the Faculty of Humanities and Social Sciences at Pázmány Péter Catholic University offers an undergraduate zooarchaeology course merged with archaeobotany (thus, as a more complex bioarchaeological course).[170] At the Department of

[166] Michelle J. LeFebvre and Christina M. Giovas, *Zooarchaeology in Practice: Case Studies in Methodology and Interpretation in Archaeofaunal Analysis*, (Cham: Springer, 2018), 19-28.
[167] Michelle J. LeFebvre and Christina M. Giovas, *Zooarchaeology*, 10.
[168] Although bioarchaeology (including zooarchaeology) was listed as a subject at Miskolc University in 2016, this course is no longer offered at the department of archaeology. Gergely Paukovics, "Integrated methods of collecting and preserving the environmental and bioarchaeological heritage in Hungary: faunal assemblage" (Budapest, Central European University, 2016), 15., footnote no. 28.
[169] ELTE BTK Régészettudományi Intézet [ELTE BTK Institute of Archaeology], "Tanegységlisták [Lists of Courses]", elérés 2022. április 26., https://regeszet.elte.hu/content/tanegyseglistak.t.20427?m=6518.
[170] Bölcsészet- és Társadalomtudományi Kar Pázmány Péter Katolikus Egyetem [Faculty of Humanities and Social Sciences, Pázmány Péter Catholic University], "Mintatantervek a 2021–2022-es tanévben alapképzésre felvett hallgatók számára [Curricula for students enrolled for undergraduate studies in the academic year 2021-2022]", elérés 2022. április 26., https://btk.ppke.hu/oktatas/alapkepzesek-ba/tantervek/a-2021-2022-es-tanevben-alapkepzesre-felvett-hallgatok-szamara.

Archaeology in Pécs (the University of Pécs, Faculty of Humanities), zooarchaeology is listed in the description of the faculty, but no curriculum includes this area as a subject.[171]

Medieval worked hard osseous materials – selection processes

Animal bones and other raw materials of animal origin found in archaeological excavations, like other artifacts, go through a multi-stage selection process, starting from the death of the given animal, until the bone, tooth and antler finds are collected and stored or exhibited. This long process is subject to many natural and human influences. The natural impacts relate primarily to the stage of archaeological site formation, while human impacts are most tangibly related to the what the tools were used for, how they were discarded, organized into collection, documentation, scientific processing, and collections management of archaeological artifacts, which includes inventory, conservation, and storage.[172]

As already mentioned, early research, which would not always meet today's expectations of archaeological excavations, was mainly linked to an antiquarian interest and can be understood as a direct selection process. The early excavations were characterized by the unsystematic collection of animal bones during excavations. A more systematic system of acquisition, analysis, examination, and evaluation only began later. For a long time, the collection and study of animal bone material was overshadowed by other types of archaeological finds because of the rudimentary nature of excavation methods, the lack of documentation, precise and accurate processing and paucity of specialists in what was then a new field as well as the particular nature of this type of find.

The existence and interpretability of the archaeological context are crucial for understanding archaeological finds of animal origin: in many cases, they are no more than a simple carrier of

[171] Pécsi Tudományegyetem [University of Pécs], "Régészet Alapszak BA-képzés [Bachelor Degree in Archaeology]", elérés 2022. április 26., https://regeszet.btk.pte.hu/hu/tartalom/regeszet_alapszak_ba_kepzes.
[172] Paukovics, "Integrated Methods".

biological information and have no intrinsic dating value. A faunal assemblage at a site contain material that derives from a variety of contexts. They can take the form of household or food waste, be deposited after the site is abandoned, appear as raw materials to make various tools and ornaments, appear as worked tools used in everyday life, or even as special personal objects with added value.[173]

The academic processes impacting the survival of worked and non-worked faunal materials (irrespective of historical period) but connected to human activities can be separated into two groups: one occurs during excavation where bones can be missed, and the second after the fieldwork ends connected to the organizational setup of each responsible institution.[174] These can be summarized with the list of the following steps:

1. Selective processes during fieldwork:

- Excavation, (destructive, intrusive intervention)
- On-site documentation
- Collection methods (hand collection, shovel collection, earth-moving equipment), sampling (e.g. sieving, flotation)

2. Selective processes within the collections:

- Restoration
- Collection conditions
- inventorying worked materials
- Exhibitions

[173] See Péter Csippán, „Az állatcsont, mint információhordozó leletanyag [Animal bone as archaeological finds]", *Dissertationes Archaeologicae* 3, no. 1 (2013): 53–84.

[174]As these issues were the main topics of numerous articles, I am briefly summarizing them in the form of short lists, later emphasizing those (e.g. "Restoration") which are important or relevant in the case of medieval worked materials.

These processes and steps are directly connected to human activities and strongly subjective decisions, which determine the future of each object, or at least each assemblage. All of these processes happen behind "closed doors", as the wider public is not involved.

Issues of protocols

There are several issues surrounding the treatment of hard osseous materials regardless of whether they were worked or not. However, in this section, I am only dealing with the problems which affect worked hard osseous materials from the medieval period.

Most of the problems associated with the selection process involving human factors (after burial) are related to the field collection methods, packaging, and handling of artifacts. Despite the existence of several internationally developed guidelines for processed and unprocessed faunal materials, these are often not "enforced" in practice. These objects are subject to the cumulative effect of separation and out-of-context removal compared to other types of archaeological artifacts, as mentioned earlier.

In the Budapest History Museum, where I have worked in the past and from which the material for this thesis originates, the following practice prevails.

Worked, finished, more decorative objects, or raw materials that have been processed and are recognized as worked objects by archaeologists without any previous training in zooarchaeology, are kept as part of the "small find" collection, which is essentially part of the archaeological collection. The unprocessed (sometimes believed to be worked objects) or early-stage processing finds from the same site, which may be grouped by the expert with workshop waste, are considered by the museum to be part of the animal bone material (as ecofacts), and therefore become part of the natural history and zooarchaeological collection. Thus, a single assemblage of worked osseous artifacts may be deliberately separated and objects are often

deposited in the collection away from each other on shelving and several years apart, even though their archaeological context is the same and their interpretation should ideally only be carried out together.[175]

In general, an important step in the selection process is the discarding of archaeological materials. The museum does not currently have a single set of recommendations that summarize these practices, so the decision is entirely based on the subjective choice of the material handler specialist as to whether an artifact is discarded or recorded. It is also not recommended to discard animal bone material that has not yet been identified and recorded, according to general national and international practice, as these finds should be viewed as a unique, irreplaceable data set. Finds in the early stages of processing, if recognized by the expert eye, are set aside for later examination and are therefore fortunately not affected by the disposal practices that affects unprocessed faunal material (zooarchaeological materials, that have been not worked up).

The collection and packaging of artifacts in the field also have a strong impact on the continued potential lifespan of the artifact within the collection stores. Worked medieval materials often involve composite objects and tools that require several types of organic or non-organic materials (e.g. metal) to make. These often have a corroding and damaging effect on each other, making restoration work essential. The disadvantage of restoration work, however, is that hard osseous raw materials do not take priority over other archaeological materials, artifact types, or materials for important projects in progress, so corrosion and erosion can continue unabated for the time it takes for the material to be examined or inventoried at all. Even then restoration is

[175] The current practice at the Budapest History Museum's Medieval Collection. The finds from the same archaeological context have to be inventoried under different entries, based on individual decisions, based on which object the given researcher consideres as waste material, or finished objects. In the case of Carmelita complex, the inventory number 2021.27 refers to the waste materials, 2021.49 refers to the finished objects, considered as archaeological, and not zooarchaeological finds.

not guaranteed. There is currently no specific training in Hungary for how to best conserve this type of material, so these composite objects, mainly made together with metal, are sent to a specialist in other types of materials for conservation. This practice may negatively impact the preservation and subsequent life of the hard osseous raw material, as the primary raw material of the objects is not defined as faunal material (but usually metal).[176]

There are also differences in practice and standards regarding the primary cleaning processes that accompany and precede restoration. As regards the cleaning processes, it is important to note that worked hard osseous objects are particularly sensitive to mechanical cleaning. Any more invasive cleaning process can damage (whether it be brushes or paintbrushes) the surfaces of objects that carry the most important traces of manufacture and use wear hindering the possibility of subsequent observations, especially at high magnifications. Data can be greatly influenced or even distorted by more invasive cleaning interventions.

When these objects are restored, the effects can have dire consequences for the future study of worked hard osseous objects. I have directly observed damage from restoration on the materials studied for my thesis. In the early 1950s, excavated worked bone materials were often coated by an irreversible layer of varnish and missing parts were restored with other materials making it difficult or impossible to examine or interpret the object or to identify the basic raw material. Inventory numbers, even today, are still written on the smoothest part of objects which is often the best preserved surface, destroying hope for further, more detailed analyses.

[176] An example for this is the Conservation recommendations by the ICAZ Worked Bone Research Group. https://www.wbrg.net/conservation/. A such, it emphasizes the preservation of ivory.

The issues of visibility – zooarchaeological finds, worked materials, strategies

Despite the growing interest and the continuous development of the discipline,[177] there is a general lack of publication of medieval materials or integration into archaeological narratives. In addition, faunal material information is less accessible, less visible and understandable, not just for the wider public, but for researchers in archaeology as well. Most zooarchaeological material processing is usually published in the form of appendices and is not integrated into a comprehensive, holistic interpretation and narrative of the sites, except for a few data tables, at least in the case of Hungarian archaeological publications.

The publication of worked hard osseous raw materials, has a different set of problems: objects that the researcher considers to have added value, to be more interesting or valuable, are presented in a very selective way, so that materials that connected to everyday life and craftsmanship in different historical periods, in this case, medieval life, whether cottage industry or serial production in workshops, may remain unprocessed for decades. An example of this is some of the material used in this thesis coming from excavations that took place on the grounds of the Buda Palace from 1948 onwards but that was ignored and uninterpreted until today.

The historiography and advancement of archaeology and the related fields as well as the interplays between different humanities, social- and natural fields had an impact on developments in zooarchaeological research. The treatment and inquiry of bioarchaeological remains, including the medieval and early modern, worked hard osseous objects, were and still

[177] Such are isotopic examinations, application of DNA (aDNA), ZooMS, etc. See Lefebvre and Giovas, *Zooarchaeology in Practice: Case Studies in Methodology and Interpretation in Archaeofaunal Analysis*, 191–250; Gifford-Gonzales, *An Introduction to Zooarchaeology*, 503–30; Michael Buckley, "Zooarchaeology by Mass Spectrometry (ZooMS) Collagen Fingerprinting for the Species Identification of Archaeological Bone Fragments," in *Zooarchaeology in Practice: Case Studies in Methodology and Interpretation in Archaeofaunal Analysis*, 2018, 227–47, https://doi.org/10.1007/978-3-319-64763-0_12.

are greatly influenced by the different academic trends influencing research focus and methodology.

