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Digital Methods and the Study of Fragmentary Medieval Grave Slabs

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Abstract. The study of medieval grave slabs is often hampered by wear, fragmentation, reuse, and the poor legibility of inscriptions. This article examines the potential of digital methods for the study of grave slabs from medieval Livonia, focusing on Reflectance Transformation Imaging (RTI) and digital photomontage. Case studies demonstrate how RTI can enhance the legibility of worn inscriptions and carved decoration, while digital photomontage enables the virtual reassembly of dispersed fragments that can no longer be physically reunited. The article also explores the digital integration of surviving fragments with historical drawings, showing how such reconstructions can facilitate their interpretation and presentation in churches and museums. These methods can generate new art-historical and epigraphic knowledge while also enhancing the accessibility and public understanding of medieval grave monuments.

Keywords: medieval grave slabs; medieval Livonia; Reflectance Transformation Imaging; epigraphy; inscriptions

Grave slabs are invaluable sources for the study of medieval social history, visual culture, epigraphy, and heraldry. Large-scale, artistically sophisticated, and aesthetically striking memorials were costly commissions that could generally be afforded only by rulers, members of the nobility, and high-ranking clergy. From the late Middle Ages onwards, grave slabs also survive for prominent urban elites, such as town councillors and wealthy merchants. These monuments were decorated with human figures, religious symbols, inscriptions, and coats of arms or

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merchants' marks that both identified and commemorated the deceased through visual and textual means.[1]

The size, decoration, and location of grave slabs within the church interior served as markers of social status. The study of their material, style, and ornamentation provides new insights into medieval art history and the working methods of medieval stonemasons. Their inscriptions yield valuable information about the deceased, including the date of death and family relationships, while also shedding light on broader aspects of medieval mentality, religious belief, and literate culture. Examining grave monuments together with their spatial and liturgical context offers new perspectives on the culture of commemoration in the Middle Ages.[2]

The study of medieval grave slabs, and especially their inscriptions, presents exceptional challenges for several reasons. As individuals of high social status were generally buried inside churches (and, in monastic complexes, also in other spaces such as chapter houses and cloisters[3]), the floor slabs marking their graves have been subjected to centuries of wear and are often now almost illegible. In general, the older the slab, the poorer its state of preservation. Preservation also depends on the material used in a particular region: marble and brass, for example, tend to survive better than limestone or sandstone. The carving technique is another important factor. High-relief figures and inscriptions are usually better preserved than low-relief decoration or incised slabs.

Deciphering and transcribing inscriptions is particularly difficult because parts of the text may have been worn away entirely. The task is further complicated by the frequent use of abbreviations, missing letters, and spelling errors.[4] Such errors may have been introduced not only by medieval stonemasons but also by nineteenth- and twentieth-century restorers, who were not always able to read Gothic minuscule script correctly and inadvertently altered the original text.[5] Moreover, grave slabs

1 See, e.g., N. Saul. English Church Monuments in the Middle Ages: History and Representation. Oxford University Press, Oxford, 2009, 92–93, 108–111, 114–119; K. Krüger. Corpus der mittelalterlichen Grabdenkmäler in Lübeck, Schleswig, Holstein und Lauenburg (1100–1600). Thorbecke, Stuttgart, 1999, 173–190.

2 N. Saul. English Church Monuments, 120–142; A. Mänd. Keskaegne kunstiteos kui kirjalik allikas. – Vana Tallinn, 2023, 32 (36), 68, 74–76. For commemoration practices in medieval Livonia, see G. Strenga. Remembering the Dead: Collective Memory and Commemoration in Late Medieval Livonia. Brepols, Turnhout, 2023.

3 T. Coomans. Life inside the Cloister. Understanding Monastic Architecture: Tradition, Reformation, Adaptive Reuse. Leuven University Press, Leuven, 2018, 104–107.

4 See, e.g., V. Brandis, J. L. de Jong, R. Seidel. Introduction. – Funerary Inscriptions in Early Modern Europe: Shaping Identities to Remember. Ed. by V. Brandis, J. L. de Jong, R. Seidel. Brill, Leiden, Boston, 2025, 4.

5 A. Mänd. Visuaalne mälestamine: Liivimaa ordumeistrite ja käsknike hauaplaadid (14.–16. sajand). – Kunstiteaduslikke Uurimusi / Studies on Art and Architecture, 2019, 28, 3–4, 83;

were often reused, both during the Middle Ages and the early modern period. As a result, the original inscriptions were frequently damaged by the addition of new texts, coats of arms, and other commemorative symbols.

The surviving medieval grave monuments from Livonia (roughly corresponding to present-day Estonia and Latvia), together with those known from historical drawings, date from around 1200 to the mid-sixteenth century.[6] In Estonia alone, more than two hundred inscribed slabs are thought to survive, although their exact number cannot be established because no comprehensive catalogue has yet been compiled and the National Register of Cultural Monuments includes only protected monuments.[7] Most grave slabs were carved from local varieties of limestone, abundant particularly in northern and western Estonia. Written sources also mention a small number of brasses,[8] but none have survived.[9]

Relatively few grave slabs remain intact and in good condition. Most survive only as fragments, either as single pieces or as several fragments that can no longer be reassembled into a complete monument. Grave slabs have been damaged or destroyed by fires and warfare,[10] but many were also deliberately broken or relocated. This occurred, for example, when church chancels or naves were rebuilt, when space was needed for new memorials in the early modern period, or when church floors were repaired or replaced in later centuries.

A. Mänd. Grave Slabs of Ecclesiastical and Secular Dignitaries in Livonia, *c.1470–c.1560.* – Funerary Inscriptions in Early Modern Europe: Shaping Identities to Remember. Ed. by V. Brandis, J. L. de Jong, R. Seidel. Brill, Leiden, Boston, 2025, 55–56.

6 H. Loeffler. Die Grabsteine, Grabmäler und Epitaphien in den Kirchen Alt-Livlands vom 13.–18. Jahrhundert. G. Löffler, Riga, 1929; K. Markus. Esimesed kristlikud hauatähised. – Eesti kunsti ajalugu 1, 1100–1520. Koost. K. Markus. Eesti Kunstiakadeemia, Tallinn, 2023, 387–390; A. Mänd. Hauaplaadid 14. sajandist 1550. aastateni. – Eesti kunsti ajalugu 1, 1100–1520. Koost. K. Markus. Eesti Kunstiakadeemia, Tallinn, 2023, 391–395; E. Grosmane. Stone Sculpture. – Art History of Latvia I, 9th Millennium BC – 1562. Ed. by E. Grosmane. Art Academy of Latvia, Riga, 2024, 256–261.

7 A. Mänd. Arutlusi hauatähistest ja muinsuskaitsest: Keskaegsed hauaplaadid Tallinna toomi käärkambris. – Aja lugu: Muinsuskaitse ja restaureerimise ajaloost. Toim. A. Randla. (Eesti kunstiakadeemia toimetised, 21). Eesti Kunstiakadeemia, Tallinn, 2016, 10–14.

8 I. Põltsam-Jürjo. Liivimaa väikelinn Uus-Pärnu 16. sajandi esimesel poolel. Argo, Tallinn, 2009, 406; A. Mänd. Church art, commemoration of the dead and the saints' cult: Constructing individual and corporate *memoria* in late medieval Tallinn. – Acta Historica Tallinnensia, 2011, 16, 24.

9 The only known exception is a bronze roundel bearing the symbol of St Mark the Evangelist, which once adorned the corner of a limestone grave slab found in the Dominican church in Tallinn. M. Kurisoo. *Ars moriendi* – suremise kunst. Näitus Niguliste muuseumis 02.11.2012–02.06.2013. Eesti Kunstimuuseum, Tallinn, 2013, 60.

