



A unique, non-normative burial of a young adult female from a 17th-century cemetery in Pień, north-central Poland. A multidisciplinary approach

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ABSTRACT

A non-normative 17th-century burial of a young adult female (grave 75) was discovered in 2022 in a cemetery in Pień, Poland. The burial, uncovered and later disturbed, is distinguished by the co-occurrence of a sickle and a padlock within a single grave, a combination not previously reported in the published archaeological literature. A series of archaeological and osteological examinations were conducted. The methodological approaches included radiocarbon dating, DNA analysis, elemental composition (SEM-EDS and MAXRF), and stable isotopic analyses. In the studies of textiles materials, SEM-EDS analysis was employed, whereas for the artifacts discovered with the individual's remains (the padlock and the sickle), X-ray imaging and xylological analysis were utilized. This research provides a stronger basis for interpreting the cultural and historical context of the time, including an attempt to address questions regarding the circumstances of the death of the female from grave 75.

Grave 75, a female of high social status, was likely feared at the time of her burial due to a padlock on the big toe of her left foot. In addition, her grave underwent a secondary deposition, presumably to resecure the grave by adding a sickle around the neck. These observed practices can be described as anti-demonic, protecting the living from dangerous deceased individuals, in which grave 75 would likely have been blamed for unspecified misfortunes (e.g., diseases, famine) that often plagued the 17th-century Polish-Lithuanian Commonwealth. Ongoing palaeopathological research may shed new light on the cause of death of this young female, which remains a mystery today.

1. Introduction

From various historical periods and regions, we have evidence of graves where specific, atypical practices were observed concerning the

buried individuals. These burials are most often referred to as atypical, non-normative, extraordinary, or deviant (e.g., Aspöck, 2008). In some of these cases, actions indicative of fear of the deceased were observed. Often the term vampiric/anti-vampiric is used in relation to these burials, with

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varying degrees of justification (e.g., Krumphanzlová, 1961; Grenz, 1967; Żydok, 2004; Tsaliki, 2008; Wyrwa, 2008; Nuzzolese and Borriani, 2010; Matczak et al., 2021; Borriani, 2024), even though the term vampire itself only became widespread in Europe around the 18th century (cf. Kozak, 2021).¹ Various terms were used to designate individuals who, after death, became or were believed to have the potential to become demons (vampires). In the Slavic context, these include upiór, strzyga (also: striga/strigoī), wieszczci, or łepi (cf. Kozak, 2021).² The diversity of these designations pertains both to ethnographic data and to the interpretation of burials exhibiting apotropaic, anti-demonic practices. In the latter case, the use of the term vampire (and related labels) is often subjective and more general in nature, functioning essentially as a broader category denoting a demonic being.³ An anti-vampiric grave (i.e., anti-demonic, incorporating protective practices) can thus be defined as any grave in which actions related to burial rituals were observed that are not typical for a specific human group, cultural unit, or region. These actions aimed to eliminate the presumed threat posed by the deceased to the living members of that group (Żydok, 2004). This definition is ontological in nature; therefore, in our case, the specificity of archaeological knowledge must also be taken into account. From the territory of Central and Southeastern Europe, several hundred so-called anti-vampire burials are known, dated from the post-medieval period to modern times (Matczak et al., 2021).⁴

However, this particular type of grave, found in Europe and dated to the post-medieval period (16th–18th century), has been rarely mentioned in archaeological literature, except for a few examples from Poland: Łekno (Wyrwa, 2008), Sanok (Kotowicz, 2011), Drawsko (Polcyn and Gajda, 2015; Gregoricka et al., 2014; Gregoricka et al., 2017; Betsinger and Scott, 2014), Gliwice (Pierzak et al., 2018), Kamień Pomorski (Barrowclough, 2014); from Slovakia: Turčianský Svätý Martin (cf. Králíková, 2007), Kostolisko (Hrubec, 1971), Smolenice (Dušeková, 1980), and Prostějov (Barrowclough, 2014); from Czechia: Čelákovice (Mašková, 2005); from Bulgaria: Plovdiv (Barrowclough, 2014), and from Italy: Nuovo Lazzaretto (Nuzzolese and Borriani, 2010). This study presents a detailed case analysis of an exceptional non-normative burial of a young female from the 17th-century cemetery in Pień, integrating multidisciplinary data to illuminate contemporaneous anti-demonic practices while reconstructing her probable origin, social standing, and broader cultural context.

2. Background

2.1. Geographical setting

The burial site in Pień is located in north-central Poland, within the Fordon Valley (Fig. 1a–b), which forms the southern part of the Lower Vistula Valley (Kondracki, 1998). Geomorphologically, it is situated on the eastern slope of a breakthrough section of the Vistula Valley, where the river cuts through moraine uplands (Fig. 1c). This river gap formed at the end of the Pleistocene, during the recession of the ice sheet of the last glaciation (Weichselian). Beginning in the Alleröd period (approximately 13.9–12.9 ka), the Vistula floodplain started to develop (Molewski and Weckwerth, 2017), reaching its present level in the mid-Atlantic period, around 5 ka (Tomczak, 1987).

¹ The term vampire can, however, be traced back to the early Middle Ages (around the 10th century). It originates from Slavic languages, where it appears in various phonetic variants, most commonly as vampire or upiór (wraith) (Stachowski and Stachowski, 2017).

² In Poland, from the 17th century onward, the term strzyga primarily referred to a revenant and functioned as a synonym of upiór (Kozak, 2021).

³ For the analogies cited in the discussion, the original interpretations of the burials have been retained.

⁴ Based on the analyzed early medieval burials from the territory of Poland, it has been established that they rarely have only one distinguishing characteristic (Żydok, 2004).

The burial site is located in the upper part of the valley slope, which inclines 5–10°, at an elevation of 66–68 m a.s.l., approximately 37 m above the Vistula Valley floor (Fig. 2a). Geologically, it lies within outcrops of sandy-gravelly fluvioglacial deposits visible on the valley slope (Fig. 2b). These deposits underlie the till from the last glaciation (Kozłowska and Kozłowski, 1990). Since the burial site was last used, the surrounding landscape has undergone significant changes (Fig. 1b and 3), particularly in the Vistula Valley. It is believed that the riverbed retained its natural characteristics – as a braided and anastomosing river – until the 19th century, when the Prussians began regulating it (Tomczak, 1971). The previous multi-stream channel occupied almost the entire floodplain, with a width of 1.1 km in the Pień region – more than twice its current width of approximately 450 m. Its remnants include, among others, Lake Duża Reptówka. The river was characterized by numerous sandy bars and islands (Fig. 3). Changes in the burial site's surroundings also pertain to the extent of forests, meadows, and wetlands. The magnitude of these transformations can be assessed using maps from the late 18th century (Schrötter, 1802). Today, the area surrounding the burial site is partially forested, with the remaining land primarily used for agriculture. Since the 18th century, the number of built-up areas has increased, although the road network has largely maintained its historical layout (Fig. 1b and 3).