Antiquarian traditions are still strongly present in the treatment, collection, exhibition, and publication of worked osseous object assemblages. In the case of archaeological, faunal materials and , skeletons, mainly special specimens and finds were exhibited in various Wunderkammer, private collections, and later in public collections with an institutional background.[178] In the early period of research, most attention was paid to the so-called 'nobler' materials such as ivory objects, created mainly for representational purposes, most of which were never buried but were preserved in church or private collections.[179]

Certain strategies regarding the accessibility and visibility of medieval, worked materials certainly can be observed in museums and collections. Based on my observations while working in different museums and collections, I could break down how these "strategies" are implemented in two, interdependent ways.[180]

"Front-stage" strategies

"Front-stage" strategies are those activities, which directly involve the wider public as well as the general body professionals involved in the fields of archaeology, zooarchaeology, history, and heritage-related sciences. This strategy involves the following activities and phenomena:

- Exhibitions
- Publications, catalogs
- Museology-related activities, educational schemes

[178] Simon J. M. Davis, *The Archaeology of Animals* (London: Routledge 1987), 19-21.
[179] See the section on bone working by György Ráth, *Az iparművészet könyve* [Handbook of craftsmanship], Budapest: Athenaeum, 1905.
[180] I use already existing terminologies in the field of sociology and business-marketing. Although these are not established within Hungarian archaeological or heritage research, in my opinion these terms can best express how different processes, activities and decision-making works, at least in the case of worked hard osseous materials.

- Online, digital platforms

A further category includes **education**, which can involve both the wider public and students in the field who have studied related methodologies in all the above fields. Thus, education is one intermediate way to present and communicate to the public about faunal materials, including worked hard osseous tools and objects.

These categories can be differentiated in terms of *how* the strategy or activity is implemented. **Exhibitions** and **publications** represent a more passive (one sided) way to communicate information to the wider public as well as the more closed group of professionals. The issue of different scientific publications and catalogs poses further problems in terms of accessibility and availability: the language of scientific publications is not always understandable or clear, logical for outsiders and the wider field of researchers. They are generally aimed at researchers in the field with specialized knowledge or prior training in the subject. Another issue regarding the category of the exhibition is that traditional display cases usually present a one-sided, descriptive, "dry" (or even boring) narrative on an otherwise very exciting and colorful class of archaeological finds.

Active ways to share knowledge include **museology related events and activi**ties, where the public can be more involved in interactive ways, encountering aspects of the field of zooarchaeology and the tangible remains of material culture in general, for example worked osseous materials, which represent a unique class of finds in archaeology. Museological activities provide the public with an opportunity to actively make and use tools without archaeological context within the framework of craft activities. These events and activities can involve many alternative ways to utilize otherwise discarded faunal materials through games, and plays, meanwhile distributing and building knowledge. Through these artifacts and different activities, the tangible materials of history can be brought loser to the public.

Active participation by the public can also include aspects of experimental archaeology, which is constantly gaining in popularity nowadays, especially in civil circles, in self-organizing ways rather than among professionals with specialized backgrounds.[181]

A further, increasingly popular and accessible way to integrate worked and non-worked faunal materials into the mainstream archaeological narratives and to make these materials more understandable and accessible to a wider public and the specialists as well, is the utilization of different digital methods and technologies (e.g. 3D models, virtual exhibitions, etc.). Digital methods can also contribute to the preservation of the materials (especially in the case of endangered objects) themselves.[182] 3D models can be later used both for scientific purposes and as part of visual sources for exhibitions, as base materials for digital databases, online collections, etc.[183] However, these techniques are costly on a material level as well as in terms of time and human resources. Online platforms and social media can be also easily used to inform the wider public about the importance faunal materials, both worked and unworked, to understandings of past lifeways.

"Backstage" strategies

I consider strategies that are hidden from visitors or the wider public (sometimes even specialists) to be backstage strategies, impacting the preservation and curation of excavated faunal and worked hard osseous materials. These strategies include all the activities and the special locations and spatial units within the museum and its collections framework, connected to the storage and archiving of these archaeological materials.

[181] Such an example is the group of individuals interested in experimental archaeology, which was established just a year ago."Kísérleti Régészet [Experimental Archaeology]," accessed May 18, 2022, https://www.facebook.com/groups/1704529919781132.
[182] Matthew W. Betts et al., "Virtual Zooarchaeology: Building a Web-Based Reference Collection of Northern Vertebrates for Archaeofaunal Research and Education," *Journal of Archaeological Science* 38 (2011): 755–62.
[183] 3D model examples made by archaeological institutions can be found under the search term „Zooarchaeology" on Sketchfab. https://sketchfab.com/search?q=zooarchaeology&sort_by=- pertinence&type=models

Establishment and maintenance of:

- Storage units (internal to the institution or external to it)
- Collections (closed/open, natural history/zooarchaeology/archaeology)
- Comparative repositories

Comparative repositories are not only form the necessary basis for scientific research, but can function as an educational space as well. These collections form the basis of zooarchaeological research, however, their accessibility and visibility, even within the context of museums can be an issue. The establishment and maintenance of such collections requires financial background, organization, and rationalization in order to avoid unnecessary damages to the objects.

Conclusions of the chapter

In terms of integration of worked hard osseous objects from the medieval and early modern period into mainstream archaeological narratives there are several basic methods to bring the collections and the data they contain into sharper focus and encourage more holistic interpretations of different excavation sites based on this kind of data as well. Digital tools and platforms will play a growing role in terms of modern museology, virtual exhibition space, and collection of faunal materials, including objects made from worked bone and antler. Furthermore, the integration of experimental and experiential archaeological methods into museological practice connected to the wider public and interested professionals will provide more direct connections between the general public and the objects themselves. Overall, it is particularly important to consider faunal materials, including worked hard osseous finds to be of equal cultural heritage value compared with other with other classes of archaeological material such as ceramics or metal objects.

Conclusions

Based on the analysis of five excavation materials from the territory of the Buda Castle District, the following conclusions can be drawn. The results mainly connect to the general situation of bone and antler working in the Middle Ages and the Early Modern period, to the craft activities theses raw materials were used in, and craft specializations where they were particularly important.

General conclusions, thoughts

In the context of medieval crafts, and for the purposes of this thesis, major crafts were grouped and separated based on the what the basic raw materials used in the craft are woodworking, textiles, stonemasonry, etc. This separation rarely includes crafts where hard osseous raw materials are central to workshop production because they are less typical. These categories, however, are more characteristic of perceptions in contemporary research rather than of the actual value judgements, distinctions or priorities of medieval crafts.

Osseous raw materials can be used in various crafts in two ways: as processing (see later) means/tools or as raw materials integral to the manufacturing of a variety of finished usually multi-media objects. On the basis of my observations, I conclude that various crafts primarily exploited hard animal raw materials as secondary, second-order raw materials, complementing a primary material such as leather or metal.

The explanation for the extensive use of bone and antler can be found in a number of publications, so I will only briefly review them as an important element of the argument and because they have parallels with what I found in the medieval Buda castle materials. In the case of bones, a(n economically) sustainable, predictable (in simpler terms, cheaper and easier to acquire) methods of procurement may explain why craftspeople used bone in the manufacturing

process in general. Their presence may reflect on established links and networks between artisans, butchers, other participants in the processing of animal bodies must be assumed in the absence of written sources. In contrast, the procurement background for antlers is less clear in terms of the context of medieval Buda craft organization. Based on my observations, although antler was used in smaller quantities, it was utilized as a raw material in a more targeted and specialized way. This may be explained, in my opinion, by the fact that the procurement of antlers may have been less predictable, stable, more expensive or controlled, but further research is particularly necessary in Hungarian context, to establish such conclusions.

The specialized use of raw materials is common for certain types of objects and products. There are many examples of this in both the archaeological materials as well as in written source material from the medieval to early modern period. However, the use of bones and antlers exclusively, as the only raw material used to manufacture certain objects, as the final products in medieval workshop context, is rarely encountered in archaeological worked osseous assemblages. There are two reasons for this:

- Either most of the objects or product to be made are composite. Craft specialization was constructed around these multi-media and multi-part objects.
- In addition, the use of raw materials is not reserved for one product alone but rather used to produce several types of commercially available goods.

The exclusive use of animal derived materials (as the single raw material used to manufacture a product) in medieval Buda specifically is only connected to the use of horn for making objects like combs. However, due to preservation issues there is very little direct archaeological evidence for horn-based objects, and written sources shed little light on this "industry" either.

With regard to Hungarian research, I have come to the conclusion that independent, bone-working workshops, an idea entrenched in contemporary Hungarian archaeological research,

never technically existed *per se* within the medieval craft context. In many cases, medieval craft products were complex objects comprising a variety of raw material types, and it was this complexity characterized the craft itself rather whether hard osseous raw materials were used.

An exception to this may be the case of *paternoster* or rosary bead-makers. In Konstanz, rosary bead-making appears to have been an established workshop industry although sources indicate that bead-making was also part of the medieval manufacturing process in workshops that also processed other raw materials (metals, glass, coral, etc.).

In a wider Hungarian context, there is no confirmation based on either archaeological materials and/or historical document sources for individual, established bone/antler working workshops. Rather, the use of several raw materials in the same craft context seems to have been the rule. Overall, craft specialization and use of osseous materials in workshops are certainly present, but as mentioned earlier, the characterization of the workshop should not be based on the raw materials but on the commercial goods and objects which were produced there.

The scale of production was certainly also an important factor in the Middle Ages and early modern period. In Hungary, on the one hand, small-scale, cottage industry, or individual temporary, mobile workshops certainly operated in order to satisfy the immediate but temporary local basic social units such as households or small communities. Archaeological finds associated with this type of production can be traced in the record from the Arpadian period onwards, and later on, in some rural areas.

Bone and antler may also have been used in more stable, serial production, crafts-related workshop settings connected to other, more complex types of handicrafts or even to manufacturing connected to guilds. In this case, it can also be assumed that a certain degree of cooperation and networking existed between different craftspeople, people with variable levels of experience and available technologies. Overall, bone-working may have been more of a

temporary, workshop activity, a secondary occupation, that took place in a variety of urban spaces.

Conclusions on serial production and craft specialization in Buda

The finds recovered from the excavations in Buda reflect the extent to which bone and antler raw materials were used. The study of these materials raises the following issues:

- How many different and varied tools and objects could have been made of bone, antler and/or horn, as raw materials of component parts,
- Were there identifiable raw material preferences in general and for specific types of objects,
- To what extent were these trends in raw material choice influenced by the selective nature of the recovery and curation of archaeological finds during and after excavation,
- What kind of serial production can be detected?

Based on the written source materials (the Buda Law Book) and the worked osseous archaeological finds, hard osseous raw materials were widely used by craftspeople in the Buda castle area in connection with a variety of local, specialized crafts. The more established (supported by significant amount of archaeological finds, and/or written sources) craft workshops produced:

- Knife-makers (detectable)
- Tool-makers (handles, detectable, more indirect)
- Bow-makers (cross-bow bolts, isolated cases, further research is necessary)
- Button, bead-making (based on archaeological materials)
- Horn-processing (detectable through scattered archaeological materials, otherwise minimal information available)

Different issues arise in the case of bone and antler- manufacturing processes in medieval Buda.

