

RECONSTRUCTING A LOST LUXURY: A LATE MEDIEVAL BONE SADDLE FRAGMENT FROM TATA

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Tata is primarily known for its castle, which functioned for an extended period in the fifteenth century as a secondary royal residence. Less widely recognised is that, during this period, two market towns – Ótata (Old-Tata) and Újtata (New-Tata) – also existed in the immediate vicinity of the castle. In 2016, an archaeological excavation was carried out on a plot located within the area of former Ótata, adjacent to present-day Tata's main square. The finds also included a small fragment of a carved bone plate. Its ornamental decoration, as well as its shape and thickness, suggests that it originally formed part of the carved decoration of a wooden saddle covered with bone plates – a distinctive object type characteristic of fifteenth-century Central Europe. Most comparable saddles have survived only in museum collections, which makes the specimen recovered at Tata particularly significant. This study presents the circumstances of the discovery, situates the fragment within the context of currently known bone saddles, and discusses the results of material analyses, as well as its photogrammetry-based 3D model and digital reconstruction.

Keywords: Late Middle Ages, material culture, bone saddle, art history, material analysis (ZooMS), photogrammetry, 3D reconstruction

INTRODUCTION

In 2016, an excavation was carried out in the market square of the Hungarian town of Tata, during which a fragment of a bone plate was revealed. The thinness, the circular shape, the low reliefs, and the two round slots of the excavated piece suggest that it once formed part of a special late medieval luxury object: a bone saddle.

Late medieval bone saddles are special equestrian products from the fifteenth century. Twenty-nine original late medieval examples have survived, along with six nineteenth-century copies in museum collections. In addition to the fragment discussed here, further bone saddle fragments were excavated in 2007 in the cellar of Herrengasse 10 in Vienna. The significance of these archaeological finds lies in the opportunity they provide for destructive technical analyses, which are not possible in the case of bone saddles preserved in museum collections. Moreover, the finds contribute to a better understanding of the original late medieval context of this object group. Today, bone saddles are dispersed among museums worldwide, and in most cases, their provenance can be traced back only to the nineteenth century. The discoveries in Tata and Vienna therefore offer a rare opportunity to contextualize bone saddles within their original late medieval context and to associate the group more securely with a specific geographical area and timeframe.

CIRCUMSTANCES OF THE EXCAVATION

In April 2016, a short-term, small-scale excavation (approximately 700 m²) was conducted at a site adjacent to Tata's main square (Kossuth tér 16) in advance of the construction of a residential building (*Fig. 1*). During the investigation, a total of 32 archaeological features were identified, datable from the late Árpád Period (twelfth–thirteenth centuries) to the early modern era. Although no remains of late medieval residential buildings could be documented – most likely due to later disturbances – several features attest to the use of the plot during this period.

A fragment of a carved bone plate was recovered from one of the shallow pits (Feature 27). The precise function of the feature could not be determined. Reddish traces of burning observed along the sides suggest

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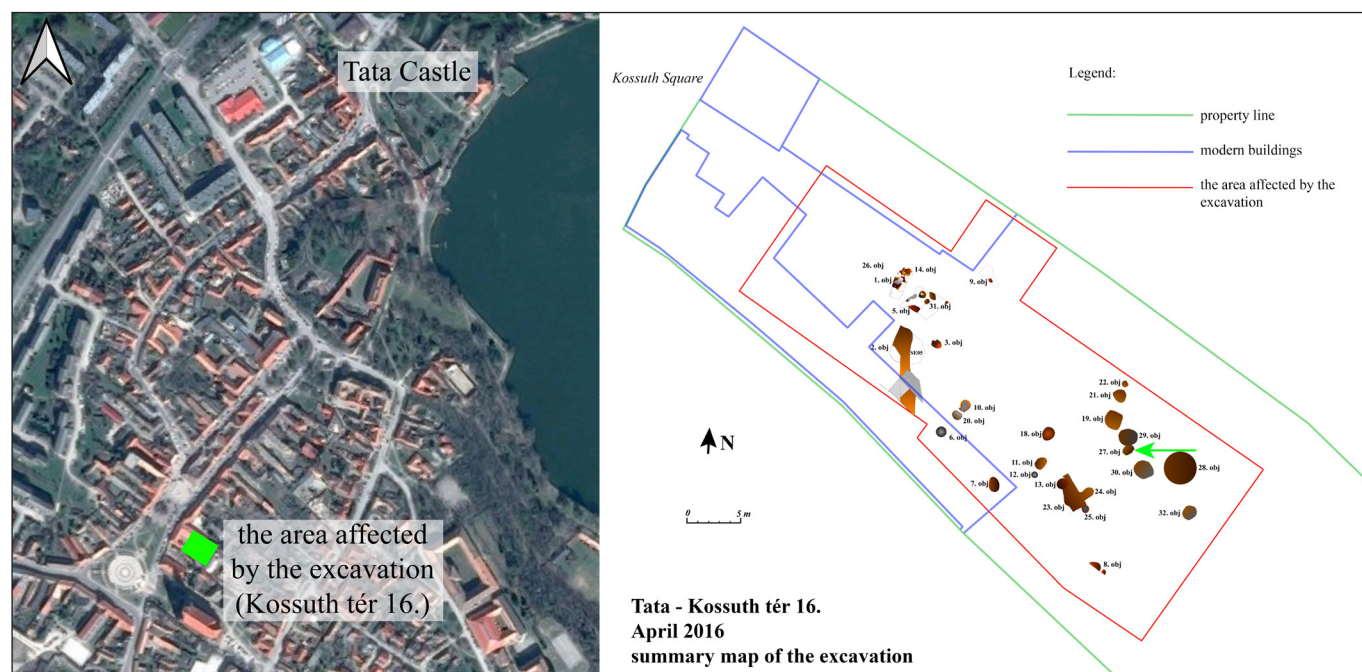