2.2. The burial site

At the cemetery site in Pień, archaeological rescue excavations⁵ were conducted by a research team from the Institute of Archaeology at Nicolaus Copernicus University in Toruń between 2005 and 2009 (Poliński (ed.), 2020) and in 2022–2023 and 2025. These excavations revealed the existence of remains from two cemeteries in the area: an early medieval burial site (from the second half of the 10th century and the first half of the 11th century CE) with elite chamber graves, and a post-medieval cemetery (17th century). To date, an area of 920 m² has been investigated, uncovering 101 post-medieval graves (Fig. 4).⁶ A post-medieval grave containing the remains of a young female buried with a sickle and a padlock (grave 75) was discovered during the fieldwork in the 2022 season.

2.3. The 17th-century cemetery

There are no written references regarding the 17th-century rural cemetery in Pień, and this necropolis is not marked on maps (Poliński, 2020a). However, it is likely Protestant due to a complete absence of devotional items (crosses and medals), which is characteristic of Catholic burials (cf. Kolbuszewski, 1996). The few acquired elements of the deceased's equipment has been associated with the Protestant population (e.g., a key), or of various religious groups (e.g., coins and padlocks) (Poliński, 2020c). The socio-political, economic, and religious conditions, especially in the 17th century, both in Pień and in the neighbouring estates belonging to the Ostromecko nobility, would support the hypothesis that the cemetery under investigation had a Protestant character. It should nevertheless be noted that the northern part of Pień (the farmland with its pine and spruce forests) had been the property of the Benedictine nuns of Chełmno since 1613. In this area, alongside the Polish population (predominantly of the Catholic faith), there is clear evidence of the presence of Germans (primarily Lutherans) and people who came from the Netherlands (Mennonites) (cf. Poliński, 2020c). There is, however, no data in the source materials regarding the location of the 17th-century Protestant cemeteries in the northern part of the Ostromecko estates (Wielka

⁵ The early medieval and post-medieval cemetery in Pień is located on a slope, part of which had long been used by the local population as a sand and gravel extraction site and was still recently exploited for agricultural purposes.

⁶ In 1966, two skeletal graves were accidentally discovered at the cemetery site in Pień, one of which had a sickle placed by the clavicle. Only a note about the find has been preserved at the L. Wyczółkowski District Museum in Bydgoszcz (Poliński (ed.), 2020).

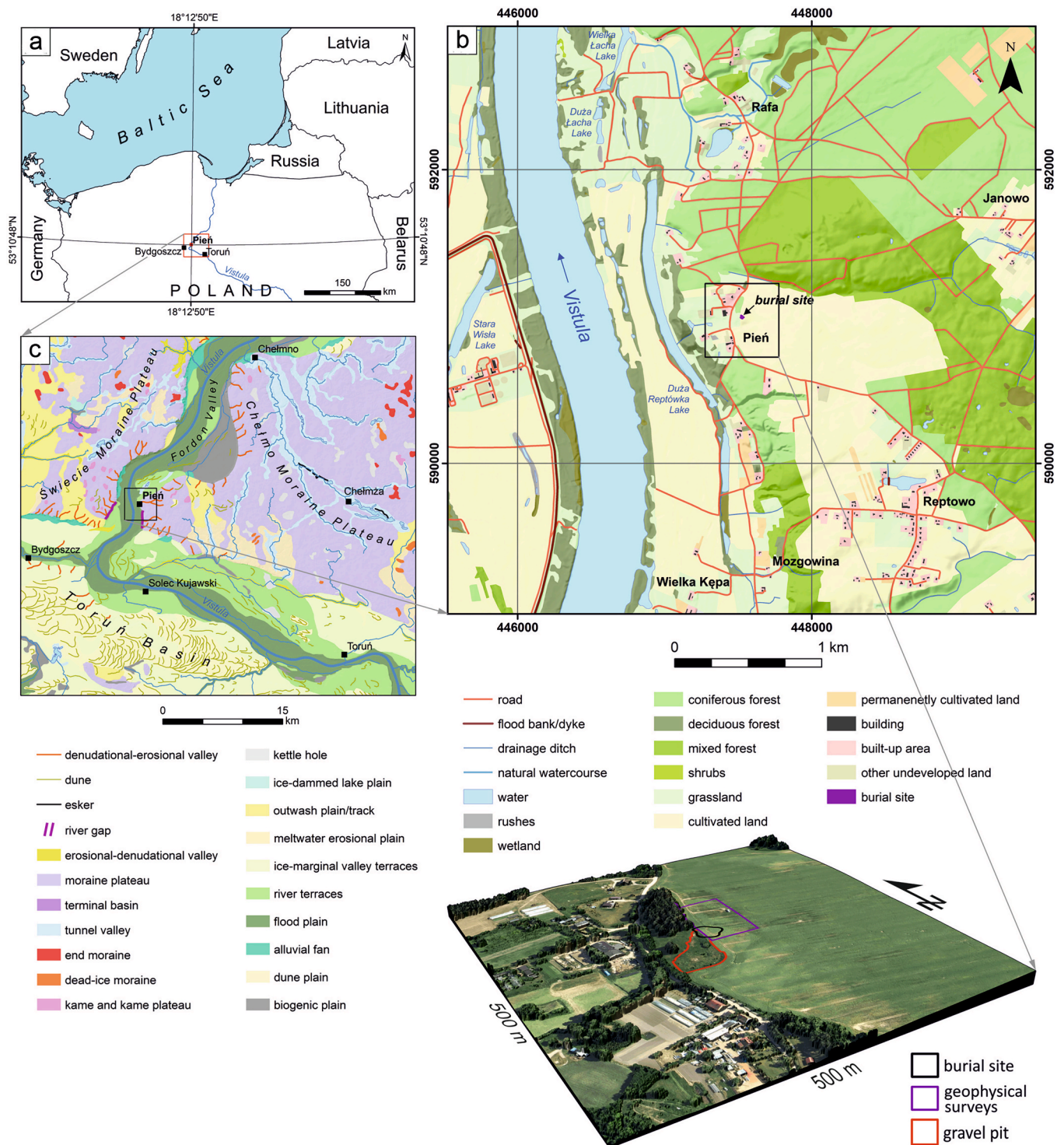


Fig. 1. The location of the village Pień in northern Poland (a), on the topographic map (b) with visualization of the village center (data source: Head Office of Geodesy and Cartography), and (c) on the geomorphological map (map according to Molewski and Weckwerth, 2017).