10 See, e.g., M. Kurisoo. Patching Together a Thousand Pieces. Tombstones of Tallinn's St Nicholas' Church: History, Restoration and Layout in the Exposition of the Niguliste Museum in the 1970s. – Kunstiteaduslikke Uurimusi / Studies on Art and Architecture, 2013, 22, 3–4, 153–176.

Wear, damage, fragmentation, and limited accessibility are the principal reasons why the study of medieval grave slabs is so time-consuming and challenging. Moreover, art historians are generally not trained to read inscriptions in Latin and Middle Low German. The monochrome character of Estonian and Latvian grave slabs, together with the relative rarity of figural decoration, has probably also contributed to their limited appeal for art historians.

Although digital methods for the study of grave monuments – including digital epigraphy – have advanced rapidly across Europe in recent years,[11] they have so far seen only very limited application in Estonia and Latvia. Rather than discussing the full range of digital methods that might prove promising for future research, this article adopts a user-oriented perspective based on my own experience. It examines the methods I have tested and assesses their effectiveness in reading inscriptions and identifying the deceased. In particular, I focus on Reflectance Transformation Imaging (RTI) and digital image processing, including photomontage. Through a series of case studies, I demonstrate how and to what extent these methods facilitate the analysis and visual reconstruction of fragmentary grave slabs.

FRAGMENTS AND REFLECTANCE TRANSFORMATION IMAGING (RTI)

The condition and degree of preservation of medieval grave slab fragments vary considerably depending on their age, location, and other environmental factors. Within churches, fragments may be embedded in the floor, mounted vertically on walls, or stored loose against a wall, in the sacristy, beneath the tower, or in the porch. In some cases, they have been removed from view altogether and deposited in the attic space above the vaults. Because dressed stone was a valuable building material, grave slabs were frequently reused, and fragments are therefore often found in a wide range of secondary contexts. They commonly served as construction material: for example, they were built into the exterior or interior walls of churches and bell towers (as at Valjala and Kaarma

11 See, e.g., Epigraphy in the Digital Age: Opportunities and Challenges in the Recording, Analysis and Dissemination of Inscriptions. Ed. by I. Velázquez Soriano, D. Espinosa Espinosa. Archaeopress, Oxford, 2021; B. Luci. Unveiling the Hidden Stories: The Impact of Digital Technologies in Medieval Latin Epigraphic Field Documentation. – Digital Applications in Archaeology and Cultural Heritage, 2026, 40, https://doi.org/10.1016/j.daach.2025.e00488.

churches on the island of Saaremaa) or reused as lintels (for example in the window of the north porch of Koeru Church). Grave slab fragments also occur as stair treads, both inside churches (as on the staircase leading to the vaults in the north-east corner of Haapsalu Cathedral) and outside them (as on the sacristy steps of Umurga Church in Latvia[12]).

The preservation of grave slabs and their fragments is strongly influenced by their location, i.e. whether they are exposed outdoors or kept indoors and, in the latter case, whether they remain embedded in the floor or have been mounted on walls for display. Unsurprisingly, monuments exposed to the elements suffer the greatest weathering, especially those lying at ground level or fixed vertically to exterior walls. Indoors, the most vulnerable are slabs set into the floors of heavily trafficked areas of churches (or of former churches now functioning as museums). Among the most damaging forms of reuse is the conversion of a medieval grave slab into a church threshold. In such cases, the slab is subjected both to constant foot traffic and, when located at an exterior entrance, to the effects of weathering. As a result, its decoration often becomes almost completely obliterated, making it impossible to determine its original owner, date, or decorative programme.

Two parish churches in Estonia provide particularly striking examples. While the threshold slab of Haljala Church is located just inside the south portal, the corresponding slab at Jüri Church lies directly outside the entrance (Fig. 1). In both cases, centuries of foot traffic combined with weathering have worn the surfaces so severely that



Figure 1. Worn late medieval grave slab serving as the threshold of Jüri Church, Estonia. Photo by Stanislav Stepaško

12 A. Caune, I. Ose. Latvijas viduslaiku mūra baznīcas 12. gs. beigas – 16. gs. sākums: Enciklopēdija. Latvijas vēstures institūta apgāds, Rīga, 2010, 439.

only faint traces of the Gothic minuscule inscription and fragments of the corner ornaments survive along the edge nearest the wall.

One digital method that has proven particularly useful for the study of worn grave slabs is Reflectance Transformation Imaging (RTI), a technique that combines multiple photographs taken under light from different angles. In recent decades, RTI has become an established method for the digital documentation and analysis of archaeological and cultural heritage surfaces. RTI enhances the visibility of shallow engravings and inscriptions and allows researchers to relight the surface interactively, making it possible to read inscriptions and identify motifs that are invisible or barely visible to the naked eye.[13] In Estonia, RTI has been used, for instance, in the study of daguerreotypes[14] and medieval seal impressions[15], but has so far been less frequently applied to large surfaces such as grave slabs.

At St Olaf's Church in Tallinn, one of the city's two medieval parish churches, fragments of medieval and early modern grave slabs have been relocated to the porch at the western end of the nave. Most of the fragments are stored loose along the south wall, while two larger medieval fragments have been mounted on the west wall of the porch, one on each side of the portal. There are no labels providing information about these slabs. The northern slab is somewhat better preserved, whereas the slab to the south of the entrance, which bears a fragmentary merchant's mark incorporating an unidentified coat of arms at its centre, is extremely worn.[16] Previous researchers have been unable to decipher a single word of its inscription.[17] Although the inscription is indeed illegible to the naked eye, digitally processed photographs (Fig. 2) nevertheless made it possible to decipher individual letters and even a few words from the inscription on the left-hand side of the slab.[18]

13 For the use and potential of this method, see, e.g., G. Earl, K. Martinez, H. Pagi. Reflectance Transformation Imaging (RTI) System for Ancient Documentary Artefacts. – VAST 2010: The 11th International Symposium on Virtual Reality, Archaeology and Cultural Heritage, 116–119; G. Earl, K. Martinez, T. Malzbender. Archaeological Applications of Polynomial Texture Mapping: Analysis, Conservation and Representation. – Journal of Archaeological Science, 2010, 37 (8), 2040–2050; H. Mytum, J. R. Peterson. The Application of Reflectance Transformation Imaging (RTI) in Historical Archaeology. – Historical Archaeology, 2018, 52 (2), 489–503.

14 H. Pagi, J. Miles, A. Uueni, S. Hogarth, K. Sikka. Reflectance Transformation Imaging in Daguerreotype Investigation. – Archiving 2017 Final Program and Proceedings, 2017, 116–121.

15 See the contribution by Juhan Kreem in this volume.

16 Monument no. 2148. https://register.muinas.ee/public.php?menuID=monument&action=view&id=2148 (accessed 25/06/2026).

17 M. Loit. Keskaegsest surmakultuurist ja hauatähistest reformatsioonieelse Tallinna kirikutes ja kloostrites. – Vana Tallinn, 2006, XVII (XXI), 64.

18 A. Mänd. Oleviste kiriku keskaegsest sisustusest ja annetajate ringist. – Acta Historica Tallinnensia, 2014, 20, 41–43, figs. 4–5.