Fig. 1: Tata – Kossuth tér 16. – Location of the site within Tata and the summary map of the excavation (the findspot of the bone plate indicated by an arrow). (Made by Bianka Gina Kovács)

that it may originally have served as a storage pit, intentionally fired on the inside prior to use and was later repurposed as a refuse pit (Fig. 2). In addition to the bone fragment, several ceramic sherds (Kuny Domokos Museum, inv. no. 2016.13.27.1–14) and animal bones were found within the pit. Most of the ceramics were produced on a slow wheel. Of these, the two rim fragments can be dated on typological grounds to the late Árpád Age (thirteenth-fourteenth centuries) (Fig. 3), and the only base fragment shows traces of having been cut from the slow wheel with a knife, while three body sherds were fast-wheel-thrown, all from the middle layer (SE 57). One is a shoulder fragment decorated with two grooves and, based on its form and decoration, can be dated to the second half of the fifteenth century (Fig. 3a, bottom right). Based on assemblages analysed from the surrounding area, the transition to the fast wheel probably took place in this region by the late fourteenth or early fifteenth century; slow-wheel-thrown vessels are therefore unlikely to date later than the fourteenth century (KOVÁCS 2018, 31–37; KOVÁCS 2025B, 224). Accordingly, the ceramics from the pit can only be broadly dated to the thirteenth-fifteenth centuries.

The carved bone plate fragment was recovered from the upper surface of the lowest, reddish-black burnt layer. Fortunately, the animal disturbance visible in the documentation drawing did no harm to this layer.