Issues of spatiality

Generally, worked osseous materials have been found from all over the Buda Castle District in addition to the excavation materials I examined. Most sites have yielded secondary workshop debris. Thus, despite the "need" of archaeologists to localize workshops precisely it is rarely, if ever, possible. Further research is needed, with a comprehensive examination of excavated material, but until recently, this work has been carried out very selectively making contextualization of the worked bone and antler objects and the manufacturing debris associated with processing, difficult. The question also arises of whether craft production in the *suburbia,* as a separate spatial dimension, can be connected to the materials coming from the castle quarters. Was there separation or direct links between the two areas? Although there are strong indicators that there were indeed connections and close cooperation between the Castle District and the suburbs in close proximity to Buda, the low numbers of written sources and archaeological materials does not permit thorough research. Only hypothetical assumptions can be made about certain and general market dynamics. The extent of craft-related activities concerning hard osseous materials is requiring, as usual, further research.

The profile of the artifacts recovered

The following materials were recovered from the excavations:

- Specialized workshop waste,
- Commonly used, everyday objects, local products
- Special, recognizable objects that may have arrived in medieval Buda though commerce/individual routes

Special, representative objects appeared in large quantities (elaborately decorated cutleries, ivory and walrus tusk objects, etc.) in the vicinity of the palace, i.e. the excavation materials from the Royal Palace and the Teleki Palace sites. Such objects can be interpreted to a certain extent as connecting to court representation, but at the same time, their marked presence compared to more mundane objects indicates the nature of the collection at the time of the fieldwork. As mentioned above, worked osseous materials appear in two ways: as parts of tools used in craft manufacturing or as raw material for manufacturing final products, the focus of this thesis. Ceramic and leather-working tools were recovered in small numbers from the excavations, as tools used in craft manufacturing.

In the context of the medieval Buda Castle District, knife-handle-making seems to have been the most important craft employing osseous raw materials as complementary elements in knives of various types, something certainly supported by written sources. Despite this evidence, however, it remains a further question how the trade in knives operated in medieval Buda. My two conclusions regarding the knife-makers and the trade in knives are based on two things. A greater proportion of knives arrived in the form of blades, produced in manufacturing centers in Western Europe (Nuremberg or Steyr, for example). Buda plays a transit-trade role during the course of which some of the knife blades were either sold locally, fitted with handle covers on the spot, while another part of the merchandize is forwarded to other areas within the Carpathian Basin. workshops. The style of the handles fitted onto the imported knife blades would have catered to local market tastes.

Contextualization

of the material is particularly important. The finds and objects recovered from the territory of medieval Buda display a similar composition with regard to the type and style of the finds compared to other medieval urban sites. Within the Carpathian Basin, several medieval

excavations have brought to light worked osseous materials. In Although materials from Visegrád have not yet been processed, the finds from the Palace (42 pieces)[184] and the Citadel (127)[185] contained similar types of everyday objects (knife or tool handles, crossbow elements (nuts in particular), clothing ornaments, etc.) as well special objects in smaller quantities. In terms of raw material preferences, the impact of the easier availability of red deer antler gathered from the surrounding forests is quite evident: antler was used more frequently as the raw material for certain objects compared to the medieval Buda material.

Outside of the borders of the medieval kingdom of Hungary, the medieval town of Wroclaw shows a similar picture in terms of the osseous raw materials used in manufacturing parts of objects, although various craft specializations are more prominent and can be better identified spatially. Craft activity in Wroclaw include button-bead, dice, knife handle, horn sheath and comb manufacturing.[186] The materials from Buda reveal a somewhat different kind of production: evidence of tool handle production and bow-making have been found but comb manufacturing waste is absent from the materials in Buda (which is possibly connected to the preferred use of horn which does not usually survive on dry archaeological sites or the absence of identified/collected materials). In terms of raw material preferences, the Wroclaw assemblages contain a similarly high number of worked flat bones, a raw material that was clearly also often used in Buda workshops. Similar trend is visible in the case of the town of Inowroclaw (N=347) in terms of the use and working methods of flat bones.[187]

[184] Kováts, "Finds of Worked Bone and Antler from the Royal Palace of Visegrád."
[185] Kováts, "A visegrádi Fellegvár megmunkált csont- és agancsleletei [Worked bone and antler finds from the Visegrád Citadel]."
[186] Konczewska, "Bone, Horn and Antler Working in Medieval Wrocław."
[187] Kamilla Pawlowska, "The Remains of a Late Medieval Workshop in Inowroclaw (Kuyavia, Poland): Horncores, Antlers and Bones.," in *Written in Bones. Studies on Technological and Social Contexts of Past Faunal Skeletal Remains*, ed. Justyna Baron and Bernadeta Kufel-Diakowska (Wroclaw: Institut Archeologii Uniwersytet Wroclawski, 2011), 313–19.

Overall, the manufacturing and use of osseous raw materials in the medieval Castle District of Buda hold a prominent place in certain local craft specializations. The archaeological finds present a complex picture of handicraft organization and revealed new connections to previously studied crafts. As for the integration of this particular type of raw material in craft production, their manufacture was not necessarily part of individual, established workshops, but in the Middle Ages and in the early modern period, they were more likely to belong to different types of craft spaces, which should themselves be categorized on the basis of their scale of production, beyond the actual objects, tools and ornaments they produced. Their presence as finished and half-finished objects reflect the local and distant market demands of the period, the status of craftsmanship and cooperation of different types of craftsmen of varying status and backgrounds. Craftspeople in medieval Buda workshops, in all likelihood, despite the specialized nature of their activities, worked flexibly with a varied toolkit and a diverse palette of raw materials, which may have been substitutable, predictably available and usable at the same time, so depending on the manufacturing and market context.

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Glossary[188]

Chaîne opératoire: 'operational sequence', the technical processes and social, cultural acts involved in the production, use, and disposal of artifacts.

Hard osseous materials: in this thesis this expression refers to worked bone and antlers. In general, this summary term is also used in the literature to refer to tusks, ivory, horn, shellfish, and eggshells, in addition to the above raw materials. These are not included in this thesis, because ivory was not worked locally and the remainder of these raw materials do not appear in the excavation material. In the international literature, this group of materials is usually described as industry from hard materials derived from animals (GB) tierische Rohstoffe (DE), kemény állati eredetű nyersanyag (HU). For the sake of simplicity, this group of raw materials will be referred to in this thesis variously as bone and antler tools, worked bone and antler objects.

Taphonomy: the study of post mortem processes, impacted both by natural (weathering, humidity, physical/chemical processes) and human (butchering, burning etc.) modifications, causes. The taphonomic processes in the case of worked bone and antler artefacts prevail in several ways. The effects involved in burial have an impact on the ability of objects to survive, their condition, state, and interpretability. In many cases, centuries under the ground can lead to deterioration of the surface of the material or to distortions that can cause difficulties in the technical analysis of the craft processes and the interpretability of the object. These include damage caused by root acids, deterioration of objects due to weathering, surface, or subsurface exposure, to name but a few examples.

[188] "A Glossary of Zooarchaeological Methods," Online Handbook, Oxford Handbooks Online, April 2017, https://www.oxfordhandbooks.com/view/10.1093/oxfordhb/9780199686476.001.0001/oxfordhb-9780199686476-miscMatter-12. (accessed May 15. 2022)

Taxonomic identification: the assignment of an animal specimen to a taxon, relying on morphological and biometric observations, reference collections of taxon-specific traits.

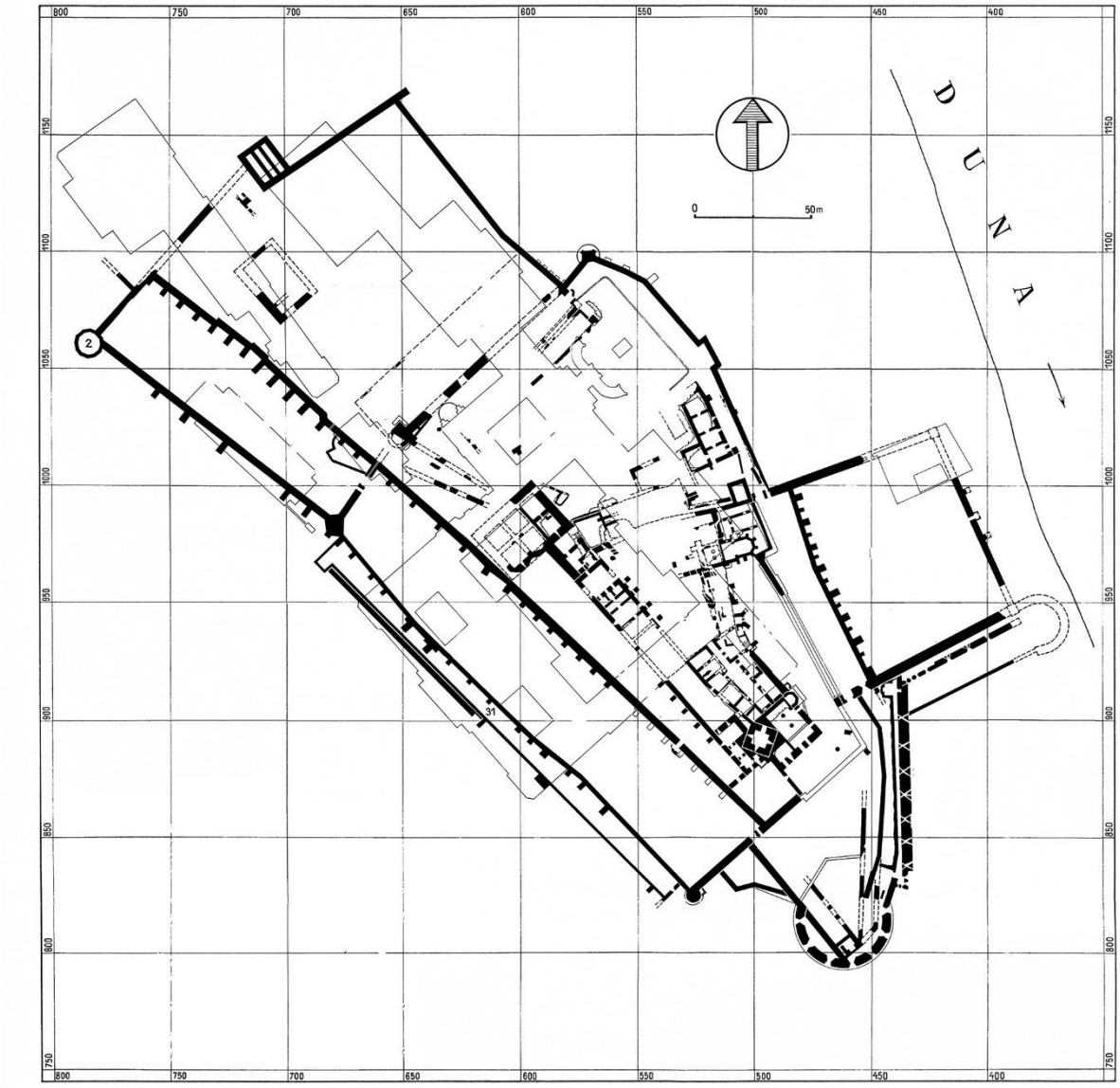
Maps

Map 1 The Castle District of Buda.