Figure 2. Fragment of a burgomaster's grave slab in St Olaf's Church, Tallinn. Digitally enhanced image. Photo by Stanislav Stepaško

At my request, the professional photographer Stanislav Stepaško produced RTI images of the two medieval grave slab fragments mounted on the west wall of the porch. The resulting images made it possible to read both the inscriptions and the fragmentary coats of arms carved in the centre of each slab more clearly. RTI proved particularly valuable for the study of the slab south of the entrance, whose surface is heavily worn and damaged. Its inscription, carved in Gothic minuscule, is further complicated by unusually elongated letterforms, making the text especially difficult to decipher. In addition to the words that had already been identified during my earlier examination, RTI revealed the deceased's office on the left-hand side of the inscription: *de bo[r]gemest[e]r* (the burgomaster). It also showed that I had previously misread one of the words. Thanks to RTI, the text along the left edge of the fragment can now be read in its entirety as *de bo[r]gemest[e]r de got gnade.* The final word, gnade, did not fit within the inscription band and was therefore carved above it in smaller letters.

Unfortunately, RTI did not improve the legibility of the inscription along the upper edge and right-hand side of the fragment, where the surface is even more severely worn than on the left. There, I was still able to identify only a few isolated letters. It is possible that future investigation of this and other heavily damaged fragments could benefit from 3D scanning and photogrammetry. This grave slab fragment from St Olaf's Church will be discussed again later in the article.

DIGITAL PHOTOMONTAGE OF FRAGMENTS

In most cases, fragments belonging to the same grave slab are kept in the same location, whether in a church or a museum. However, this does not necessarily mean that they are situated next to one another. In the early modern period, when space was needed for new grave monuments, and during later repairs to church floors, medieval grave slabs were sometimes cut into two or more pieces and re-laid at different locations within the floor. As a result, visitors – including art historians – may fail to recognise that separate fragments once formed part of the same monument. Even when the connection is noticed, it is usually impossible to lift the fragments from the floor and physically reassemble them.

A notable exception is provided by the fragments of the grave slab of the vassal Woldemar Sorsever and his wife, dating from the 1370s, which were removed from the floor of the nave of Tallinn Cathedral in 2016. The slab, surviving in at least thirteen fragments, was subsequently conserved and has since been displayed on the wall of the cathedral's Fersen Chapel.[19] The principal arguments for rescuing the monument were its early date, its status as a listed monument, and the imminent risk of further deterioration, as the fragments were located in one of the busiest parts of the church.[20] Clearly, however, it is neither feasible nor desirable to remove all medieval grave slabs from church floors, and in most cases there is no suitable space available for their display.

Where fragments cannot be physically removed and reassembled, they can instead be digitally reunited by means of photomontage, using

19 T. Sakermaa. Woldemar Sorseveri hauaplaadi konserveerimine. – Muinsuskaitse aastaraamat 2017. Muinsuskaitseamet, Tallinn, 2018, 76.

20 See M. Klammer, T. Sakermaa. Tallinna toomkirik. Woldemar Sorseveri hauaplaat: seisukord ja ettepanekud. Ettepanekud hauaplaatide säilitamiseks. Tallinn, 2013. Manuscript in the Archives of Tallinn Urban Planning Department, TLPA MO, n. 12, s. 504.

software such as Adobe Photoshop. This approach not only enables the virtual reconstruction of a monument's original appearance and facilitates the identification of the deceased, but also enhances the scholarly value of small, isolated fragments that might otherwise pass almost unnoticed when embedded in the church floor. The following case studies illustrate the potential of this method.

Three worn fragments of medieval grave slabs are embedded in the chancel floor of St Maurice's Church in Haljala (historical Viru County, northern Estonia). The largest fragment is situated in the western part of the chancel, on the boundary between the nave and the chancel; the second lies along the north wall, and the third, partially covered by the altar rail, is located south of the altar. Thanks to a drawing made by Danish illustrator Søren Abildgaard in 1754 (Fig. 3), it is possible to establish that the first two fragments belonged to the grave slab of the nobleman Hinrick Hastfer, who died in 1523. Admittedly, Abildgaard recorded only the year of death: he did not identify the deceased, and on the right-hand inscription band he left a blank space where the deceased's first name should have appeared.[21] It is possible that in the mid-eighteenth century an object – perhaps a lectern – stood on top of the slab and prevented Abildgaard from seeing Hinrick's name, which remains clearly legible on the larger surviving fragment today.

A digital photomontage combining the larger fragment with the smaller strip (Fig. 4) makes it possible to reconstruct much of the slab's original appearance. Only the fragment from the lower right corner is missing. The two coats of arms in the centre of the slab, belonging to Hinrick Hastfer and his wife, a member of the Taube family, have suffered considerably more wear than is evident in the mid-eighteenth-century drawing. In contrast, the inscription is relatively well preserved. Combining Abildgaard's drawing with the surviving fragments makes it possible to reconstruct the entire Middle Low German inscription: *Int iar m v^{c} / xxiii starf hinrick / hastuer va[n] / katte[n]tack de got* (In the year 1523 died Hinrick Hastfer of Kattentack.[22] May God [have mercy on his soul]). The inscription records the year of death, but not the exact day or month. In written sources, Hinrick Hastfer (Hastever)

21 P. Grinder-Hansen. Søren Abildgaard (1718–1791): Fortiden på tegnebrættet. Nationalmuseet, Copenhagen, 2010, 650, no. 842. Poul Grinder-Hansen was unaware that the fragmentary grave slab has survived in the church. Abildgaard's drawing is also available at: https://samlinger.natmus.dk/DMR/asset/56149 (accessed 25/06/2026).

22 Kattentack refers to Aaspere manor in Haljala parish, in the historical Viru County.

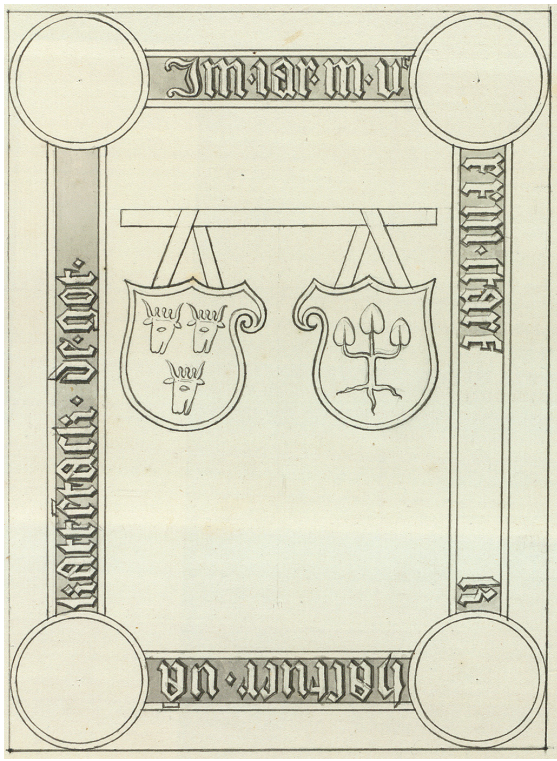


Figure 3. Grave slab of Hinrick Hastfer (†1523) and his wife. Haljala Church, Estonia. Drawing by Søren Abildgaard, 1754. National Museum of Denmark



Figure 4. Grave slab of Hinrick Hastfer (†1523) and his wife. Haljala Church, Estonia. Photos and photomontage by Stanislav Stepaško

is last mentioned on 19 April 1523, when he was serving as district judge (*Mannrichter)* of Viru County.[23]

A comparison between Abildgaard's drawing and the surviving fragments also reveals that the drawing is not entirely accurate, either in its proportions or in certain details. The original slab was somewhat shorter in relation to its width than Abildgaard depicted. Moreover, he left the corner roundels blank, whereas they originally contained the symbols of the Evangelists. The upper left roundel can still be identified as the symbol of St Luke, while the lower left roundel preserves the symbol of St Matthew.