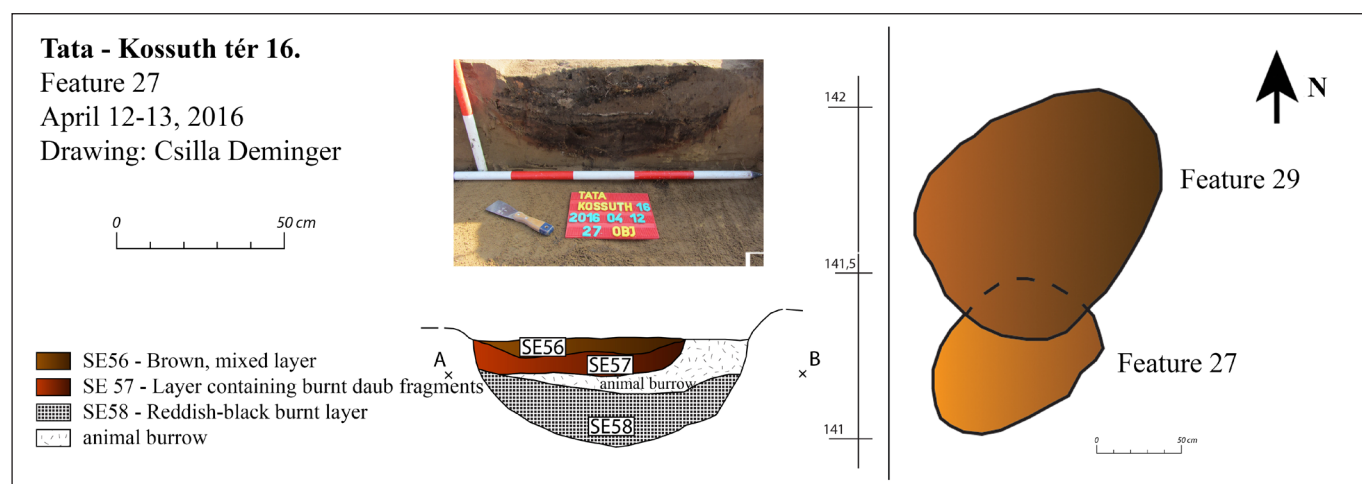


Fig. 2: Photograph, section drawing, and plan view of the pit (Feature 27). (Made by Bianka Gina Kovács)

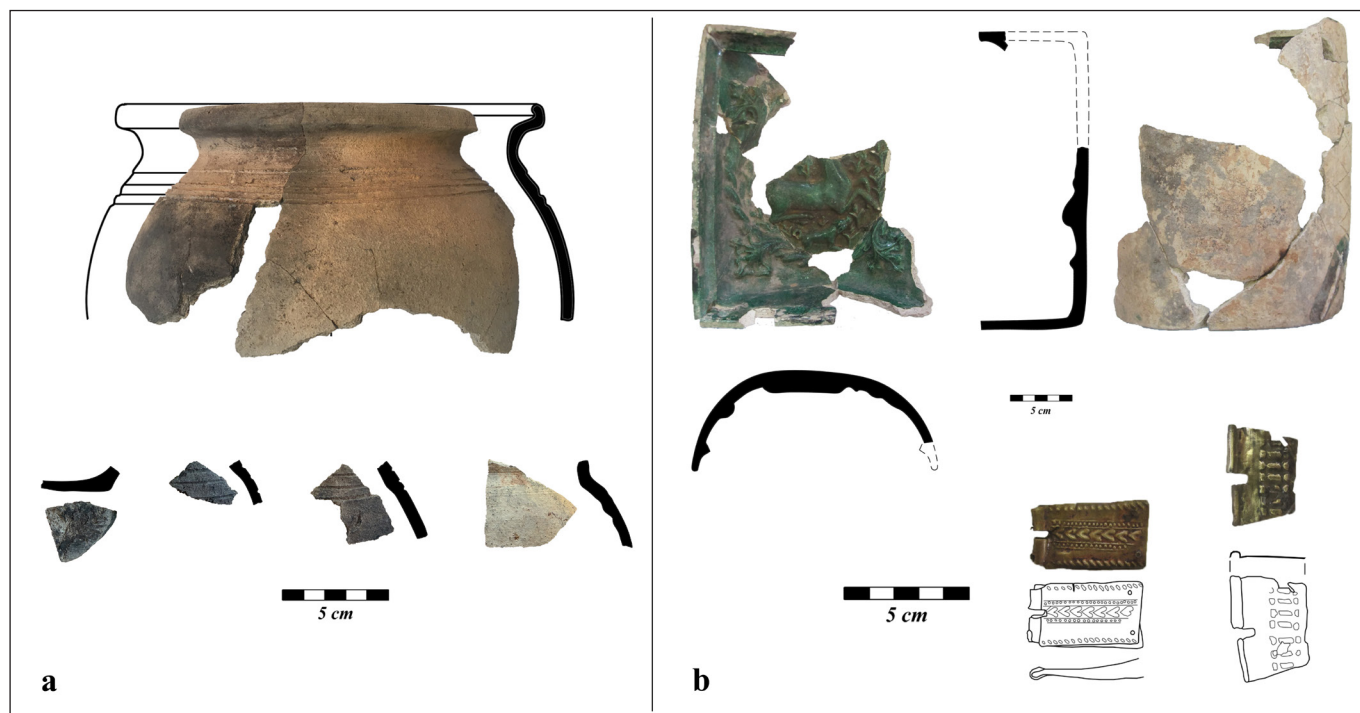


Fig. 3: Selected finds from Feature 27 (a) and Feature 29 (b). (Made by Bianka Gina Kovács)

The dating is further refined by the fact that the feature was partially cut by a later pit (Feature 29). Finds from this later pit can be dated to the second half of the fifteenth century and the first half of the sixteenth century (Fig. 3). Since the fill of the later pit most likely accumulated in the first half of the sixteenth century, the deposition of the feature containing the bone fragment must have occurred prior to this date. Based on excavation observations and associated finds, the bone plate fragment was most probably deposited in the pit during the fifteenth century (KOVÁCS 2018, 35; KOVÁCS 2025A, 191, 195–197).