After Nagy et. al. 2016

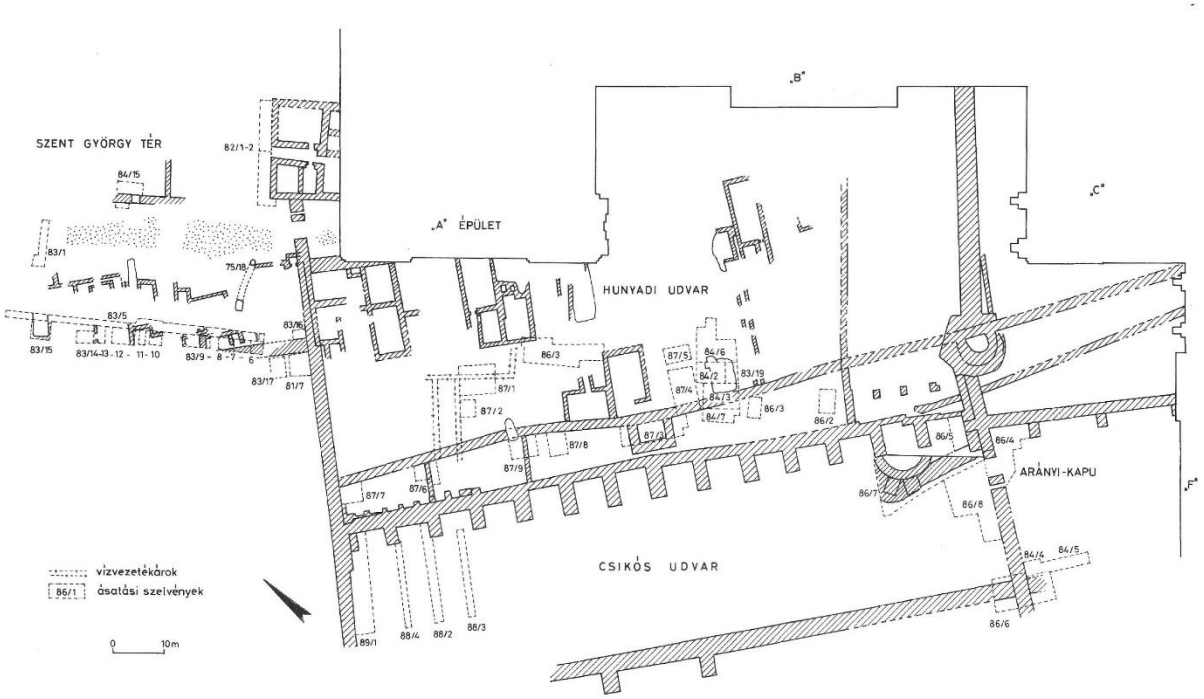
Map 2 The excavation sites examined.

After Nagy et. al. 2016



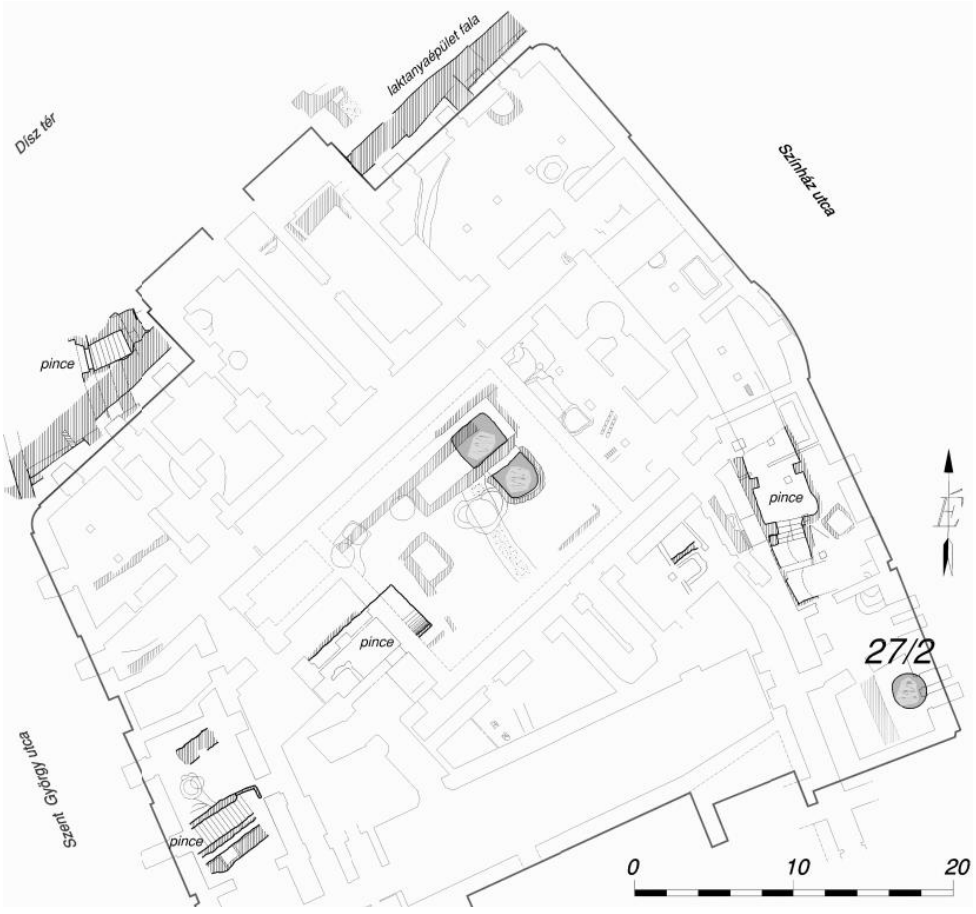
Map 3 The excavation survey of the Royal Palace.

After Gerevich, 1966



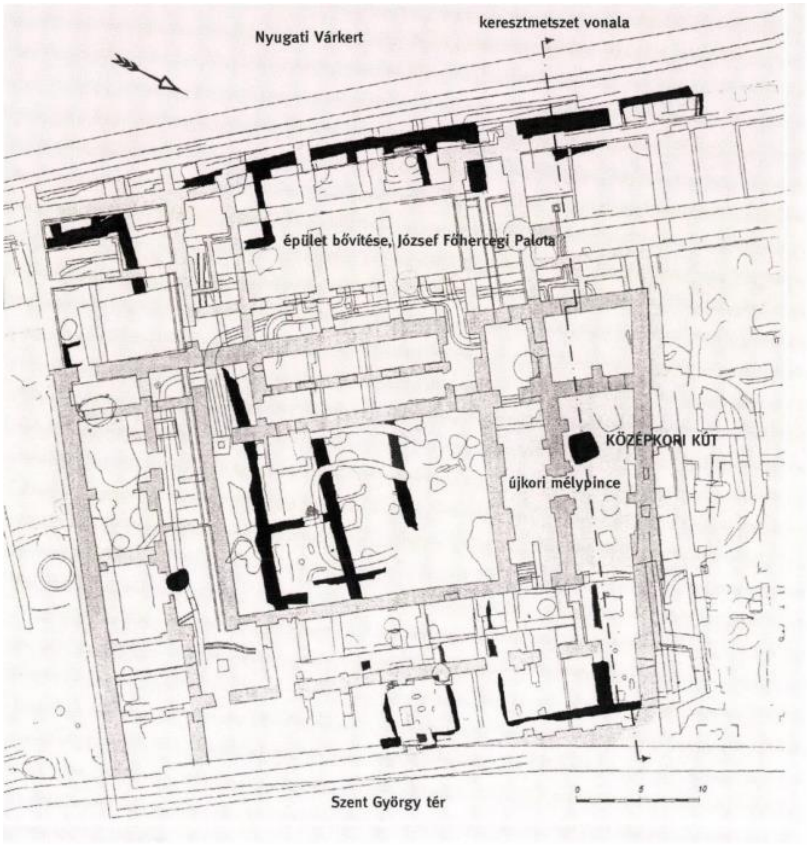
Map 4 Excavation survey of the Northern Courtyard (1982-1991)

Magyar, "Ásatások a Budavári Palota területén és annak északi előterében," 110.

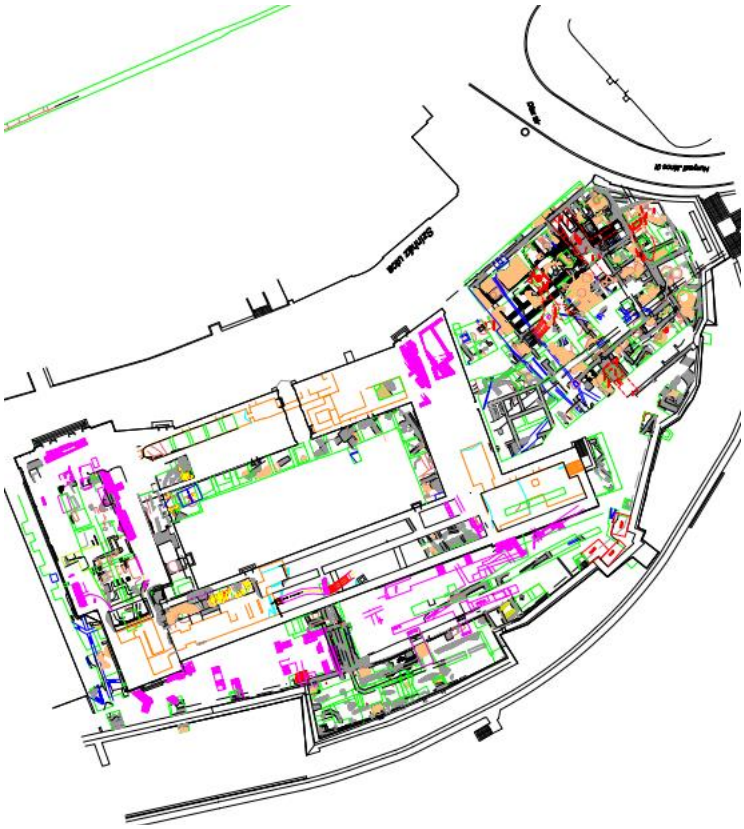


Map 5 Excavation survey of 17 Dísz Square

Bencze, "Régészeti kutatások a Dísz tér 17. sz. alatt. (Előzetes jelentés)", 165.



Map 6 Excavation survey of 17 Dísz Square
B. Nyékhelyi, *Középkori kútlelet a budavári Szent György téren*, 6.