A second example comes from St Nicholas' Church in Tallinn (since 1984 the Niguliste Museum), where the floor of St Anthony's Chapel contains, among other monuments, a fragment of the grave slab of the city's journeyman minters (Ger. *Münzgesellen*). The slab bears a Gothic minuscule inscription along its border and, in the centre, a coat of arms with the date 1533 in Arabic numerals. The grave slab was already fragmentary by the late nineteenth century, when it was first described by Eugen von Nottbeck.[24] However, Nottbeck failed to recognise that a second fragment of the same slab had also survived, a strip approximately 40 cm wide and 160 cm long, preserving the upper corner of the shield enclosed within a roundel and part of the marginal inscription. It is possible that before the Second World War this strip was not yet embedded in the floor of St Anthony's Chapel, since, according to the art historian Mai Lumiste (1932–1985), who directed the restoration of St Nicholas' Church and its grave slabs after the devastating fire of 1944, the fragment was discovered beneath the floor of the nave.[25] Lumiste did not realise that it belonged to the larger fragment of the journeyman minters' slab.[26] The connection likewise escaped Mari Loit (1977–2016), who compiled the catalogue of the Niguliste Museum's grave slabs in 2002.[27]

23 Est- und Livländische Brieflade, T. 1, Bd. 1. Hrsg. von F. G. von Bunge, R. von Toll. Kluge und Stroem, Reval, 1856, 484, no. 902.

24 E. von Nottbeck, W. Neumann. Geschichte und Kunstdenkmäler der Stadt Reval. Bd. 2, Die Kunstdenkmäler der Stadt. 2nd edn., Kluge, Reval, 1904, 169–170, no. 84. In Nottbeck's description, only the first three digits of the date (153) are recorded. The fourth digit may have been concealed beneath a pew or another heavy object and was therefore not visible.

25 M. Lumiste. Niguliste kirik. Antoniuse kabeli hauaplaatide paigaldamine. Manuscript in the Archives of Tallinn Urban Planning Department, n. 5, s. 250C. Tallinn, 1973, 8, no. 30. See also the floor plan at the beginning of her manuscript.

26 Ibid., 6, no. 23.

27 M. Loit. Tallinna Niguliste kiriku hauaplaatide kataloog. Manuscript in the Art Museum of Estonia. Tallinn, 2002, 18, no. 29, cf. 16, no. 23.



Figure 5. Grave slab of journeyman minters, 1533. Niguliste Museum, Tallinn. Photos and photomontage by Stanislav Stepaško

Because the floor of St Anthony's Chapel is completely paved with grave slabs, it is impossible to remove and physically reassemble the two fragments. Here again, digital photomontage provides a solution by allowing the fragments to be reunited virtually (Fig. 5).

The partially preserved inscription along three sides of the journeyman minters' grave slab remains reasonably legible: *<v>nde dritteyn vort / hebben hir dissen sten g[...] / [...]st de*[28] *muntergsellen (sic!) to ev*[29] *[...]r weg*[30] (... and thirteen have here this stone ... the journeyman minters at [Reval]). If the word *dritteyn* (thirteen) refers to the year 1513, an obvious question arises: why does the coat of arms in the centre bear the date 1533? Both the inscription and the central motif were recut during the restoration campaign of the 1970s, as was the case with several other grave slabs in St Anthony's Chapel.[31]

28 The letters *d and e form a ligature.*
29 Nottbeck read *r[evel]* (Geschichte und Kunstdenkmäler, 170), whereas the first letter now appears to be *e*. The error may have been introduced when the inscription was recut, since the Gothic minuscule forms of *r* and *e* are relatively similar.
30 The letters *w* and *e* form a ligature.
31 M. Kurisoo. Patching Together a Thousand Pieces, 158–161. See also M. Lumiste, R. Kangropool. Niguliste kirik. Kunst, Tallinn, 1990, 60.

While the fragments of the journeyman minters' slab remain in the same room, more complicated cases also occur, in which fragments of a single monument have ended up in different buildings because their relationship has gone unrecognised. One such example is the grave slab of the burgomaster discussed above, whose largest surviving fragment is mounted on the west wall of the porch of St Olaf's Church (see Fig. 2). Another, smaller fragment from the same slab, originating from the lower right corner, also survives in the porch but has been placed along the south wall among numerous other grave slab fragments. This corner piece preserves a double roundel containing an Evangelist's symbol and the fragmentary Middle Low German inscription *starf her ioha[n]* (died Master Johan).[32]

More remarkably still, one or perhaps two[33] additional fragments of the same monument are embedded in the floor of the south aisle of St Nicholas' Church (now the Niguliste Museum). Their connection with the fragments in St Olaf's Church has hitherto gone unnoticed. By means of digital photomontage, all fragments can be reunited virtually (Fig. 6). In the resulting reconstruction, the Niguliste fragments occupy the lower part of the left-hand side of the slab.

How the fragments of the St Olaf's grave slab came to be incorporated into the floor of St Nicholas' Church remains unclear. One possible explanation is that, during the post-war decades when St Nicholas' Church was being restored and converted into a museum, some of its architectural stonework was temporarily stored in St Olaf's Church, and when the floor of the nave at St Nicholas' was laid in the late 1970s or the early 1980s,[34] some grave slab fragments discovered at St Olaf's may inadvertently have been transferred along with the material destined for reinstallation. At present, however, this remains only a hypothesis, as I have found no documentary evidence confirming that stonework from St Nicholas' Church was ever stored at St Olaf's.[35]

Another comparable case dates from the transitional period between the Middle Ages and the early modern era. In the westernmost bay (the space beneath the tower) of St Mary's Church at Pöide on the island of Saaremaa, several fragments of medieval grave slabs are

32 A. Mänd. Oleviste kiriku keskaegsest sisustusest, 43–44, fig. 6.

33 As the adjoining fragments are partially obscured by cement, it is uncertain whether they represent one fragment or two.

34 M. Lumiste. Ettepanek hauaplaatide *pro* fragmentide paigaldamiseks pikihoone, koori ja Väikese kabeli põrandatesse ning maa-aluse vestibüüli seintele. Tallinn, 1979. Manuscript in the Archives of Tallinn Urban Planning Department, n. 5, s. 250B.

35 Rein Kaur, a restorer of the grave slabs, now aged 86, does not recall any of the carved stones having been kept in St Olaf's Church or transferred from there to St Nicholas' Church. Telephone conversation with the author, August 2026.



Figure 6. Burgomaster's slab. Two larger fragments in St Olaf's Church, Tallinn (cf. Fig. 2); two smaller fragments in the floor of the Niguliste Museum. Photos and photomontage by Stanislav Stepaško

preserved. Among them are three fragments belonging to the right-hand side of the grave slab of Johann Möller (Müller), lord of Kingli (Ger. Möllershof) Manor, and his wife Anna Treiden. The corner roundels are decorated with stylised double roses, while one fragment preserves part of the Treiden family coat of arms. The fragments also retain portions of inscriptions from two different periods, the earlier of which includes the date 1552.

Two additional fragments of the same grave slab survive some 50 kilometres away, in the collection of carved stone monuments at the Saaremaa Museum in Kuressaare Episcopal Castle. The fragment forming the upper left corner had previously been recognised by museum staff as belonging to the Möller–Treiden slab, as it preserves the Möller family coat of arms and part of the marginal inscription containing the family name *MVLLER*.[36] The museum also houses the lower left corner of the slab, but this fragment has not previously been associated with the monument.[37] Although it is somewhat more worn than the other pieces, the double rose in the corner roundel, together with the inscription – whose script, content, and layout correspond closely to those of the other fragments – clearly demonstrates that they belong to the same grave slab.