LATE MEDIEVAL BONE SADDLES: CONTEXT, TECHNICAL CONSTRUCTION, AND MATERIALS

As no written or pictorial sources concerning the production of late medieval bone saddles have survived, their precise places and dates of manufacture remain uncertain. Stylistic differences among the known examples suggest that they were produced in several workshops across a broad geographical area, possibly extending from the Rhineland to Transylvania, from around 1430 to the end of the fifteenth century. Only one example can be linked to a specific owner and, thus, to a more precise chronological framework: the bone saddle of Ercole I d'Este (1471–1505), now kept in Modena, on which the duke's coat of arms and motto are carved. This heraldic evidence allows the object to be associated securely with the court of Ferrara in the later fifteenth century (SOMOGYVÁRI 2025, 104–105, 121–124).

Late medieval bone saddles were constructed according to a specific technical method. As was common practice in the period, the core of the saddle consisted of a wooden saddle tree, typically made of beech, birch, or limewood. This core was covered with additional layers: first leather and parchment, while the inner side was coated with birch bark. The thin bone plates were then applied to this prepared surface using small nails and adhesive (SOMOGYVÁRI 2025, 27–35).

Although the bone plates appear monochrome today, they were originally lavishly painted. Traces of polychromy remain visible on several surviving examples, including a saddle preserved in Vienna (Kunst-historisches Museum, Hofjagd- und Rüstkammer, inv. A 64).

The extent to which bone plates covered the saddle tree varies. In most cases, the plates cover nearly the entire surface of the saddle tree, with the exception of the supporting elements of the cantles. These saddles display symmetrically arranged bone plaques of different shapes on either side, and the joints between the



Fig. 4: Bone saddle. New York, The Met, inv. 04.3.249
(© The Metropolitan Museum of Art)



Fig. 5: Bone saddle. London, The Wallace Collection, inv. A 407 (© The Wallace Collection)

individual plates are clearly visible upon close examination (Fig. 4). In other examples, the plates were applied using a similar technique but did not cover the entire surface, allowing portions of the leather to remain visible and giving the saddle a less homogeneous appearance (Fig. 5).

TECHNICAL ANALYSES

Since all the intact bone saddles known today are held in museum collections, their value and fragility mean that invasive – especially destructive – technical analyses are rarely carried out on them. The fragment from Tata therefore provided a rare opportunity to undertake scientific examinations.

The first step was microscopic analysis, conducted to obtain further information about the surface and to determine whether traces of paint were preserved, as is the case with several surviving bone saddles. In contrast to those examples, no pigment residues were identified on the Tata fragment. However, fine scratches visible on the surface suggest that they were intentionally created to improve the adhesion of paint (SOMOGYVÁRI 2025, 37) (Fig. 6).

Another scientific analysis focused on identifying the raw material of the bone plates. The thin panels decorating the wooden saddle tree were long believed to have been made of ivory, and some examples are still officially described as having ivory plates (SCHLOSSER 1894, 260–294; SCHLOSSER 1899, 220–282).

The physical characteristics of the plates on late medieval bone saddles clearly indicate that they are made of bone rather than ivory. Moreover, the dimensions of the plates on most examples suggest that they derive from large mammals, such as cattle or horses. This supposition was already raised by Sonia O'Connor and T. P. Connor during the restoration of the saddle of the Tower of London in 2006. The restorers identified the plates as probably originating from the pelvis of a horse or cattle, while the edging elements were made from deer antler, whose combination of strength and malleability, particularly when warmed and shaped, made it especially suitable for this purpose (SOMOGYVÁRI 2025, 34).

The fragment from Tata finally made it possible to address this question on firm scientific grounds. A rapid and relatively low-cost analytical method, Zooarchaeology by Mass Spectrometry (ZooMS), developed originally at the University of York, can be used to identify animal species through the analysis