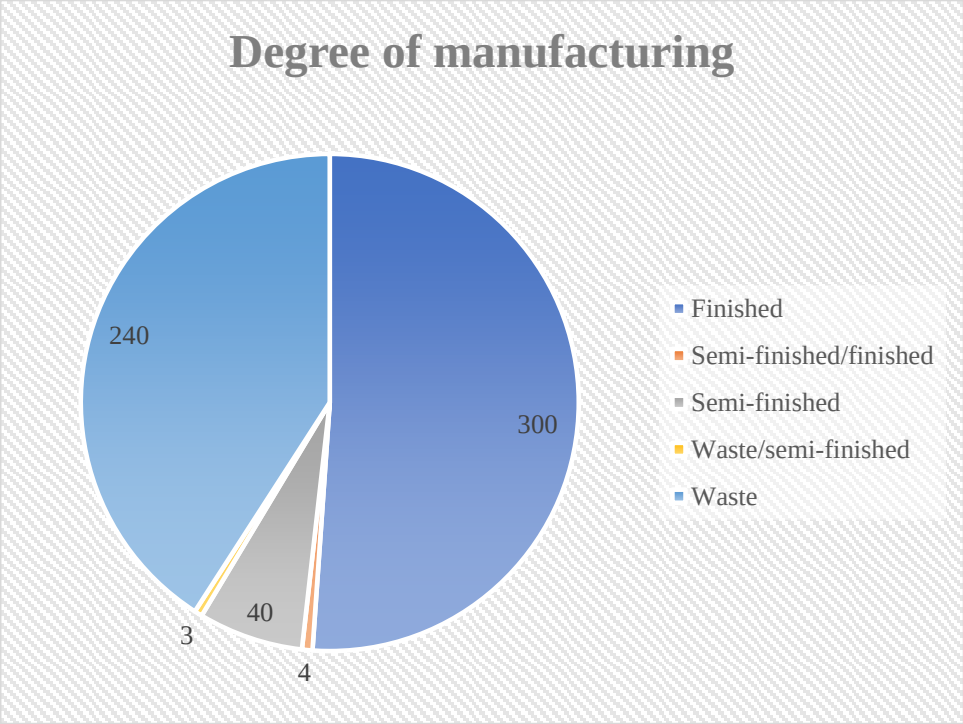


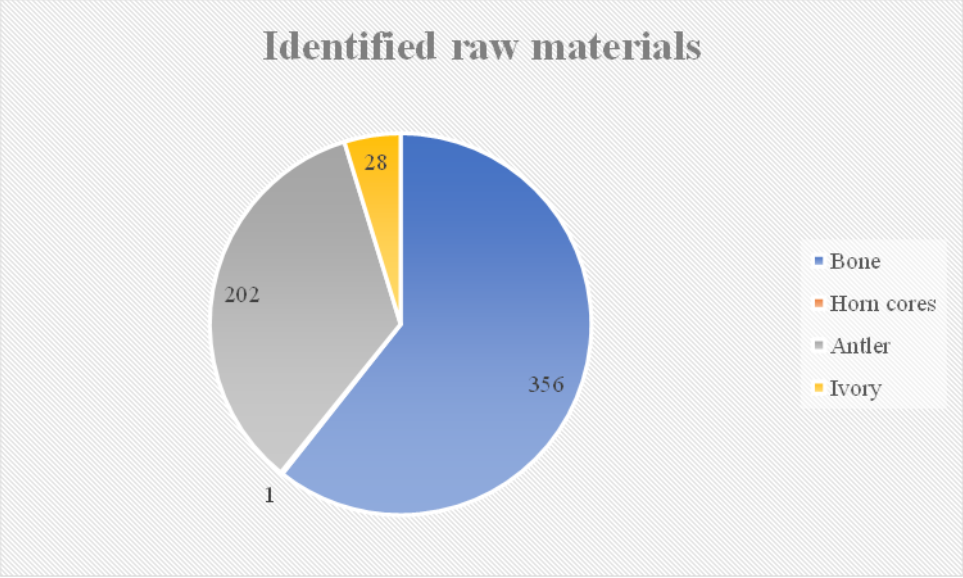
Map 7 Excavation survey of 17 Dísz Square by Adrienn Papp