Kępa, Mozgowina, Reptowo, and Pień-Reptowskie Łąki; Raszeja, 2002), which bordered the farmland of the Chelmino Benedictine nuns'. It is worth noting that the cemetery of interest to us in Pień was located to the east of the Benedictine nuns' farm and to the north of Reptowo and Łąki Reptowskie, thus clearly outside the zones of settlement at that time (Fig. 1b). The Protestant population in the northern part of the Ostromecko estates, which likely included Mennonites (Olenders), must have constituted a significant percentage by the end of the 16th and in the 17th century; for example, Mozgowina was an Olender village (cf. Nowosad,

2005; Raszeja, 2002). One of the burial sites for this population in the 17th century was most likely the necropolis studied in Pień.

Was it a regular cemetery, or a burial site for rejected individuals (*faux âtre*, meaning false cemetery: cf. Ariès, 1992)? The traditional funerary rite in the medieval and post-medieval periods required burial in consecrated ground, within a cemetery (Labudda, 1983), where the dead were to await resurrection and salvation (Ariès, 1992). Consequently, burial in unconsecrated ground was considered a disgrace for both the deceased and their family. Such burial places were generally

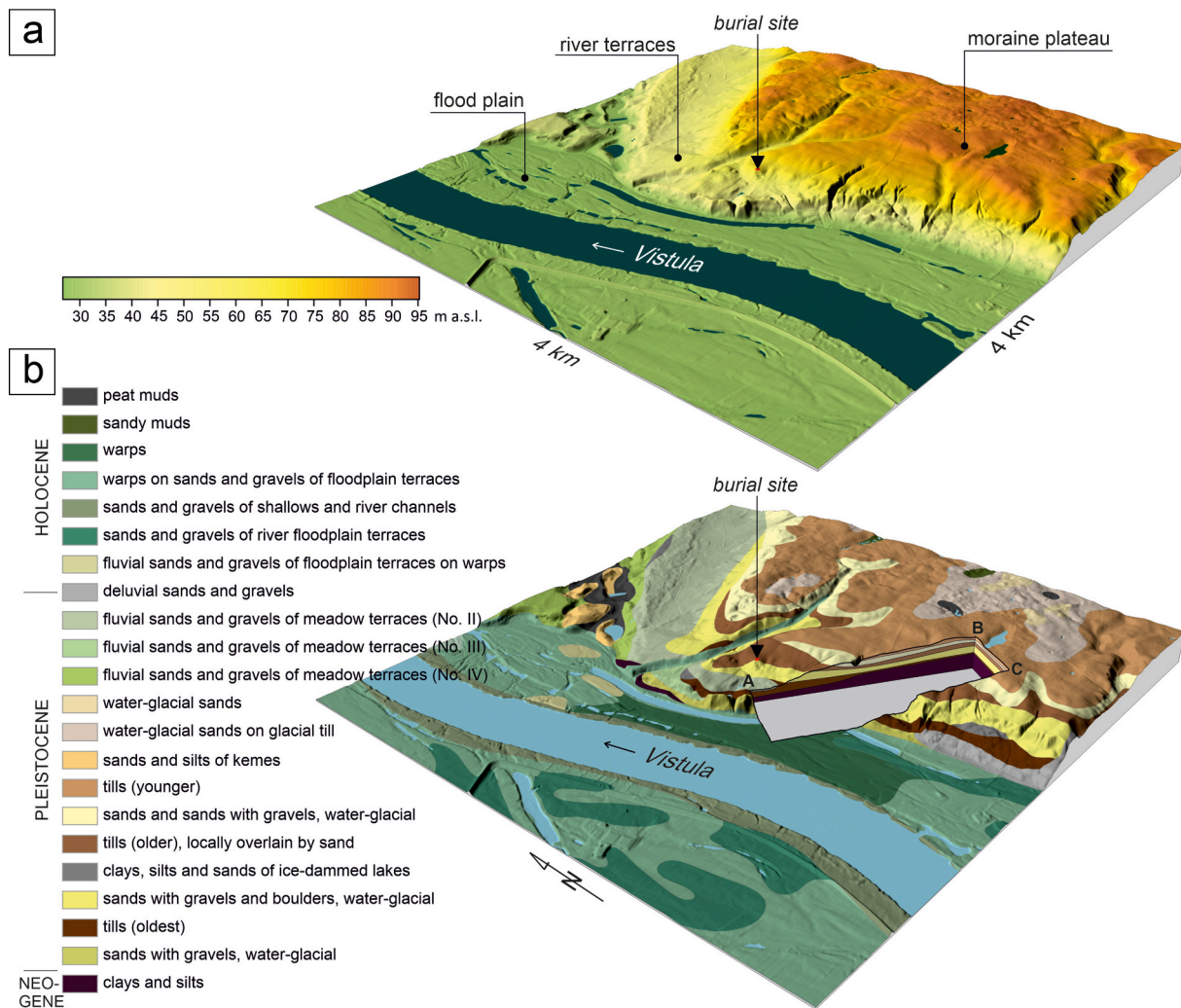


Fig. 2. Hypsometry (a) and geological structure with geological cross-section A-B-C (b) of the burial site surroundings on 3D models (vertical exaggeration of models approximately 3) (geology based on Kozłowska and Kozłowski, 1986, 1990).

omitted from written sources, which explains the absence of source data concerning them. This mode of burial was applied to suicides, heretics, outsiders without municipal citizenship, vagrants, tragically deceased individuals, drowned persons, women who died in childbirth, as well as orphans and unbaptized children (cf. Pierzak et al., 2018).