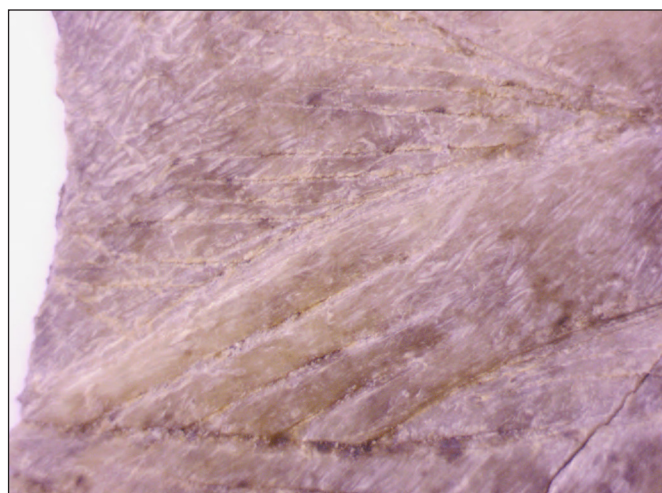


Fig. 6: Microscopic detail showing fine incisions observable on the bone plate. (Photo by Friderika Horváth)

of collagen and other surviving proteins in archaeological and historical artefacts. ZooMS is typically applied to fragmented, morphologically undiagnostic bone fragments, but it can also be applied to parchment, ivory, and leather objects (BUCKLEY, COLLINS & THOMAS-OATES 2008, 325–334). The analysis of the Tata fragment in February 2021 confirmed earlier suggestions: the bone derives from cattle (Bos). Based on the structural characteristics of cattle bones, it is likely that the thin plates were produced from either the scapula or the pelvis.

A comparable examination was carried out in August 2022 on a fully preserved bone saddle now displayed in the Metropolitan Museum of Art, New York (inv. 40.66). The examination, similarly to the ZooMS project, was performed using Mass Spectrometry, as in the ZooMS analysis. The results corroborated previous findings, identifying the plates as Bos (cattle) and the edging elements as coming from Red deer (Cervus elaphus) antler (GILBERT ET AL. 2024, 3).

DESCRIPTION, ANALOGIES AND RECONSTRUCTION

The fragment from Tata is an irregularly shaped circular bone plate (112×74 mm), with a thickness of 1–1.5 mm. Two circular perforations are preserved near the central–upper part of the fragment. The surface is decorated in low relief, and consists primarily of ornamental carvings. One edge – probably the lower edge – and a small section of the opposite side are framed by a carved border (Fig. 7).

Due to the fragmentary nature of the piece, the identification of motifs is challenging. Nevertheless, two details can be compared with carvings on other late medieval bone saddles. One is the three-lobed leaf visible in the lower central area of the fragment, for which a comparable motif can be found on a bone saddle preserved in the Metropolitan Museum of Art (New York, The Metropolitan Museum of Art, inv. 04.3.249) (Fig. 8). Another comparable detail is located on the right side of the fragment, which can be identified as the thigh of an animal. A similar anatomical detail can be observed on the bone saddle in the Tower of London (London, Tower – Royal Armouries, inv. VI.95), where it forms part of an ornamental dragon (Fig. 9).



Fig. 8: Detail of a bone saddle. New York, The Met, inv. 04.3.249 (© The Metropolitan Museum of Art)

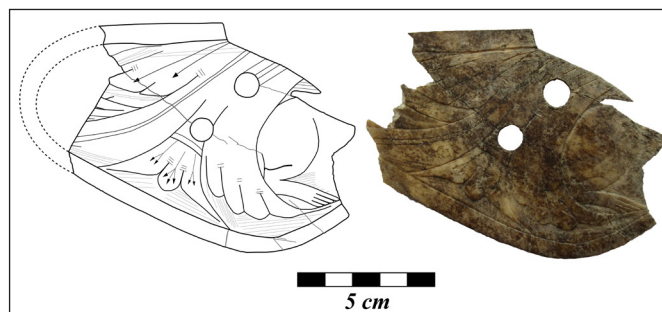


Fig. 7: Drawing (post-sampling) and photograph (pre-sampling) of the Tata bone plate. (Made by Bianka Gina Kovács)



Fig. 9: Detail of a bone saddle. London, The Tower of London – Royal Armouries, inv. VI.95 (© Royal Armouries)



Fig. 10: Reconstruction of a medieval bone saddle, detail.
(Made by Marcin Ruda; photo by Virág Somogyvári)



Fig. 11: Reconstruction of the bone saddle from the Tower of London, inv. VI.95. Saddle tree by Joram von Essen; painted imitation of bone carvings by Markéta Poskočilová; accessories by Marcin Ruda. (Source: <https://mrleather.org>)

An even more elaborate fantastic creature appears on the saddle preserved on Isola Bella (Stresa, Isola Bella, Museo Borromeo).