By digitally combining all five fragments (Fig. 7), it is possible to reconstruct most of the slab's original appearance, although some losses remain in both the central field and along the margins. The inscription running around the border reads: *ANNO 1552 / DEN* [blank left for the day of the month] *IS DER EDEL ERENFEST / VNT MANHAF/DIGE IOHAN MVLLER IN GOT / ENTSLAPEN* (In the year 1552, on the [day left blank], the noble, honourable, and valiant Johann Möller fell asleep in God). A later, four-line inscription was subsequently added beneath the coats of arms in the centre of the slab: *ANNO 1586 IS IOHAN / MVLL[ERS SIN]E ELICHE HVS/FRUWE ANNA TREIDEN / IN GOT ENTSLAPEN* (In the year 1586, Johann Möller's lawful wife Anna Treiden fell asleep in God).

Because the inscription has previously been misread, reference works have given Johann Möller's year of death as 1568.[38] The grave slab, however, clearly demonstrates that he died considerably earlier, in 1552.

Evidence concerning when the right-hand portion of the slab was discovered and when the left-hand fragments were transferred to Kuressaare Castle is incomplete. When Martin Körber (1817–1893) described the artistic heritage of Pöide Church in the late nineteenth century, he mentioned a broken grave slab lying in front of the church entrance, from which only the date 1586 and the family name Möller –

36 Inv. no. SM 10438:23, available at: https://www.muis.ee/museaalview/304136 (accessed 25/06/2026).

37 Inv. no. SM 10438:22, available at: https://www.muis.ee/museaalview/304135 (accessed 25/06/2026).

38 Genealogisches Handbuch der Baltischen Ritterschaften. Teil: Oesel. Bearb. von N. von Essen. Saaremaa Üldkasuliku Ühingu kirjastus, Tartu, 1935–1939, 186–187, no. VI.1. The source of the dates of death for Johann Möller and Anna Treiden given in the inscription on p. 187 is unknown.



Figure 7. Grave slab of Johann Möller (†1552) and Anna Treiden (†1586). The fragments on the left are in the Saaremaa Museum (Kuressaare Castle); those on the right are in Pöide Church. Photos and photomontage by Stanislav Stepaško

from which the name of Möllershof (Estonian: Kingli) Manor was derived – could still be read.[39] It is therefore possible that, in Körber's time, only the left half of the slab, or perhaps only its upper left fragment, remained at Pöide Church. A drawing in a manuscript by the graphic artist Johann Naha, dated 1939, depicts both fragments from the left-hand side of the slab, indicating that they had already been transferred to Kuressaare Castle by that date.[40]

39 M. Körber. Oesel einst und jetzt. Bd. 3. Arensburg, 1915, 40.

40 Johan Naha käsikirjad. Kuressaare. Tallinn, 1939, 35, fig. [4]. Manuscript in the Archives of the National Heritage Board, ERA.5025.2.12265, available at: https://register.muinas.ee/ftp/DIGI_2013/pdf/era5025_002_0012265.pdf (accessed 25/06/2026).

According to the Estonian Museums Public Portal, the lower left corner of the slab was discovered in the former cemetery of Kuressaare, located on the site of the present-day town park.[41] The reliability of this information, however, is open to question.

The fragments from the right-hand side of the slab, now preserved beneath the tower of Pöide Church, are in considerably better condition than those from the left. As these fragments were not documented in the church before the Second World War, they probably came to light later, most likely during archaeological investigations. It has not been possible to determine exactly when this occurred. It must, however, have taken place during the second half of the twentieth century, since the investigations carried out at Pöide Church in the twenty-first century are exceptionally well documented.[42]

Because most of the Möller–Treiden grave slab can now be reconstructed, it would be highly desirable to physically reunite the fragments that are currently dispersed between different locations. After conservation, the reassembled monument should ideally be returned to its original location in Pöide Church.

COMBINING HISTORICAL DRAWINGS AND FRAGMENTS DIGITALLY

Whereas the previous section examined grave slabs of which the greater part survives despite their fragmentary condition, this section focuses on monuments whose surviving fragments provide little indication of their original appearance. How can the broader public be made aware that even such isolated fragments retain considerable value as historical sources?

Many grave slabs that have now been wholly or partially destroyed are documented in eighteenth- or nineteenth-century drawings. One way of giving surviving fragments a new life is therefore to place them digitally onto these historical drawings, thereby visualising which part of the original monument each fragment represents. This approach is feasible, however, only if the historical drawing is reasonably accurate in its proportions, something that cannot always be expected, particularly

41 https://www.muis.ee/museaalview/304135 (accessed 25/06/2026).

42 For a brief history of archaeological studies, see: V. Kadakas. Arheoloogilised uuringud Pöide kirikus. Aruanne. Tallinn, 2023, 5–6. Manuscript in the Archives of the National Heritage Board, available at: https://register.muinas.ee/ftp/Arheoloogiliste%20uuringute%20aruanded/L-9102_Aeelu_2012_KadakasV_kirik-21058_Saaremaa-Pöide-Maarja.pdf (accessed 25/06/2026).

of eighteenth-century artists. For example, the surviving fragments of the Hastfer grave slab in Haljala Church discussed above cannot be combined with Søren Abildgaard's 1754 drawing (see Figs. 3 and 4) without substantially distorting the proportions of the drawing.

An instructive example of how surviving fragments can be identified and visualised with the aid of a nineteenth-century drawing is provided by the fifteenth-century grave slab of Brun Warendorp from St Nicholas' Church in Tallinn. Like many other grave slabs in the church, it was shattered during the Soviet air raid of March 1944 and the subsequent collapse of the nave vaults a few years later. The subsequent history of this monument, however, differs from that of the slabs that were restored during the 1970s and reinstalled in the floor of the church, which was then being converted into a museum.

In 2002, Tiina Mägi, director of the Kodulinna House in Tallinn, discovered several hundred fragments of limestone in the former studio of the sculptor and conservator Paul Horma (1940–1988). Some of the fragments preserved parts of inscriptions and carved decoration. Mägi transferred the material to the Estonian Academy of Arts for safekeeping. The stone conservator Isabel Aaso-Zahradnikova, together with her students, began to study the finds and established that they represented the remains of two grave slabs. Their provenance, however, remained unknown. The mystery began to unravel in 2016, when an interview with Rein Kaur, formerly the stone conservator at the Niguliste Museum, revealed that two grave slabs had disappeared during the restoration of the church in 1981. One of them, represented by 206 surviving fragments, was identified by Merike Kurisoo as the monument of Casper Goldberg (†1635).[43]

The second slab, whose Gothic minuscule script indicates a late medieval date, survives in only fifteen fragments. Most preserve no more than two or three letters, although one fragment contains the word *geboren* (born), and another bears the later inventory number *No. 37*. On the basis of these details, together with Eugen von Nottbeck's late nineteenth-century description and drawing,[44] I was able to identify the monument as the grave slab of Brun Warendorp, a merchant from Münster who became a member of the Table Guild of Tallinn's Great Guild in 1428.[45] By the late nineteenth century, the upper edge of the

43 I. Aaso-Zahradnikova, M. Kurisoo, A. Mänd. Killustikust kunstiteoseks: Niguliste kaks taasleitud hauaplaati. – Muinsuskaitse aastaraamat 2017. Muinsuskaitseamet, Tallinn, 2018, 77.

44 E. von Nottbeck, W. Neumann. Geschichte und Kunstdenkmäler, 162, no. 58, fig. 119.

45 Tallinn City Archives, TLA.191.2.1, fol. 10v.

slab, which originally bore the year of Warendorp's death, had already been lost. The inscription surviving on the remaining three sides read: *fridages na svnte mathaeus dach do starf / brvn warendorp va[n] / mvnster geboren biddet ghode vm[m]e de sele* (On the Friday after St Matthew's Day died Brun Warendorp, born in Münster. Pray to God for his soul).