The location of the cemetery in Pień, set away from the village on a slope by a crossroads, in a potentially unconsecrated area, far from a church or chapel, suggests that we may be dealing not only with a Protestant necropolis but also with a burial site for the rejected and possibly the poor, who could not afford a traditional burial (cf. Wawrzeniuk, 2021). However, the decisive and determining factor in defining the character of the cemetery in Pień may be the several dozen non-normative burials uncovered so far, including the most characteristic grave 75.⁷ The post-medieval Protestant cemetery in Pień might have served as a burial place for individuals rejected by society, irrespective of their social status, who were likely feared even after death.⁸

⁷ This refers to burials with intentionally placed stones, padlocks, sickles, and coins, as well as those featuring unusual body arrangements. Some of these have already been published (Polinski (ed.), 2020).

⁸ However, it needs to be mentioned that even graves with evident examples of protective practises/anti-demonic, e.g., burials with sickles from Drawsko (Polcyn and Gajda, 2015), could be also located in consecrated land, among other deceased members of a given community.

3. Materials and methods

The archaeological investigations at the Pień cemetery were conducted as rescue excavations. In accordance with Polish law, the work was carried out under permits issued by the Kuyavian-Pomeranian Voivodeship Conservator of Monuments (Decision No. ZAR/282/2022, Permit No. 221/2022). No additional permissions were required for the study and analysis of the recovered human remains. Upon completion of the research, all remains will be transferred to the Leon Wyczółkowski District Museum in Bydgoszcz. They are currently housed at the Institute of Archaeology, Nicolaus Copernicus University in Toruń.

3.1. Archaeological context analysis

All elements and features of grave 75 are presented in the context of the studied cemetery. The grave pit is described (orientation according to cardinal directions, shape, top and floor, fill, and dimensions), as well as the skeleton found within it (orientation according to cardinal directions and layout) and the location of the discovered artifacts (padlock, sickle, and remnants of textiles). During the exploration of grave 75, two iron objects were recovered: a padlock and a sickle, as well as remnants of decorative woven band made of silk and metal threads. The padlock and sickle underwent detailed formal analysis (shape, size, structure) and chronological-spatial analysis. In the case of the padlock, X-ray imaging was used, while for the sickle, microscopic imaging of the

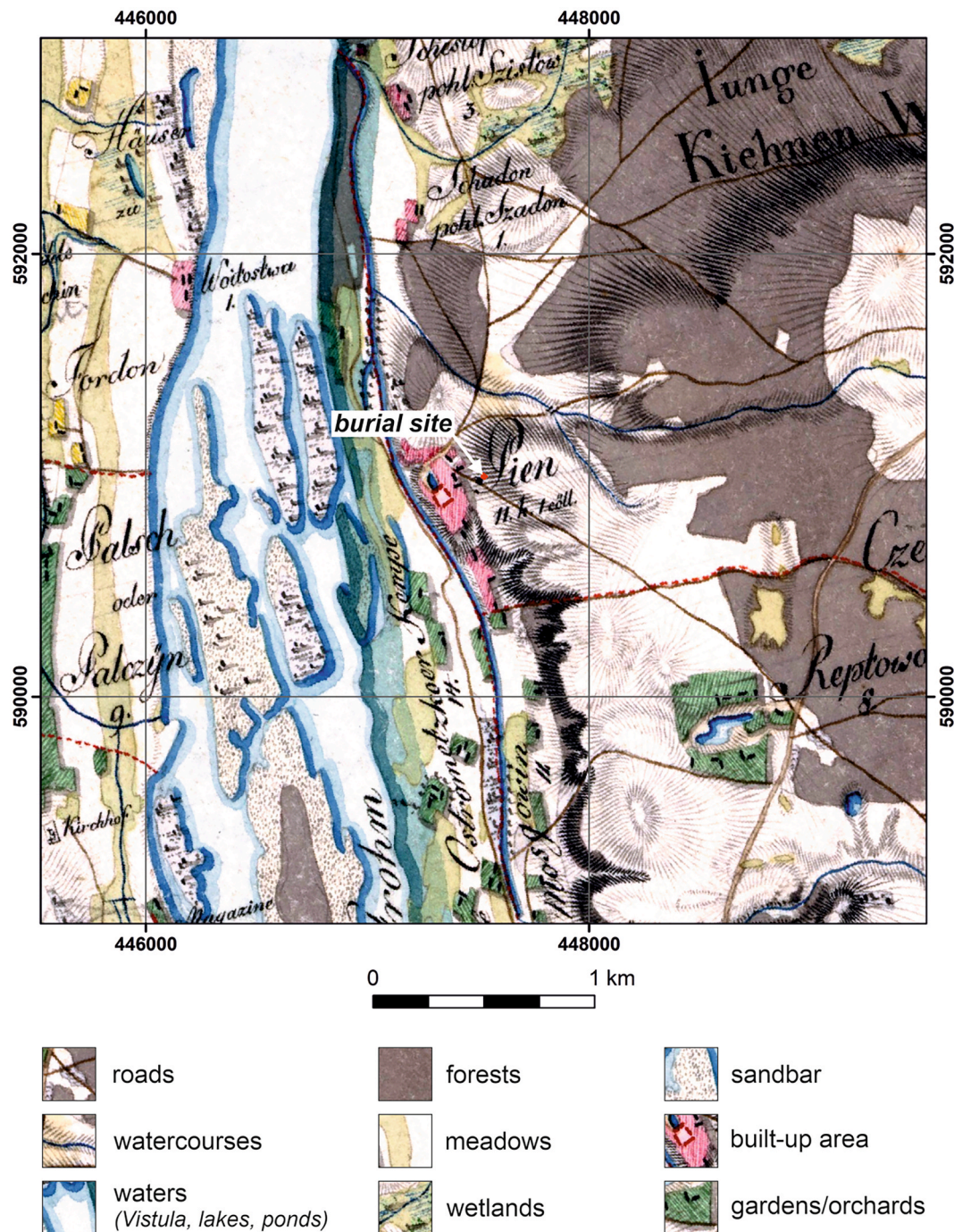


Fig. 3. Fragment of Schrötter's Map (1802) (map source: Staatsbibliothek zu Berlin).

cutting edge, and results from the xylological analysis of the remnants of its handle⁹ were employed.