Such ornamental dragons appear on both the Tower and the Isola Bella saddles, though not within the same field, alongside representations of Saint George. In the case of the Royal Armouries saddle, a Saint George's cross and an inscription referring to the saint ("hilt got wol auf sand jorgen nam" – "With

God's help, in the name of Saint George") are also present (SOMOGYVÁRI 2025, XXVIII). These analogies suggest that similar fantastic creatures may once have decorated the original saddle to which the Tata fragment belonged, and they raise the possibility that additional motifs associated with Saint George were also present.

The circular outline of the fragment and the presence of two round slots provide the main clues for reconstructing its original position on the saddle. The carved border further suggests that the saddle may have been similar to those examples where the bone plates did not entirely cover the saddle tree, leaving portions of the leather visible. Similar borders can be seen on the saddle of Braunschweig (Braunschweig,

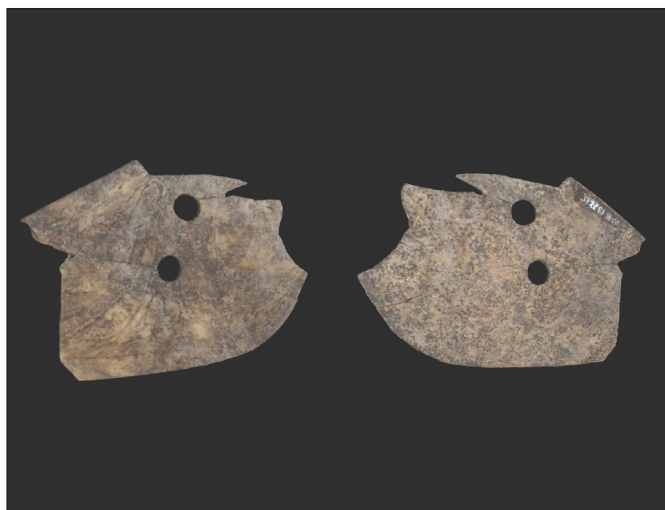


Fig. 12: Three-dimensional model of the Tata fragment.
(Created by Virág Somogyvári)

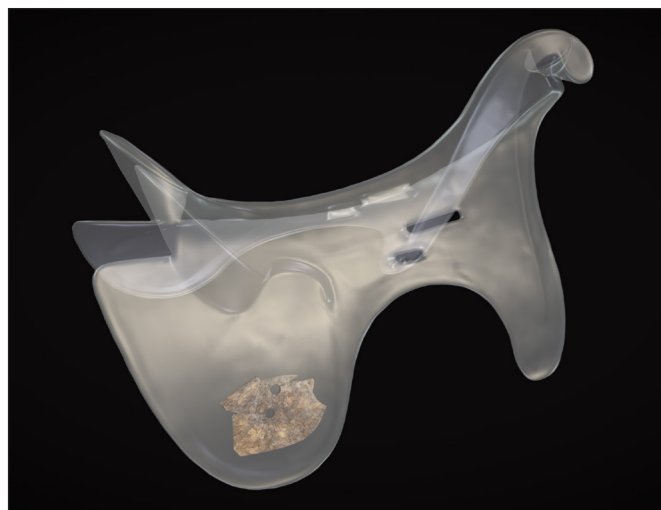


Fig. 13: Hypothetical reconstruction of the Tata saddle.
(Created by Virág Somogyvári)

Herzog Anton-Ulrich Museum, inv. MA 111) and on a saddle in the Wallace Collection of London (London, The Wallace Collection, inv. A 407–408) (*Fig. 5*).

Paired round slots appear on most of the bone saddles; in some cases, triple or quadruple sets are also found in various locations. The combination of circular shape, carved border, and double perforations indicates that the fragment most probably originated from the side of the saddle, beneath the cantle area. These round slots may have served different functions. They could have been used to fasten the padding beneath the saddle tree in order to protect the horse—an arrangement visible in modern reconstructions (*Fig. 10*). Alternatively, they may have secured the saddle flaps, as demonstrated in the reconstruction of the Tower of London (*Fig. 11*). Finally, perforations at the front and rear of such saddles could also have been used to attach the breast collar and crupper.

A three-dimensional model of the Tata fragment was created in 2022 using photogrammetry (*Fig. 12*). On this basis, a digital reconstruction was completed in 2026. The model of the fragment was integrated into a schematic bone saddle model. It was positioned on the surface where, according to the observations presented above, it most likely originally belonged (*Fig. 13*).