Appendix

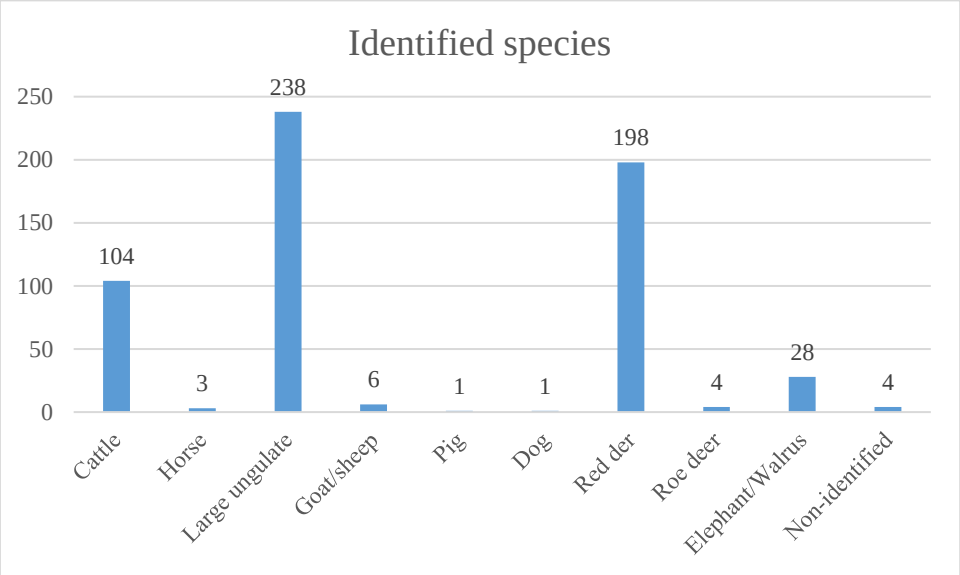
Zooarchaeological analysis

Royal Palace – N = 587

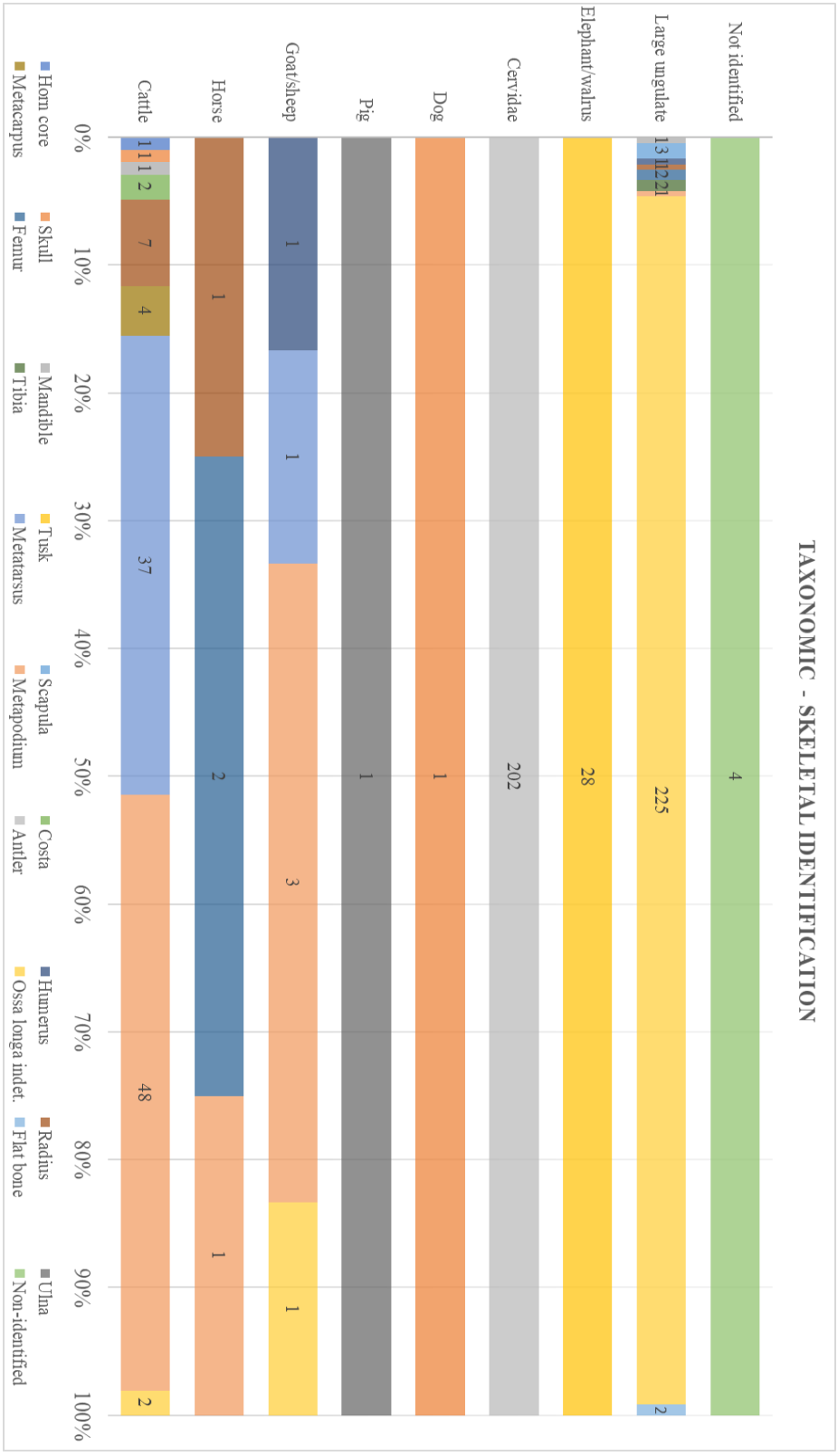




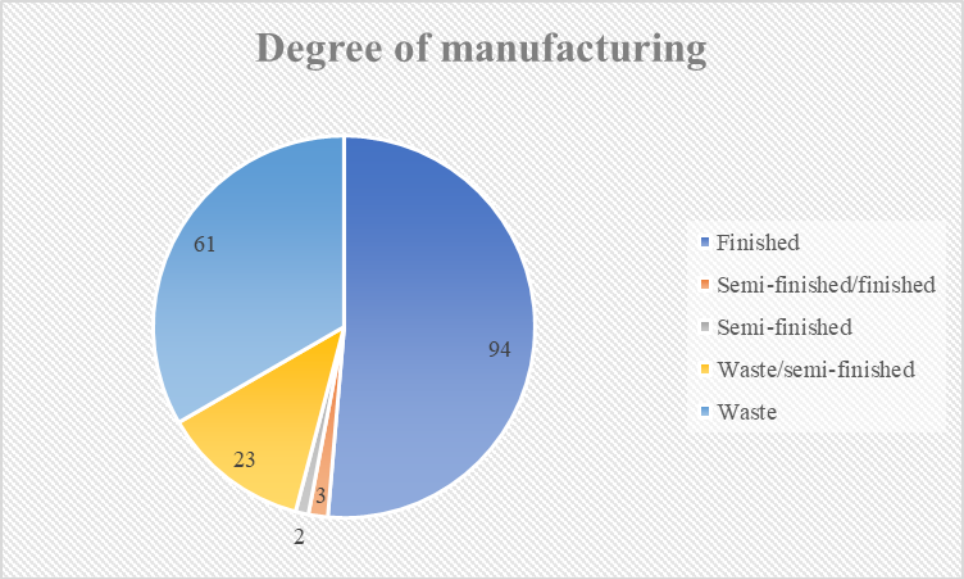
Royal Palace – N = 587

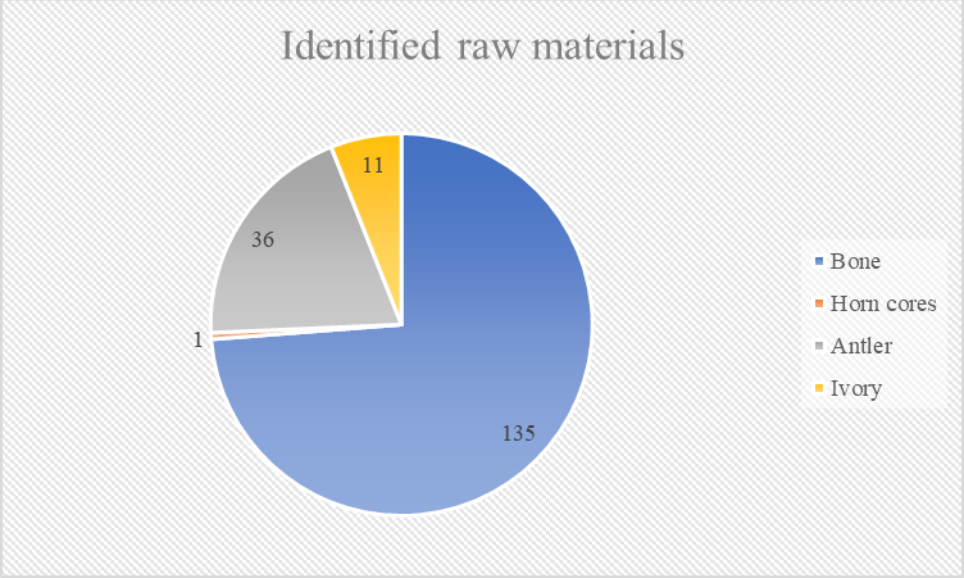


Royal Palace – N = 587



Northern Courtyard – N = 183