3.2. Osteological analysis

After an overview of the condition of the remains and the possible taphonomic alterations (Borrini et al., 2012), a general morphological observation of the bones was carried out to assess their preservation and

the general biological profile. As the individual was not skeletally mature, age-at-death estimation was based on epiphyseal union and dental development/eruption patterns, following established standards (Coqueugniot and Weaver, 2007; Cardoso, 2008). Sex determination was carried out on the pelvic region, which was fully formed in the relevant areas. Sex estimation was based on macroscopic assessment of pelvic and cranial morphology following standard osteological methods (Phenice, 1969; Buikstra and Ubelaker, 1994; White and Folkens, 2005), with consideration of the individual's developmental stage.

Skeletal elements were measured according to [Martin and Saller \(1957\)](#), following forensic protocol ([Borrini, 2011](#); [Borrini, 2022](#)). Stature estimation was based on regression formulae proposed by [Trotter \(1970\)](#), using those developed for White females. However, as

⁹ The analysis of the wooden remains of the sickle handle was carried out by Dorota Bienias, M.A., at the Bioarchaeological Laboratory of the Institute of Archaeology, Nicolaus Copernicus University.

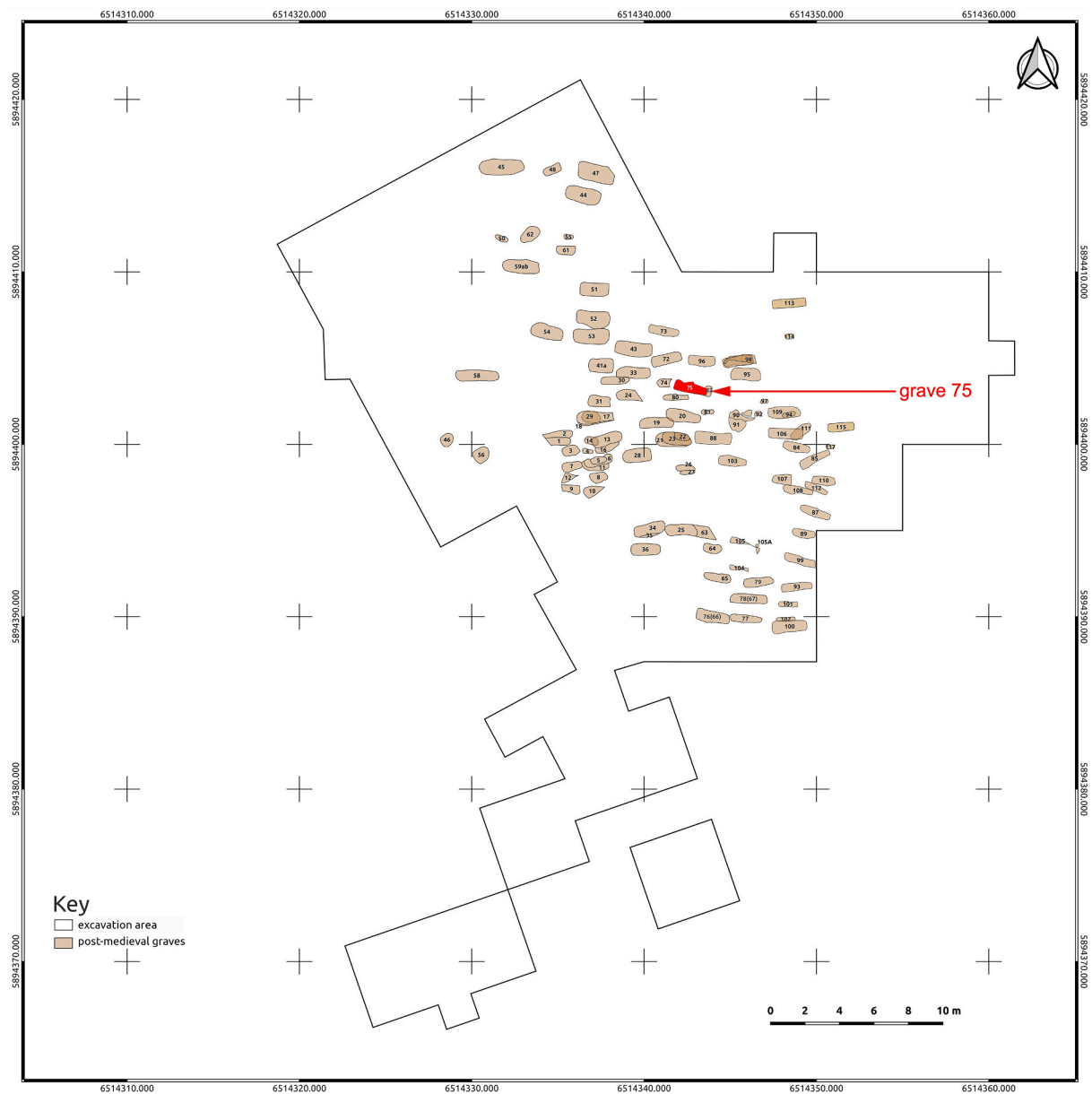


Fig. 4. Grave 75. Location in the cemetery.

these formulae were derived from modern reference populations, the resulting estimates should be interpreted with caution when applied to archaeological individuals.

A detailed analysis of osteobiographic traits and variations is currently underway; however, a general observation of the remains has been conducted to detect possible pathological alterations or congenital characteristics. A general overview of muscular insertions was performed to evaluate the activity patterns of the individual (Donatelli and Scarsini, 2006). A detailed study of the insertions is planned for future research, which will take into consideration with the entire population buried in the cemetery.

3.3. Ancient DNA analysis

The SciLifeLab Ancient DNA unit performed processing of ancient DNA and data analysis. Detailed procedures of DNA analysis, including genetic sex determination and complete mitochondrial genome sequencing presented in Appendix A and B. The FASTQ files and metadata obtained are available under project accession number

PRJEB113015 at the European Nucleotide Archive (ENA). The most-parsimonious tree of the complete mtDNA sequences was reconstructed using the mtPhyl v4.015 software (<http://eltsov.org>) and modified manually to include the updated mtDNA variation incorporated in PhyloTree Build 17 (van Oven and Kayser, 2009) and all available records deposited in GenBank. Based on this variation, the female's mtDNA was assigned into appropriate haplogroup. The haplogroup divergence estimates, ρ , and their error ranges as average number of substitutions in mtDNA haplogroups from the ancestral haplotype were converted to age estimates with 95% CI bounds using the molecular clock presented by Soares et al. (2009). Highly instable insertions at nucleotide positions 309, 315, 515, 524, 574 and 16193; transversions at positions 16,182 and 16183; and transition at position 16,519 were disregarded in phylogenetic analysis.