A comparison of the surviving fragments with Nottbeck's description and drawing reveals that, although the drawing is accurate in its proportions, some of its details are incorrect. The corner ornaments are depicted incorrectly: instead of simple roundels, they originally consisted of a combination of square and circular frames. In addition, Nottbeck omitted the later inscription *Johannes Andreä, med. Doct.,* which had been added after the slab was reused by the physician Johannes Andreä in 1631.[46]

From 1 to 5 November 2017, the Niguliste Museum hosted a small exhibition displaying the fragments of both grave slabs. The more visually striking exhibit was the Goldberg monument, whose 206 surviving fragments made it possible to reconstruct the slab's outline with reasonable accuracy.[47] In contrast, the fifteen fragments of the Warendorp slab, simply arranged side by side against the wall (Fig. 8), attracted considerably less attention.

Only later did it occur to me that the larger fragments, whose original positions on the slab could be identified, might be digitally superimposed on Nottbeck's nineteenth-century drawing (Fig. 9).[48] This approach not only enhances the interpretative value of the surviving fragments but also demonstrates that the corner ornaments were in fact of a different design from those shown in Nottbeck's drawing.



Figure 8. Fifteen fragments of the grave slab of Brun Warendorp on display in the Niguliste Museum in 2017. Photo by Stanislav Stepaško

46 E. von Nottbeck, W. Neumann. Geschichte und Kunstdenkmäler, 162, no. 58.
47 I. Aaso-Zahradnikova, M. Kurisoo, A. Mänd. Killustikust kunstiteoseks, 77, fig. 1.
48 Ibid., fig. 2.

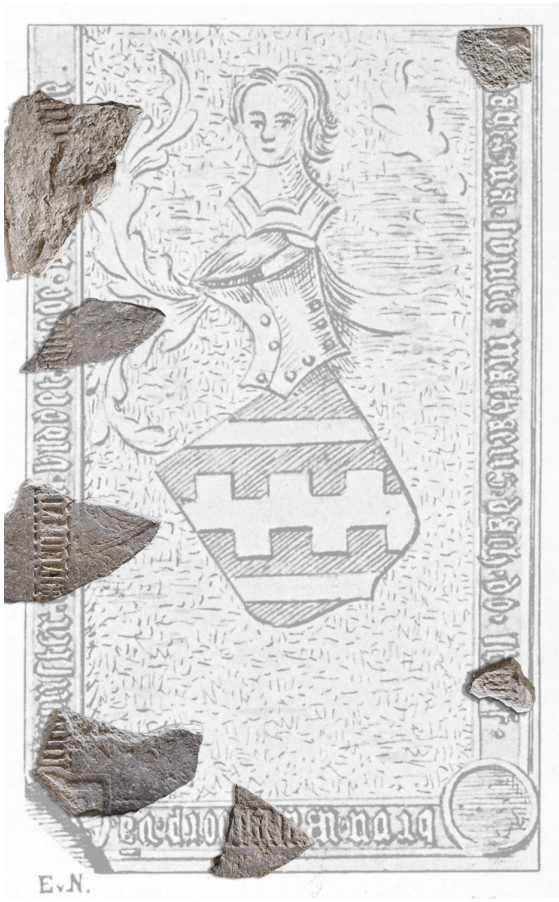


Figure 9. Grave slab of Brun Warendorp. First half of the 15th century. Niguliste Museum, Tallinn. Drawing by Eugen von Nottbeck, 1890s. Photos by Stanislav Stepaško; photomontage by Villu Plink

Following the exhibition, the fragments of both grave slabs were transferred to the Art Museum of Estonia, with the hope that a suitable location for their permanent display might eventually be found in the Niguliste Museum. To date, however, no such space has become available, and the fragments remain in museum storage, inaccessible to the public. The principal reason is presumably the limited exhibition space available in the museum, where visually more appealing works of art – such as paintings and wooden sculptures – are generally given priority over fragments of grey limestone grave slabs.

The method described above has also proved applicable to several other medieval grave slabs. One example is the monument of Heidenricus Savijerwe (†1460), a vassal and the brother of Bartholomäus Savijerwe, Bishop of Tartu. Numerous fragments of his grave slab survive in the collections of the Estonian National Museum in Tartu, but they are too incomplete to form either a coherent reconstruction or even half of the original monument.[49] Fortunately, the slab was recorded in a historical drawing by Johann Christoph Brotze (1742–1823), who most likely copied a drawing by Eduard Philipp Körber (1770–1850).[50] Two of the larger surviving fragments, originating from the upper left and lower

49 A. Mänd. Art in Medieval Tartu. – Baltic Journal of Art History, 2024, 27, 105–107; A. Mänd. Kunstist keskaegses Tartus. – Õpetatud Eesti Seltsi aastaraamat 2024 / Annales Litterarum Societatis Esthonicae. ÕES, Tartu, 2026, 91–92.

50 Johann Christoph Brotze *Estonica*. Ed. by A. Hein, I. Leimus, R. Pullat, A. Viires. Estopol, Tallinn, 2006, 258. On Brotze's copying of several drawings by Körber, including that of this particular slab, see ibid., VIII.

right corners of the slab, can therefore be digitally superimposed onto the historical drawing.[51] Through this method, the surviving pieces are transformed from what might otherwise appear to be mere fragments of stone into recognisable parts of the funerary monument of an influential medieval vassal.

A similar case is provided by the grave slab of Wolter von Plettenberg (†1535), Master of the Livonian Branch of the Teutonic Order, which originally lay in front of the high altar of St John's Church in Cēsis. A drawing of the monument by Johann Christoph Brotze, dating from 1771, has survived. Although several smaller pieces of the slab were already missing at that time, the centrally placed effigy of the deceased and the marginal inscription were still preserved in their entirety and fully legible. Today, only three fragments of the slab survive, all originating from its lower part. These preserve only Plettenberg's knees and parts of his sword and shield.[52] In Latvia, the fragments are regarded as important cultural monuments and are protected by the state.[53] Because they are visually rather unremarkable, however, historians usually reproduce Brotze's drawing and simply note that the grave slab has been destroyed.[54]

One may, of course, question when a grave slab should truly be considered destroyed: when it has been broken into pieces, when only a few fragments remain, or only when no fragments survive at all? Both the complete slab and, later, its surviving fragments have been relocated several times within St John's Church.[55] Today, the fragments are mounted on the wall of the south aisle, accompanied by a label reproducing Brotze's drawing.

Two of the three surviving fragments can be digitally superimposed onto Brotze's drawing, which proves to be remarkably accurate in its details (Fig. 10). The third fragment, however (the leftmost of the three), lacks the decoration that should occupy this area according to the drawing, while the surviving portion of its inscription band differs in design from the inscription preserved on the right-hand side of the

51 A. Mänd. Art in Medieval Tartu, 106, fig. 5; A. Mänd. Kunstist keskaegses Tartus, 92, fig. 3.

52 A. Mänd. Visuaalne mälestamine, 74, fig. 9; A. Mänd. Grave slabs of Ecclesiastical, 59, fig. 3.3.

53 No. 3094, Kapa plāksnes fragments V. Pletenbergam, https://likumi.lv/ta/id/343726-valsts-nozimes-makslas-pieminekla-izmantosanas-un-saglabasanas-noradijumi (accessed 25/06/2026).

54 E.g., J. Kreem. Ordu sügis: Saksa ordu 16. sajandi Liivimaal. Tallinna Linnaarhiiv, Tallinn, 2022, 97.

55 F. von Klocke. Zu den Bildnissen und zum Grabstein Wolter von Plettenbergs. – Westfalen. Hefte für Geschichte, Kunst und Volkskunde, 1941, 26/1, 34; G. Kalniņš. Cēsu Svētā Jāņa baznīca. Cēsu Kultūras un tūrisma centrs, Cēsis, 2015, 14 (fig. 22), 44, 50 (fig. 62); A. Mänd. Visuaalne mälestamine, 85; A. Mänd. Grave slabs of Ecclesiastical, 60.

slab. This raises the question of whether it belongs to Plettenberg's monument at all.