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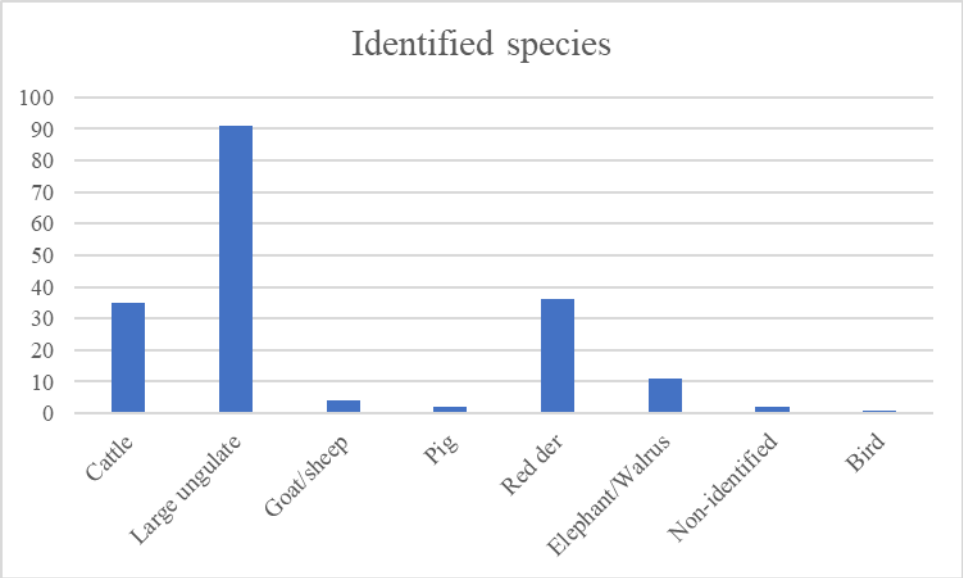

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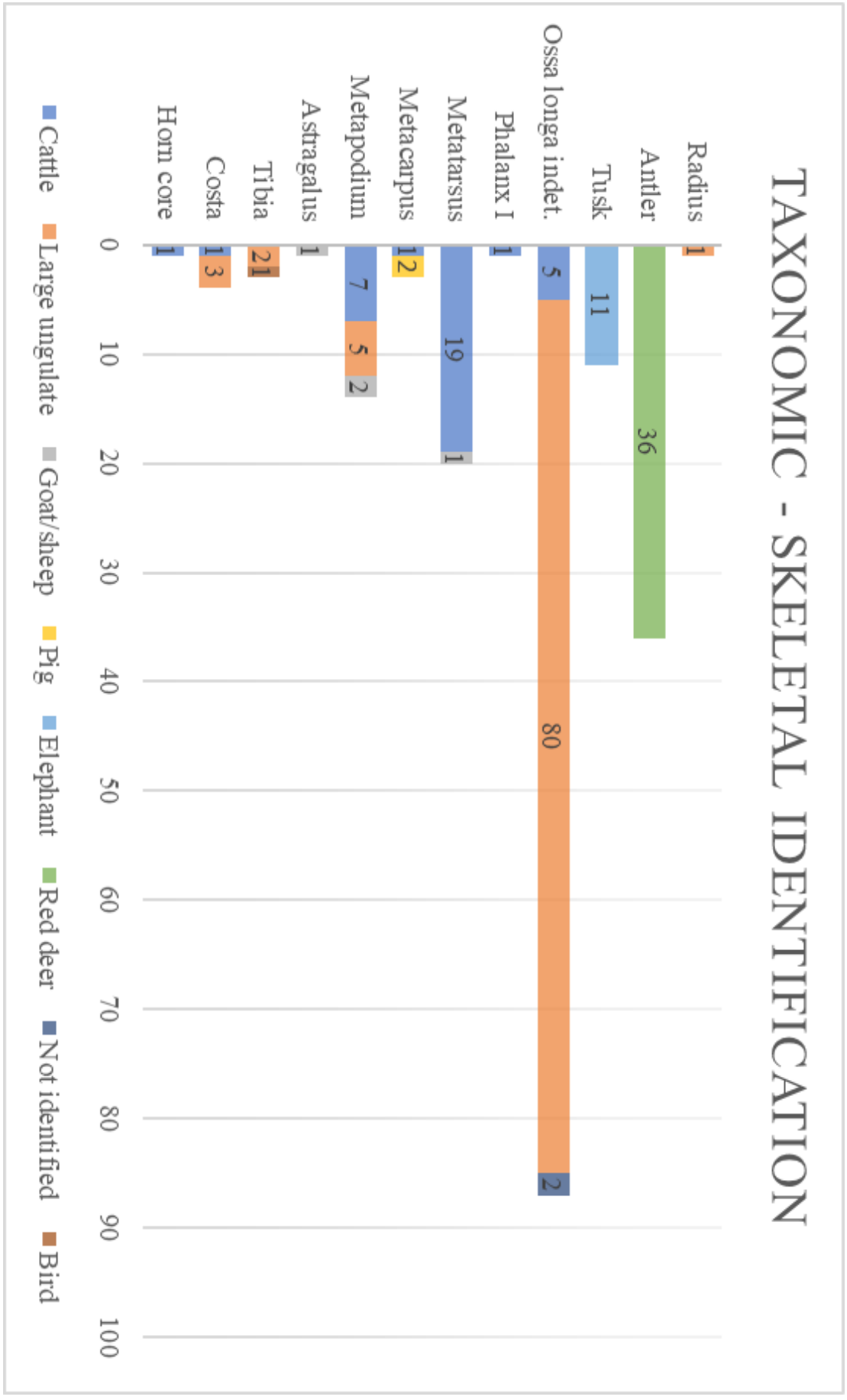
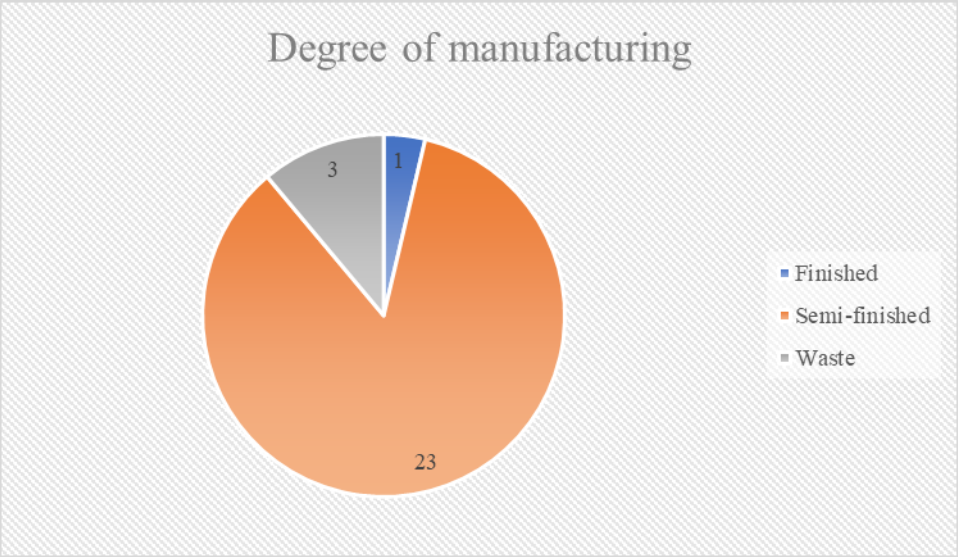
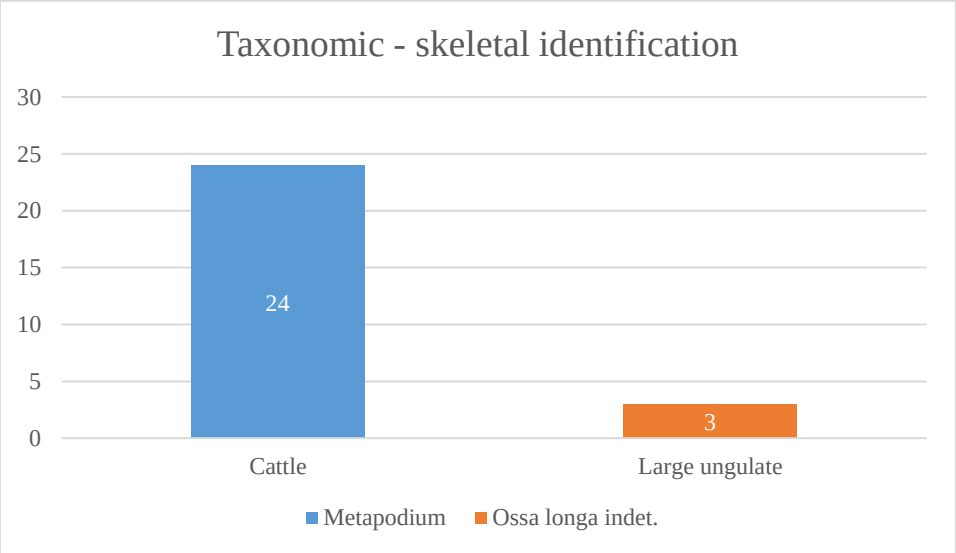
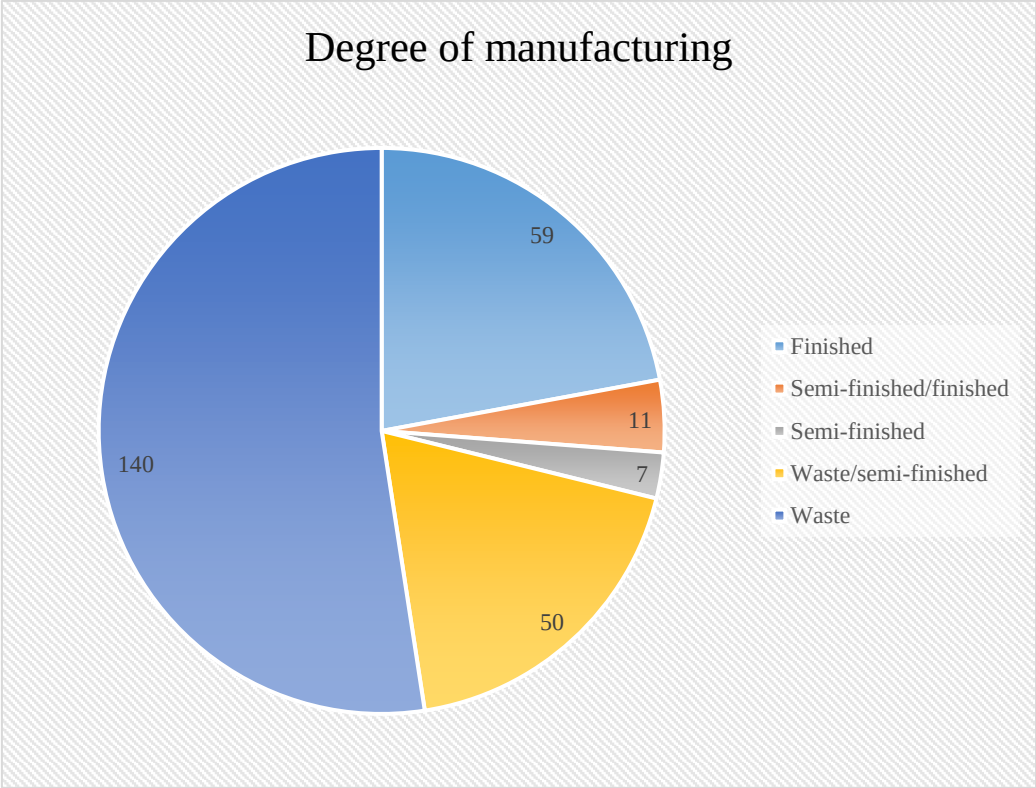