3.4. Isotopic analyses

To contextualize grave 75, radiogenic strontium ($^{87}\text{Sr}/^{86}\text{Sr}$) and stable oxygen ($\delta^{18}\text{O}$) isotopes were evaluated to determine whether the

person was born in the region or migrated there. $^{87}\text{Sr}/^{86}\text{Sr}$ and $\delta^{18}\text{O}$ can assess an individual's geographic origins through migration patterns.

$^{87}\text{Sr}/^{86}\text{Sr}$ reflects a region's underlying bedrock, based on the age and the original amount of rubidium, and becomes incorporated into dental tissues through the foods and water consumed (Bentley, 2006). $\delta^{18}\text{O}$ is obtained through the consumption of water, mostly from drinking, and the concentration of the isotope is related to factors such as elevation, latitude, and distance from an evaporation source (Luz et al., 1984).

Bulk bone collagen carbon ($\delta^{13}\text{C}_{\text{collagen}}$) and nitrogen ($\delta^{15}\text{N}$) are used to estimate diet and are integrated into bodily tissues from dietary macromolecules (proteins, lipids, carbohydrates) (Cerling and Harris, 1999; Deniro and Epstein, 1978; Katzenberg, 2008). $\delta^{15}\text{N}$ reflects the protein portion of the diet, estimates relative trophic position, and is influenced by the nutritional state. Each increase in trophic position results in an enrichment of $\sim 3\text{--}5\text{‰}$ in consumer $\delta^{15}\text{N}$ values (Cerling and Harris, 1999). $\delta^{13}\text{C}_{\text{collagen}}$ primarily represents dietary protein, whereas carbon from bone apatite ($\delta^{13}\text{C}_{\text{apatite}}$) reflects carbon derived from all dietary macromolecules (Ambrose and Norr, 1993; Deniro and Epstein, 1978). $\delta^{13}\text{C}_{\text{apatite}}$ is enriched relative to bone collagen and therefore, carbon apatite-collagen spacing can be used to distinguish differences in the carbon sources of both the protein (heavily weighted towards animal protein) and carbohydrate (mostly derived from plants) portions of individual diet (Codron et al., 2018).

Grave 75 was compared to other post-medieval individuals buried at Pień to assess their isotopic signatures ($n = 45$; Table 1). For $^{87}\text{Sr}/^{86}\text{Sr}$ and $\delta^{18}\text{O}$, approximately 100 mg of second molar tooth enamel was sampled, as it reflects childhood location after weaning (2.5–8.5 years) since enamel does not turn over (AlQahtani et al., 2010; Wright and Schwarcz, 1998). For $\delta^{13}\text{C}_{\text{collagen}}$, $\delta^{13}\text{C}_{\text{apatite}}$, and ($\delta^{15}\text{N}$), approximately 600 mg of femoral cortical bone was sampled. Only individuals with estimated sex were used to compare differences between the sexes and to assess where grave 75 fell within their estimated sex group ($n = 38$). Bones, unlike teeth, are constantly remodelling, but turnover at different rates. For example, the femur's turnover rate is approximately 13.5 years, isotopically representing an average of the last decade of life (Fahy et al., 2017).

Pień fauna was sampled to add to existing baseline data for biologically available strontium for the region, mostly from Bataille et al. (2020) Table S1 Dataset (Bataille et al., 2020; Zieliński et al., 2018; Zieliński et al., 2019; Zieliński et al., 2021) surrounding Pień ($n = 12$) and to estimate the isotopic niche space ($n = 12$). Previously published bulk collagen $\delta^{13}\text{C}/\delta^{15}\text{N}$ values from fish (Reitsemá and Kozłowski, 2013) were also included because the Pień faunal assemblage did not have enough fish bones for isotopic analyses ($n = 16$; Table 2).

The same tooth was used for $^{87}\text{Sr}/^{86}\text{Sr}$ and $\delta^{18}\text{O}$. All strontium isotope samples were processed at the University of North Carolina at Chapel Hill in the Isotope Geochemistry Laboratory following the Horwitz et al. (1992) protocol.

Oxygen isotope samples for enamel apatite were processed at the Center for Stable Isotopes (CSI) at the University of New Mexico (UNM) and all wet chemistry follows a modified version of Koch et al. (1997) and Kennett et al. (2020). All wet chemistry for bone collagen followed the protocol laid out in Kennett et al. 2020 and was conducted at CSI (cf. Appendix C). Bone apatite samples were processed following the same protocol as the enamel apatite described above at CSI. All enamel and bone apatite samples were run through Fourier transform infrared (FTIR) spectroscopy at the CSI in UNM to test for diagenetic alteration.

All statistical analyses and graphs were conducted in R Studio programming language version 4.4.2 (R Team Core, 2021). The Kruskal-Wallis test was used to test for significant differences among females, males, and indeterminate-sex individuals, as it compares the medians between three or more groups, is a non-parametric test, and normality is not assumed. All $\delta^{18}\text{O}_{\text{VDPB}}$ values were converted to $\delta^{18}\text{O}_{\text{VSMOW}}$ drinking water (or predicted water) for comparison to modern local precipitation averages in Pień and the geographic assignments (Ammer et al., 2020).

Table 1

List of individuals from Pień sampled for migration status, diet, or both.