In any case, digital photomontage conveys more effectively that the grave monument of the Livonian Master has not been completely lost. Even the surviving fragments remain valuable sources: they allow the dimensions of the inscription band and the Gothic minuscule lettering to be measured, the provenance of the limestone to be investigated, and the carving techniques employed by the stonemason to be studied.



Figure 10. Grave slab of Wolter von Plettenberg (†1535). St John's Church, Cēsis, Latvia. Drawing by Johann Christoph Brotze, 1771. Photos and photomontage by Stanislav Stepaško

CONCLUSIONS AND FUTURE PERSPECTIVES

The widespread adoption of digital photography during the twenty-first century, together with increasingly sophisticated image processing techniques, has created new opportunities for the study and digital documentation of medieval grave slabs. Standard digital photographs can be enhanced by adjusting contrast, lighting, and other image parameters to improve the visibility of worn surfaces. Even greater potential is offered by Reflectance Transformation Imaging (RTI), which has proved particularly effective in deciphering weathered inscriptions and symbols on grave slabs.

Digital photomontage provides another valuable tool by enabling the virtual reassembly of fragments that are physically separated, for example, when they are embedded in different parts of a church floor. Since there is little prospect of dismantling church or museum floors simply to reunite dispersed fragments, photomontage offers a practical means of visualising their original relationship.

Some grave slabs have become even more widely dispersed over time, with fragments ending up in different buildings. The Möller–Treiden monument discussed in this article is one such example, its fragments now divided between Pöide Church and Kuressaare Castle. In this case, physical reassembly, conservation, and redisplay of the monument would in fact be feasible. It is hoped that the digital photomontage presented here will help draw attention to this possibility.

For several grave slabs documented in eighteenth- or nineteenth-century drawings, only a few fragments survive today. These fragments are often visually unremarkable and tend to be overlooked by visitors to churches and museums. One way to increase their interpretative value would be to display reproductions of the historical drawings alongside the surviving fragments, as has already been done in St John's Church in Cēsis. An even more informative approach would be to combine photographs of the surviving fragments with historical drawings digitally, thereby demonstrating precisely which part of the original monument each fragment represents. Such digital montages would make grave slab fragments more meaningful and engaging both for specialists (including art historians, museum professionals, and heritage conservators) and for the wider public, while at the same time communicating the significance of medieval grave slabs as an important category of cultural heritage. However, this method can be successfully applied only when the

proportions of the historical drawings are sufficiently accurate, which is not always the case.

Although this article has focused primarily on fragmentary monuments, digital methods are equally valuable for the study of complete or largely intact grave slabs. One approach that has not yet been implemented in either Estonia or Latvia would be to provide interpretative panels accompanying reused grave slabs, with the decorative and epigraphic layers from different periods distinguished by colour. Such panels could also include a digital reconstruction of the slab's original appearance. A single example will suffice. Embedded in the floor of the former south aisle of St Nicholas' Church, now the Niguliste Museum, is the grave slab of Hinrick Lussenberch (†1512), alderman of Tallinn's Great Guild. In addition to Lussenberch's merchant's mark or house mark, the central field of the slab contains the shields with house marks of two later owners from different periods, together with a later inventory number.[56] To the untrained eye, these successive historical layers are difficult to distinguish. An interpretative panel – whether in printed or digital form – would therefore greatly facilitate the understanding of the monument. A virtual reconstruction could also illustrate the slab's original appearance and, where known, its original location within the church interior.

The study of heavily worn grave slabs and their inscriptions could also benefit significantly from 3D scanning and photogrammetry, techniques that have not yet been applied systematically to the investigation of medieval grave monuments in Estonia or Latvia. Their limited use is due partly to a lack of institutional interest and partly to financial constraints. At the same time, the potential benefits of such time-consuming and often costly digital methods should always be weighed against the expected results, particularly in cases where a grave slab is so severely worn that successful documentation or interpretation remains uncertain.

Finally, it should be emphasised that, despite the wide range of digital tools now available to twenty-first-century researchers, the direct examination of monuments in situ remains indispensable. The trained eye of an experienced specialist can often identify details, establish connections, and propose interpretations through close examination of the monuments and comparison with other historical sources. In

56 A. Mänd. Hauaplaadid 14. sajandist 1550. aastateni, 393, fig. [3].

this sense, digital methods should be regarded not as a replacement for traditional scholarship but as a powerful complement to it.

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DIGITAALSED MEETODID FRAGMENTAARSETE KESKAEGSETE HAUAPLAATIDE UURIMISEL

Anu Mänd

Keskaegsed hauaplaadid on väärtuslikud allikad sotsiaalajaloo, kunstiajaloo, epigraafika ja heraldika uurimisel. Plaatidele raiutud inimfiguurid, religioossed sümbolid, vapid, peremärgid ja tekstid võimaldasid surnut identifitseerida ning jäädvustasid tema sotsiaalse staatuse. Hauaplaatide materjali, kujunduse, raidtehnika ja ruumilise konteksti uurimine võimaldab seetõttu saada teavet nii keskaegse kunsti kui ka mälestamispraktikate, religioossete tõekspidamiste ja kirjakultuuri kohta.

Keskaegsete hauaplaatide uurimist raskendab nende halb säilivusseisund. Jõukamad ja kõrgema staatusega inimesed maeti enamasti kirikutesse, aga põrandas paiknevad hauaplaadid on sajandite jooksul väga kulunud. Eriti halvasti on säilinud uurendatud ja madalreljeefsed kujutised ja pealiskirjad. Lisaks on hauaplaate hilisematel sajanditel korduvalt taaskasutatud ja uute lahkunute tarvis ümber kujundatud. Enamasti on keskaegsetest hauatähistest alles vaid üksikud fragmendid, mis võivad paikneda kiriku põrandas või mõnes sekundaarses asukohas, näiteks müürituna trepiastmeks või aknasilluseks või paigutatuna lävekiviks (ill 1).

Selliste (fragmentaarsete) hauatähiste uurimiseks pakuvad uusi võimalusi digitaalsed meetodid. Artiklis lähtutakse kasutajakesksest vaatenurgast, keskendudes meetoditele, mida autor ise on katsetanud. Põhitähelepanu all on pinnamuutuste pildistamine (*Reflectance Transformation Imaging*, RTI) ning digitaalne pilditöötlus ja fotomontaaž. Juhtumiuuringute kaudu hinnatakse, mil määral aitavad need meetodid

lugeda kulunud raidkirju, identifitseerida hauaplaatide omanikke, ühendada füüsiliselt lahus olevaid fragmente ja rekonstrueerida monumentide kunagist välimust.

Matemaatilisel algoritmil põhinev RTI on osutunud eriti kasulikuks tugevasti kulunud raidkirjade ja kujutiste uurimisel. Meetod põhineb ühe ja sama pinna pildistamisel eri nurkade alt langeva valgusega ning võimaldab tuua nähtavale palja silmaga raskesti märgatavaid detaile. Tallinna Oleviste kiriku läänеportaali kõrval asuva tugevalt kulunud keskaegse hauaplaadi fragmendi (ill 2) puhul võimaldas RTI lugeda gooti minusklites pealiskirja osi, mida varem polnud suudetud dešifreerida. Muu hulgas õnnestus kindlaks teha surnu amet – bürgermeister (*borgemester*). Samas näitas see katse ka meetodi piiratust: pealiskirja kõige tugevamalt kulunud osades ei aidanud RTI teksti loetavust oluliselt parandada. Sarnastel juhtudel võiks tulevikus katsetada 3D-skaneerimist ja fotogramm-meetriat.