HISTORICAL BACKGROUND

In the Middle Ages, Tata was situated close to the central part of the Kingdom of Hungary, the so-called Medium Regni. According to written sources, several villages already existed in the area in the twelfth and thirteenth centuries; however, scholars generally agree that the settlement near present-day Kossuth Square corresponds to former Ótata (Old-Tata). This settlement was granted market town status in the second half of the fourteenth century (SZATMÁRI 2004, 34, 37). In 1397, the region came into the possession of Sigismund of Luxembourg, who soon commissioned the construction of the castle of Tata. The castle functioned as a secondary royal residence and subsequently played a decisive role in the development of the area (SCHMIDTMAYER 2011, 192). Another important factor was the heavily trafficked Vienna–Buda trade route, which passed through the region and integrated Tata into an important commercial network, thereby contributing to its development (*Fig. 14*) (SZATMÁRI-BÍRÓ 1977, 37; GLASER 1930, 152). From 1409 onwards, the king frequently visited the castle, primarily for hunting, and also received foreign envoys there on sev-

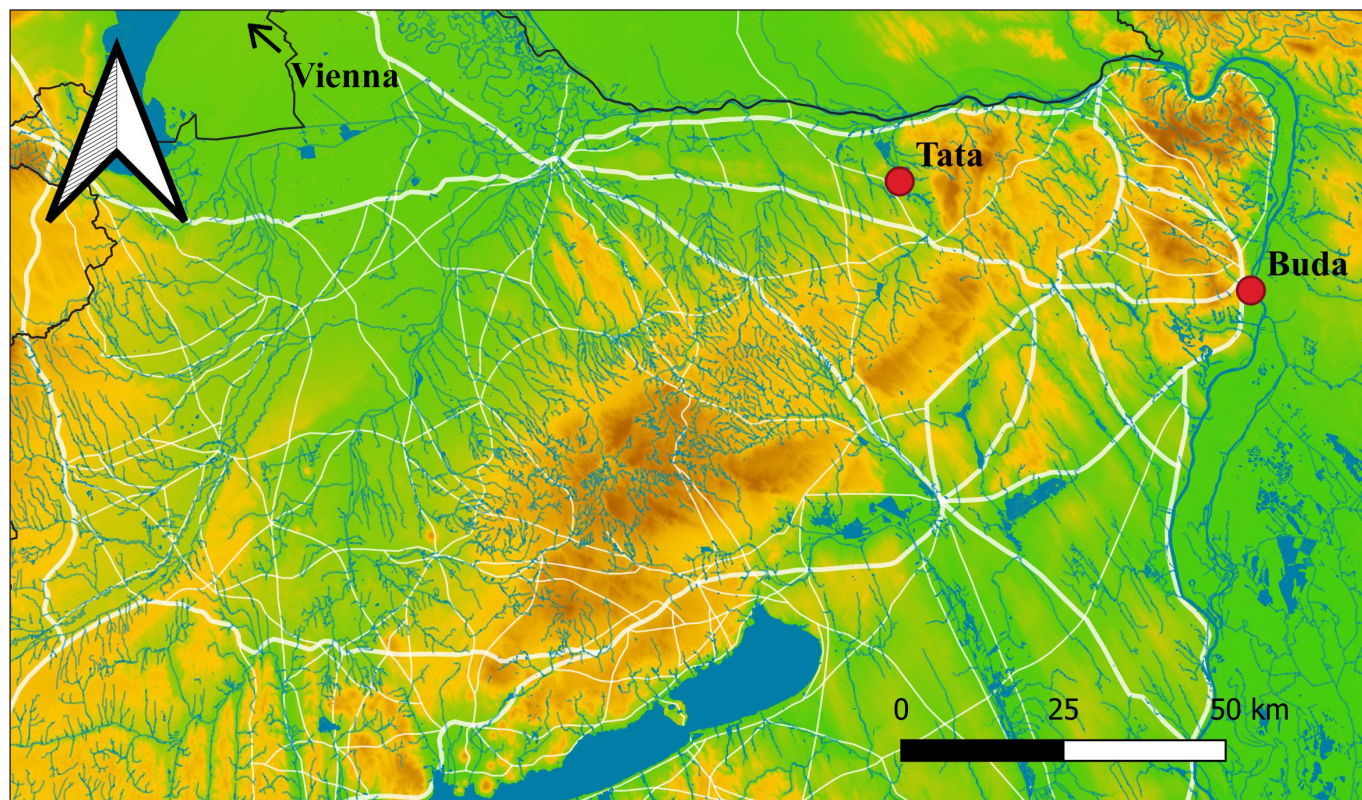


Fig. 14: Location of Tata with a schematic representation of major medieval routes. (Made by Bianka Gina Kovács)

eral occasions (ENGEL & C. TÓTH 2005). The castle continued to have prominent owners thereafter: from the early 1420s, it belonged to the Rozgonyi family, and from 1472 it returned to royal possession (under Matthias I, Vladislaus II, and Louis II). The fifteenth century and the early sixteenth century represent the heyday of both the castle and the adjacent market town. This development was interrupted in the mid-sixteenth century by the wars against the Ottomans (SZATMÁRI 1979, 148–150; SCHMIDTMAYER 2015).