ID	Sex	Tooth	Bone
Grave 001	undetermined	—	left femur
Grave 002	undetermined	—	right fibula
Grave 006	female	URM2	left humerus
Grave 009	female	—	left fibula
Grave 009A	undetermined	—	right humerus
Grave 010	undetermined	—	right femur
Grave 011	female	URM2	right femur
Grave 012	undetermined	—	right femur
Grave 013	female	LRM3	left femur
Grave 017	undetermined	ULM2	right femur
Grave 018	male	—	right humerus
Grave 019	male	—	right femur
Grave 020	undetermined	ULM2	right humerus
Grave 021	undetermined	—	left ulna
Grave 024	female	URM2	right femur
Grave 025	undetermined	LRM2	right femur
Grave 028	male	ULM2	right femur
Grave 030	undetermined	URM2	right femur
Grave 031	undetermined	LRM2	right femur
Grave 033	female	URM2	right femur
Grave 035	male	—	right radius
Grave 043	male	LLM2	left humerus
Grave 044	female	ULM2	right humerus
Grave 045	female	LLM2	right radius
Grave 051	female	URM2	right femur
Grave 052	male	ULM2	right femur
Grave 053	female	LRM2	right femur
Grave 054	male	LRM2	right femur
Grave 056	undetermined	ULM2	right femur
Grave 058	male	URM2	right femur
Grave 059	male	URM2	right femur
Grave 061	undetermined	URM2	right femur
Grave 063	undetermined	—	left femur
Grave 065	male	URM2	right femur
Grave 072	male	ULM2	left femur
Grave 073	undetermined	URM2	right femur
Grave 074	undetermined	URLM2	right femur
Grave 075	female	LRM2	right femur
Grave 076	female	URM2	right femur
Grave 077	female	URM2	left femur
Grave 078	undetermined	URM2	right fibula
Grave 079	male	LRM2	right femur
Grave 084	undetermined	URM2	right femur
Grave 085	male	LRM2	right ulna
Grave 087	female	URM2	right fibula
Grave 088	male	URM2	right tibia
Grave 089	undetermined	URM2	right femur
Grave 093	male	—	left tibia
Grave 098	female	ULM2	right fibula
Grave 099	female	ULM2	left radius
Grave 100	male	URM2	right femur
Grave 103	female	LLM3	right femur
Grave 104	undetermined	—	right femur
Grave 105	male	ULM2	left fibula
Grave 106	female	URM2	right femur
Grave 108	undetermined	LLM2	right femur
Grave 109	female	URM2	right femur
Grave 110	male	ULM2	left femur

The strontium baseline was created using hierarchical cluster analysis based on the Pień fauna samples and European water, soil, plant, and fauna data mined (Hamilton et al. 2021). The oxygen baseline was created using median absolute deviation (3MADnorm) of the Pień individuals who were able to be sampled (Lightfoot and O'Connell, 2016). If the strontium values fall within the local cluster range, they are estimated to be local, with the oxygen values as a secondary comparison, given the small number of local Pień baseline samples (Depaermentier et al., 2020). A cluster that is deemed local falls within 20 km from Pień, the estimated geographic region an individual could likely travel by foot in a day (Depaermentier et al., 2020).

The European isoscape used for the geographic assignment uses a continuous-surface assignment framework to estimate the probability of

Table 2

Fauna sampled from Pień and data mined from Kaldus for migration and dietary baselines.

Site	ID	Period	Fauna	Reference
Pień	Pień Faunal 01	post-medieval	cattle	this study
Pień	Pień Faunal 17	post-medieval	cattle	this study
Pień	Pień Faunal 18	post-medieval	sheep/goat	this study
Pień	Pień Faunal 19	post-medieval	sheep/goat	this study
Pień	Pień Faunal 26	post-medieval	horse	this study
Pień	Pień Faunal 27	post-medieval	horse	this study
Pień	Pień Faunal 30	post-medieval	sheep/goat	this study
Pień	Pień Faunal 31	post-medieval	pig	this study
Pień	Pień Faunal 36	post-medieval	cattle	this study
Pień	Pień Faunal 37	post-medieval	pig	this study
Pień	Pień Faunal 40	post-medieval	pig	this study
Pień	Pień Faunal 43	post-medieval	vole	this study
Pień	Pień Faunal 02	post-medieval	sheep	this study
Pień	Pień Faunal 06	post-medieval	sheep/goat	this study
Pień	Pień Faunal 08	post-medieval	cattle	this study
Pień	Pień Faunal 09	post-medieval	cattle	this study
Pień	Pień Faunal 10	post-medieval	pig	this study
Pień	Pień Faunal 12	post-medieval	pig	this study
Pień	Pień Faunal 16	post-medieval	cattle	this study
Pień	Pień Faunal 21	post-medieval	cattle	this study
Pień	Pień Faunal 28	post-medieval	sheep/goat	this study
Pień	Pień Faunal 29	post-medieval	red deer	this study
Pień	Pień Faunal 41	post-medieval	cattle	this study
Pień	Pień Faunal 42	post-medieval	horse	this study
Kaldus	75–08	early medieval	catfish	Reitsema and Kozłowski, 2013
Kaldus	547–03	early medieval	catfish	Reitsema and Kozłowski, 2013
Kaldus	114–08A	early medieval	catfish	Reitsema and Kozłowski, 2013
Kaldus	274–03	early medieval	carp-bream	Reitsema and Kozłowski, 2013
Kaldus	64–07	early medieval	carp-bream	Reitsema and Kozłowski, 2013
Kaldus	408–03	early medieval	tench	Reitsema and Kozłowski, 2013
Kaldus	71–04	early medieval	aspe	Reitsema and Kozłowski, 2013
Kaldus	161–05	early medieval	pike	Reitsema and Kozłowski, 2013
Kaldus	50–98	early medieval	pike	Reitsema and Kozłowski, 2013
Kaldus	100–04	early medieval	pike	Reitsema and Kozłowski, 2013
Kaldus	630–03	early medieval	pike-perch	Reitsema and Kozłowski, 2013
Kaldus	4–02	early medieval	pike-perch	Reitsema and Kozłowski, 2013

Table 2 (continued)

Site	ID	Period	Fauna	Reference
Kaldus	183–98	early medieval	sturgeon	Reitsema and Kozłowski, 2013
Kaldus	171–05	early medieval	sturgeon	Reitsema and Kozłowski, 2013
Kaldus	114–08	early medieval	sturgeon	Reitsema and Kozłowski, 2013
Kaldus	69–07	early medieval	tench	Reitsema and Kozłowski, 2013

origin of an individual by comparing the individual sample to a dual strontium and oxygen isotope (Bataille et al., 2021). The dual isotope designates the probability distribution, which ranges from 0 to 1, and defines the high probability zone to include values above the 66.7th percentile (Bataille et al., 2021). In other words, only the top third of locations are considered in the geographic assignment probabilities.

Bulk collagen data were analysed using the SIBER package to visualize and assess stable isotope niche composition, as it uses a Bayesian framework that accounts for uncertainty and can compare species and populations (Jackson et al., 2011). $\delta^{13}\text{C}_{\text{collagen}}$ and $\delta^{13}\text{C}_{\text{apatite}}$ were analysed using linear regression models developed by Kellner and Schoeninger (2007) that estimated marine and C_4 consumption.