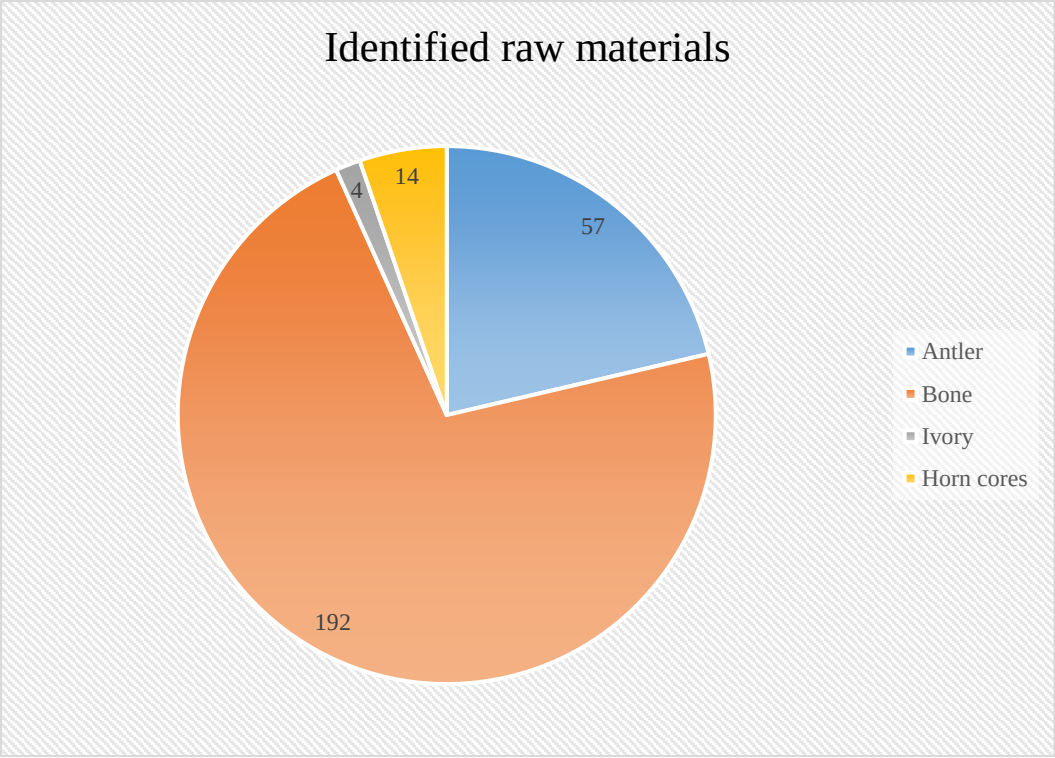
17 Dísz Square – N = 27

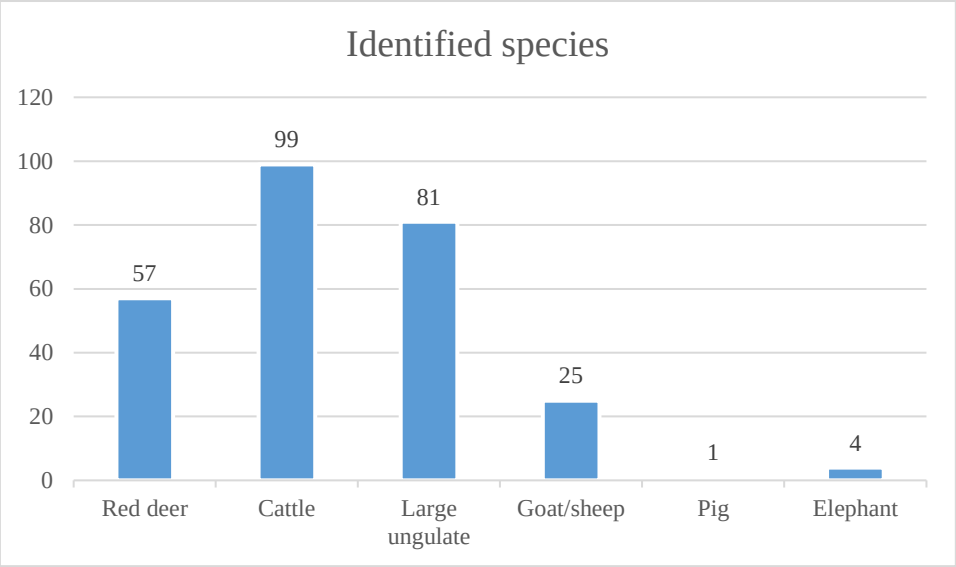


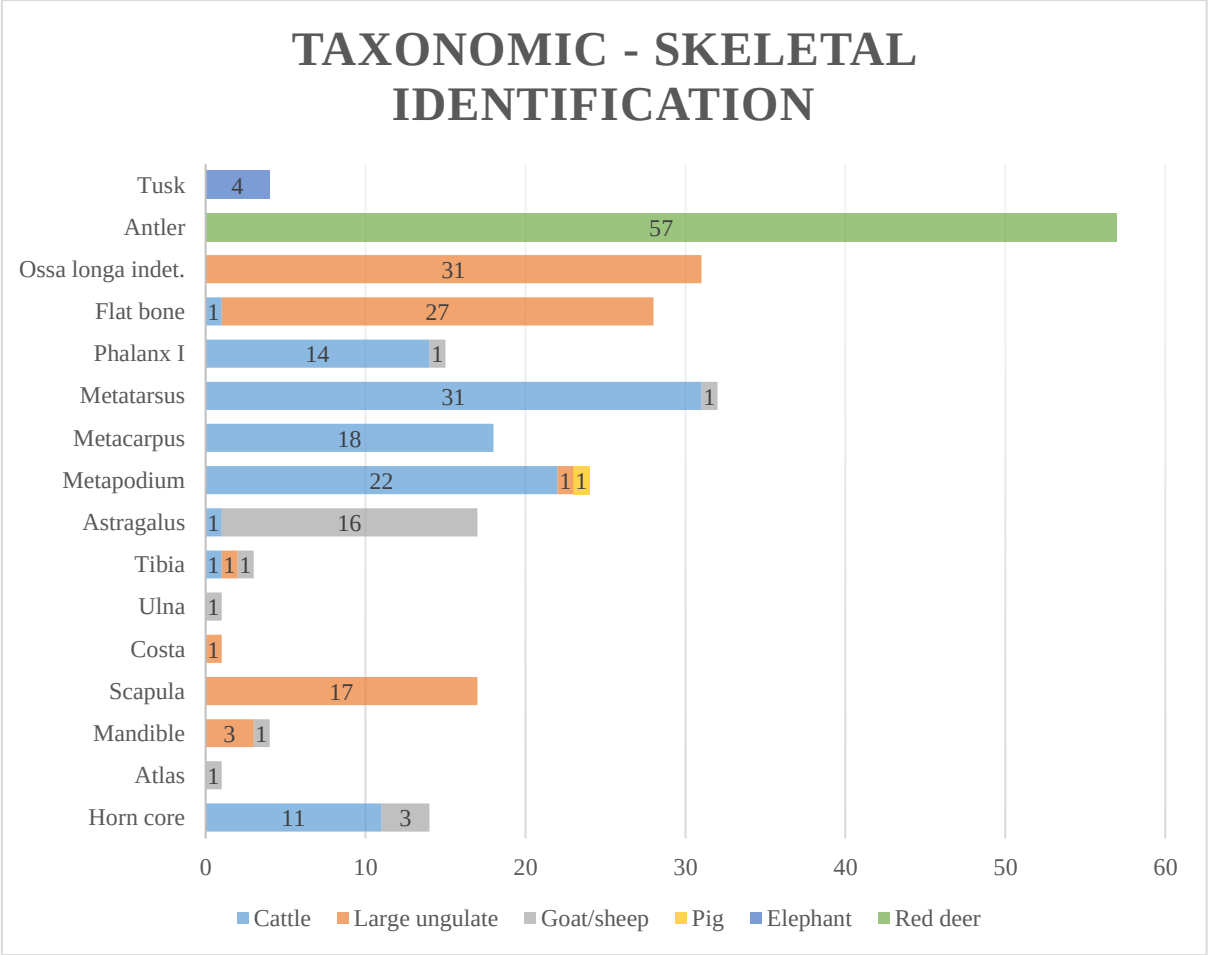


Teleki Palace – N = 257

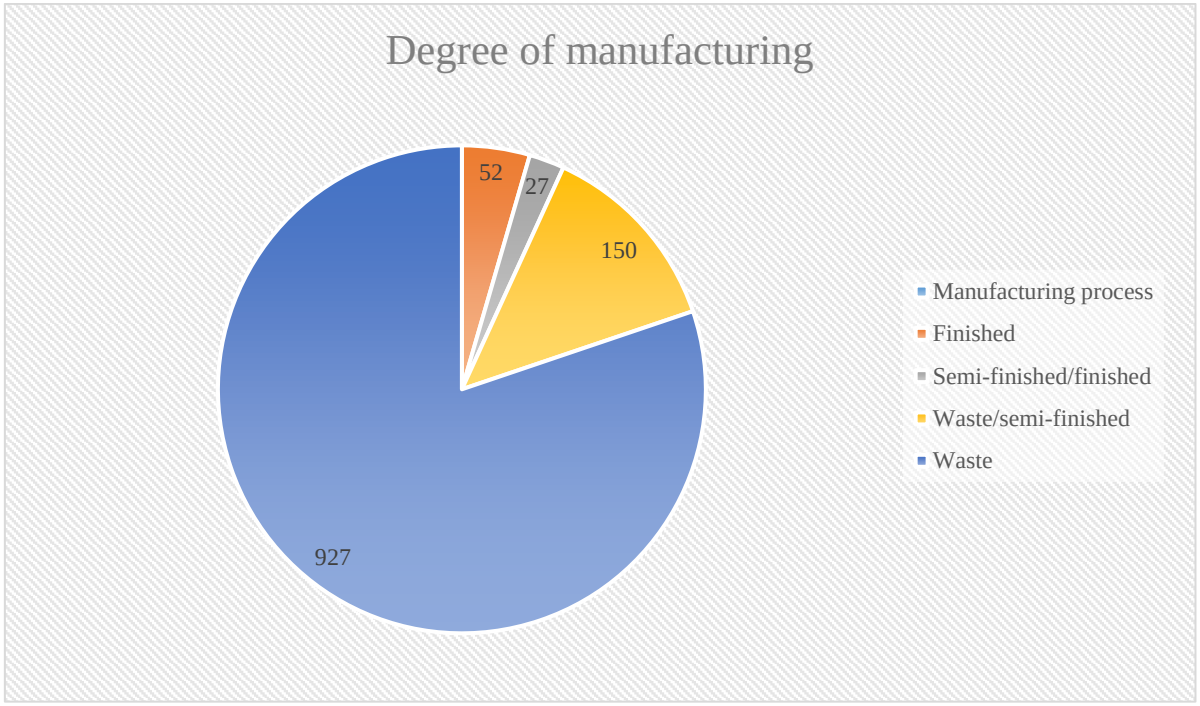


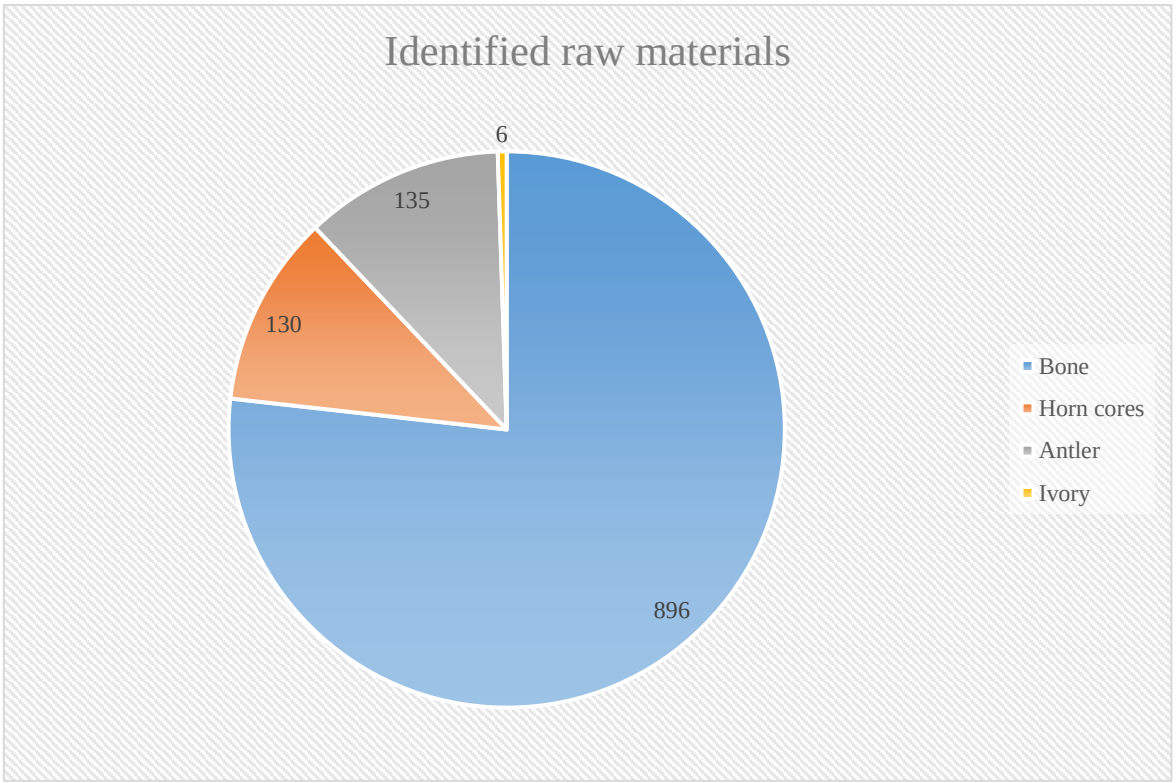


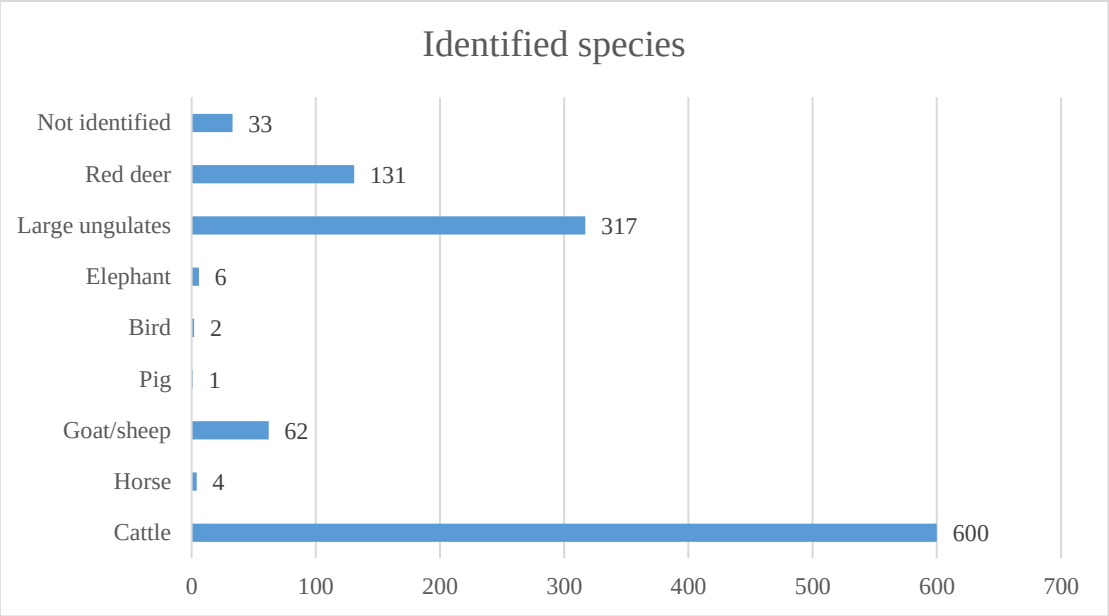


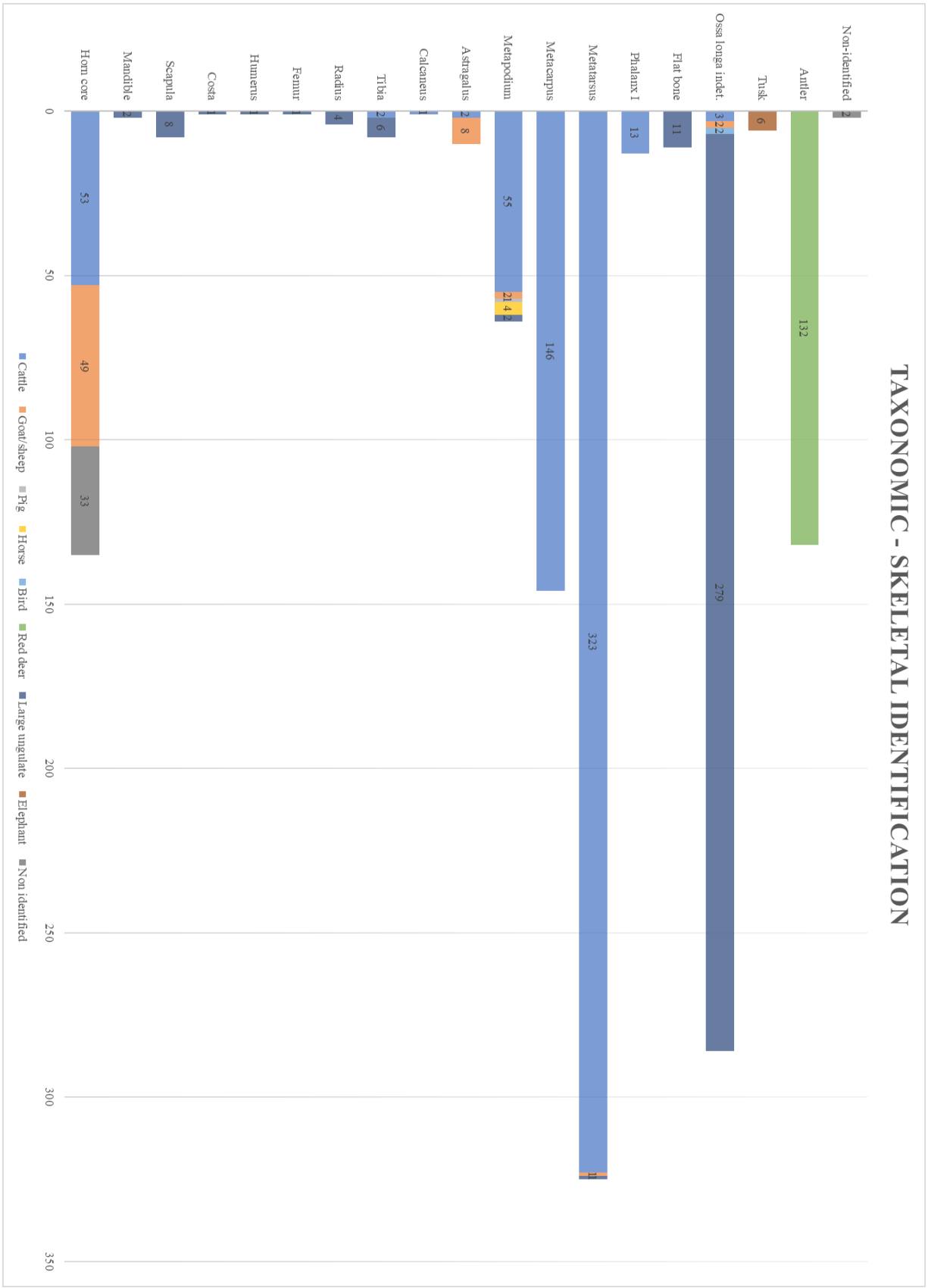


Carmelite complex – N = 1157









Catalogue

Figure 16 Remains of bow making

Figure 17 Arrow making tool, crossbow inlays

Figure 18 Clothing accessories

Figure 19 Bone beads

Figure 20 Gaming pieces

Figure 21 Tools for pottery making (49.87) and leather working (49.91, 9.175)

Figure 22 Semi-finished knife handles from 17 Dísz Square (Photo: Márta Daróczi-Szabó)

Figure 23 Workshop waste from the Royal Palace

Figure 24 Workshop waste from the Carmelite complex

Figure 25 Workshop waste – flat bones from the Carmelite complex

Figure 26 Workshop waste – flat bones from the Teleki Palace

Figure 27 Workshop waste – antlers from the Royal Palace

Figure 28 Workshop waste – horn cores from the Carmelite complex

Figure 29 Workshop waste – remains of beads and button making from the Royal Palace