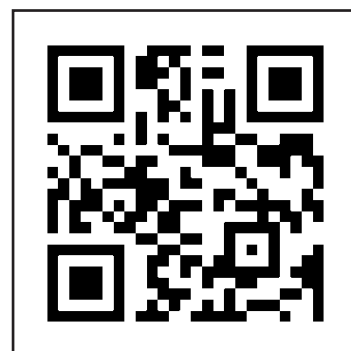
As noted above, apart from the Tata fragment, only one comparable excavated bone saddle fragment is known, from Vienna. This find was recovered in 2007 from a well at Herrengasse 10, which was later used as a latrine. The plot lies in close proximity to the Hofburg, which already functioned as an imperial residence in the late Middle Ages. On the basis of associated ceramic and glass finds, the saddle remains were likely discarded into the latrine in the first half of the sixteenth century. Unfortunately, the feature cannot be linked to a specific house or owner due to the lack of precise information on plot boundaries. According to research by Heike Krause, several families mentioned in written sources may have owned the property. Notably, these include the lords of Zelking and Starhemberg, Austrian and Styrian knights who were among the founding members of the Order of the Dragon established by King Sigismund in the early fifteenth century. It has been suggested that such saddles may have been connected in some way to the Order of the Dragon or the Order of Saint George, as dragon and Saint George motifs frequently appear on them. While members of these families would have been plausible owners, the heraldic representations on the saddle do not support this identification. Since the latrine cannot be securely associated with a specific plot, any attribution to these families remains hypothetical (TARCSAY 2023, 25, 36). This interpretation likely reflects an earlier scholarly tendency to associate bone saddles with the court of Sigismund, even in cases where they clearly date to later periods (SOMOGYVÁRI 2025, 4–6).

As in the case of the Vienna find, the dating of the Tata fragment suggests manufacture in the fifteenth century and deposition no later than the first half of the sixteenth century, though probably earlier. Unlike in Vienna, however, written sources provide no clues regarding the identification of the late medieval owner of the plot. Nevertheless, finds from the second half of the fifteenth century suggest that the owner was relatively affluent. This is further supported by the plot's location adjacent to the main square, which already fulfilled a similar central function in the late Middle Ages according to archaeological evidence. Although only a small amount of material from the first half of the fifteenth century was recovered, a few stove tile fragments indicate that the owner of the property was already of some significance at that time (KOVÁCS 2018, 36–37; KOVÁCS 2025A). Despite Tata's location along the Vienna–Buda trade route, it seems unlikely that the saddle arrived there merely as a commercial commodity. It is far more plausible that its presence is connected to the nearby royal castle. During royal visits, the entire court could scarcely have been accommodated within the castle itself. As in Visegrád, it is probable that certain high-ranking members of the court maintained residences/houses in the adjacent settlement. A written source also suggests this in the case of Pippo Spano (ZsO XIII, 567; KOVÁCS ET AL. 2023, 160).

CONCLUSION

The fragment discovered at Kossuth Square in Tata can be securely identified as part of the bone covering of a fifteenth-century parade saddle. A more precise dating within the century is not currently possible, as comparable objects span the entire period and the archaeological context does not permit further chronological refinement. Similarly, the original owner of the object cannot be identified. It is nevertheless evident that its presence in the settlement is connected to the nearby royal castle and its court.

The significance of the find lies in the fact that, following the specimen from Vienna, it represents only the second known bone saddle fragment recovered through archaeological excavation rather than preserved in a collection. Although only limited conclusions can be drawn, both finds originate from areas near royal residences and are likely associated with high-status ownership. Their presence does not necessarily indicate local



The three-dimensional reconstruction is available on the ELTE RCH Sketchfab page: <https://skfb.ly/pIULC>

production; however, it is noteworthy that both finds were found along the same trade route, providing further evidence that such luxury objects were indeed in use in this region during the period.

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