Teiseks oluliseks meetodiks on digitaalne fotomontaaž. Varauusajal ja hilisemate kirikuremontide käigus on hauaplaadid sageli mitmeks osaks lõigatud ning fragmendid paigutatud põrandas eri kohtadesse. Neid ei ole enamasti võimalik ega otstarbekas põrandast eemaldada ja füüsiliselt taasühendada. Digitaalne montaaž võimaldab aga eraldi paiknevad fragmendid virtuaalselt kokku panna ning seeläbi rekonstrueerida hauaplaadi algse välimuse. Meetodi kasutamist demonstreeritakse artiklis mitme Eesti hauaplaadi näitel.

Haljala kiriku kooriruumis paiknevad kaks fragmenti kuuluvad 1523. aastal surnud Hinrick Hastferi ja tema naise hauaplaadile. Nende fragmentide omavahelise seose kindlakstegemisel on oluline allikas Søren Abildgaardi 1754. aastal tehtud joonis (ill 3). Fragmentide digitaalne ühendamine võimaldab taastada suure osa hauaplaadi kunagisest välimusest (ill 4), ajaloolise joonise ja säilinud osade võrdlemine aga näitab ühtlasi, et Abildgaardi kujutis ei ole õiges proportsioonis ega detailitäpne. Näiteks on ta tühjaks jätnud plaadi nurkades asuvad sõõrid, kuigi säilinud fragmentidel võib seal näha evangelistide sümboleid.

Tallinna Niguliste kirikus paikneva mündisellide hauaplaadi puhul võimaldas digitaalne fotomontaaž ühendada kaks fragmenti, mille omavaheline seos oli jäänud varasematele uurijatele märkamatuks (ill 5). Veelgi tähelepanuväärsem on Oleviste kiriku bürgermeistri hauaplaadi juhtum. Selle fragmendid paiknevad tänapäeval kahes eri hoones: kaks suuremat tükki Oleviste kiriku eeskojas, üks või kaks fragmenti aga Niguliste muuseumi põrandas. Digitaalne montaaž võimaldab kõik säilinud osad taas

üheks tervikuks ühendada (ill 6). Kuidas ühe hauaplaadi osad kahte kirikusse sattusid, ei ole õnnestunud kindlaks teha.

Eriti kõnekas on Johann Mölleri ja tema abikaasa Anna Treideni hauaplaadi näide. Kolm fragmenti asuvad Pöide kirikus, kaks ülejäänut aga Kuressaare piiskopilinnuses Saaremaa Muuseumi raidkivihoidlas. Raidkirja, dekoori ja kujunduse võrdlus näitab, et kõik viis fragmenti pärinevad samast hauaplaadist. Digitaalselt ühendatuna võimaldavad need taastada suurema osa hauaplaadi algsest välimusest (ill 7) ja lugeda eri aegadel tahutud pealiskirju. Selgub, et Johann Möller suri 1552., mitte 1568. aastal, nagu varasemas kirjanduses ekslikult väidetud. Kuna märkimisväärne osa hauaplaadist on säilinud, oleks võimalik ja soovitav fragmendid tulevikus ka füüsiliselt ühendada, konserveerida ja Pöide kirikus eksponeerida.

Digitaalne fotomontaaž pakub olulisi võimalusi ka juhul, kui hauaplaadist endast on säilinud ainult väikesed fragmendid, kuid selle terviklikku välimust tuntakse ajaloolis(t)e joonis(t)e kaudu. Sellisel juhul saab fragmentide fotod asetada digitaalselt ajaloolisele kujutisele, näidates täpselt, millisest monumendi osast need pärinevad. Meetod toimib siiski üksnes sel juhul, kui ajalooline joonis on proportsioonidelt piisavalt täpne.

Hea näite pakub Tallinna Niguliste kirikust pärinev 15. sajandi kaupmehe Brun Warendorpi hauaplaat, mis purunes 1944. aasta märtsipommitamise ja mõni aasta hiljem toimunud võlvivaringute tagajärjel. Hauaplaadist on säilinud vaid viisteist väikest fragmenti, millest enamikul leidub kõigest paar raidkirja tähte (ill 8). Eugen von Nottbecki 19. sajandi lõpu kirjelduse ja joonise abil õnnestus fragmendid siiski identifitseerida ja osa neist joonisel õigesse kohta paigutada (ill 9). Digitaalne rekonstruktsioon näitab ühtlasi, et Nottbecki joonis on küll proportsioonidelt täpne, kuid eksib mõnes detailis, näiteks nurgakaunistuste kujutamisel. Digitaalne montaaž muudab visuaalselt tagasihoidlikud kivifragmendid vaatajale mõistetavaks, sest näitab nende seost kunagise tervikliku hauamonumendiga.

Sama põhimõtet sai rakendada Eesti Rahva Muuseumi kogus hoitavatele Heidenricus Savijerwe (†1460) hauaplaadi fragmentidele. Samuti on võimalik Johann Christoph Brotze 1771. aasta joonisega ühendada kaks ordumeister Wolter von Plettenbergi (†1535) hauaplaadi fragmenti Cēsise Jaani kirikus (ill 10).

Digitaalsetel meetoditel on seega kaks omavahel seotud funktsiooni. Esiteks aitavad need käibesse tuua uut teaduslikku teavet: muuta kulunud raidkirju loetavamaks, tuvastada eri paikades asuvate

fragmentide omavahelisi seoseid, korrigeerida varasemaid atribueeringuid ja rekonstrueerida hauatähiste algset kujundust. Teiseks on neil oluline roll kultuuripärandi vahendamisel. Üksikud hallid paekivifragmendid ei pruugi muuseumis või kirikus vaatajale palju öelda. Kui need aga paigutada digitaalselt oma algsesse konteksti või ühendada ajaloolise joonisega, muutub arusaadavaks, millise suurema ja sageli rikkalikult kujundatud mälestusmärgi osad need kunagi olid.

Seetõttu võiks muuseumides ja kirikutes säilinud fragmentide eksponeerimisel kasutada senisest enam ajaloolisi jooniseid ja digitaalseid rekonstruktsioone. Samuti oleks võimalik visuaalselt eristada hauaplaatide ajaloolisi kihistusi, näiteks keskajal loodud kujundust ning hilisema taaskasutamise käigus lisatud raidkirju, vappe või peremärke.

Tulevikus võiks Eesti ja Läti keskaegsete hauaplaatide uurimisel senisest süsteemsemalt rakendada ka 3D-skaneerimist ja fotogrammmeetriat. Need meetodid võivad osutuda eriti kasulikuks tugevasti kulunud pindade ja raidkirjade dokumenteerimisel, kuid nende rakendamise ajakulu ja maksumust tuleb alati võrrelda loodetava teadusliku tulemusega. Kõige tugevamalt kahjustatud raidkivide puhul ei pruugi ka tehniliselt keerukad meetodid anda piisavalt uut informatsiooni.

Seega ei asenda digitaalsed meetodid hauaplaatide vahetut uurimist. Kohapealne vaatlus ja uurija kogemusel põhinev võime märgata detaile, võrrelda raidkirju ja kujundust ning luua seoseid eri fragmentide vahel jäävad asendamatuks. RTI, digitaalne pilditöötlus, fotomontaaž, 3D-skaneerimine ja fotogramm-meetria toimivad kõige tulemuslikumalt traditsiooniliste kunstiajalooliste uurimismeetodite täiendusena. Nende suurim väärtus seisneb võimaluses muuta halvasti säilinud või fragmentaarne materiaalne pärand taas loetavaks, analüüsitavaks ja visuaalselt mõistetavaks.