3.5. SEM-EDS analysis of textiles

For analysis of the textile material, the SEM (Scanning Electron Microscopy) and EDS (Energy-Dispersive X-ray Spectroscopy) were used. SEM-EDS assesses the structural features of fibres and metal components of threads, the chemical composition of a metal, as well as the presence and composition of the outer layer, such as gilding (Cybulska, 2023; Śliwka-Kaszyńska et al., 2024). For observation in secondary imaging mode (SEI-Secondary Electron Image), the SM-6610LV (US) scanning electron microscope was used, coupled with X-ray spectroscopy with energy dispersion (EDS) X-MAX 80 (Oxford Instruments, UK). SEM research was conducted in randomly selected points in a high vacuum using the acceleration voltage of the electron beam from 10 to 20 kV.

3.6. Analysis of discoloration on the bone fragments

The palatal bone exhibited distinct greenish discoloration, suggesting localized post-mortem chemical changes and/or the presence of exogenous material. Because such alterations can be heterogeneous at the millimetre scale, the analysis was designed as a two-step workflow. First, SEM-EDS was used as a screening approach on selected fragments to identify elements enriched in the discolored and visually bright regions (potentially containing heavier metals). After gold was detected in these initial measurements, the study was extended to non-destructive MAXRF mapping of the whole palate to assess the spatial distribution of relevant elements and their association with the observed discoloration.

3.6.1. SEM-EDS analysis

The elemental composition analysis was conducted using an EDX (Energy Dispersive X-ray Spectrometer) GENESIS Apex Apollo X60 detector, integrated into an FEI Quanta FEG250 electron microscope. Measurements were performed utilizing an electron beam accelerated at a voltage of 30 kV. Based on the atomic mass and density of calcium, and following the Kanaya-Okayama equation, this configuration results in a signal collection depth of approximately 5 μm .

In all cases, the elemental composition was determined through electron microscopy focused on the brightest regions of the samples, with the scanning locations appropriately marked on the images. The primary elements constituting tissues and bones (calcium, oxygen, carbon, phosphorus, silicon, sodium, magnesium, etc.) are categorized as light elements, which do not provide substantial analytical insights.

Regions composed predominantly of these elements typically exhibit low to medium brightness in the images. In contrast, heavier metals scatter the electron beam more effectively, causing metallic regions to appear significantly brighter in the resulting images (cf. Shah et al., 2019).

3.6.2. MAXRF analysis

X-ray fluorescence (XRF) is a non-destructive technique widely used across scientific disciplines (Beckhoff et al., 2006). Portable XRF has recently gained attention in bioarchaeology for analysing elemental composition in human remains (Christensen et al., 2012; Kilburn et al., 2021; Pringle et al., 2022; Gomes et al., 2024). The latest achievement of macro XRF (MAXRF) allows for imaging of elements over a large area and is used in the conservation of works of art (Alfeld, 2020) and to a small extent in archaeology (Kowalski et al., 2021). This study applies MAXRF to the palate of a human skull to assess elemental distribution and identify post-mortem chemical changes. Examinations were performed with the MAXRF scanner M6 JetStream from Bruker GmbH using a 50 kV/0.6 mA X-ray generator with Rhodium anode, polycapillary optics, and 30 mm² SSD detector. Data from Area 1 was collected in approximately 28,000 points with an X-ray spot size of 100 µm, a 0.33 mm step size, and data collection of 200 ms in every pixel, and from Area 2.

3.7. Radiocarbon dating

Bone samples from the left ribs in grave 75 were examined at the Poznań Radiocarbon Laboratory (Lab. no. Poz-168046). The sample contained 1.6% N, 6.3% C, and 4.3% collagen, indicating good preservation for dating. The calibration was made with the OxCal software (v4.4.2; Bronk Ramsey, 2020) with the IntCal20 atmospheric curve (Reimer et al., 2020).

4. Results

4.1. Archaeological context analysis

4.1.1. Discovery

Grave 75 was located in the central part of the investigated section of the burial site (Fig. 4), at a depth of approximately 30–35 cm from the surface (top – 67.36 m above sea level). The grave pit had a shape similar to a rectangle. Its length was about 186 cm, width 54–59 cm, and depth 36–40 cm. A deviation from the commonly used orientation of burials at that time (along the E-W axis) was noted – the eastern part was oriented to the south, and the western part to the north (ESE-WNW) (Fig. 5ab). A darker rectangular discoloration was observed under the skull and the shoulder girdle (around 47 x 35 cm), which is most likely a trace of a pillow. A somewhat regular shape of the grave pit in part S and NE, and the remnants of the presumed pillow could suggest that the deceased was buried in a coffin; however, no traces of wood were found.¹⁰ The individual buried in grave 75 was fully extended, on the back, with face upwards. The right arm was slightly bent along the torso, but the moment the skeleton was uncovered, the right arm was slightly bent at the elbow, and the hand was located next to the pelvis, while the left arm was oriented towards the northeast (evidence of a later disturbance of the grave). The legs were extended along the longer axis of the grave (Fig. 5ab). The irregular shapes of the top and floor of this grave pit were observed, as well as its mixed natural geological deposits (Fig. 6).

¹⁰ Even though the presence of a pillow may suggest a more complex funerary structure, such as the use of a coffin, the supine position of the individual combined with the lack of movement observed at the level of the pelvis and legs, indicates that the body was placed in a simple grave, in direct contact with the backfill (Duday, 2005; Duday and Guillon, 2006).

On the neck of the buried individual, a large elliptical sickle was placed with the blade facing the throat, while a triangular padlock was suspended from the big toe of the left foot (Fig. 5 and 6bc). In addition to these two iron objects, fragments of a silk decoration from a head covering were observed on the skull and near the mandible (Fig. 7).

4.1.2. Artifacts/grave equipment elements

The padlock obtained from grave 75 has a triangular body, with a cylindrical cap and keyhole soldered into its upper half. The remaining walls (the lower/bottom and the side ones) were reinforced with soldered strips. Compared to the size of the body, the object has a relatively large, arched, and flat cross-section shackle which tapers to a point. It has a composite snap mechanism, consisting of a shackle, a clamp with a guide, a spring, and a crank hole with a spindle (cf. Rasl, 1987). The padlock was originally closed; however, it was found open, likely due to damage to the mechanism (Fig. 8). The damage likely occurred after the initial burial, but it is difficult to determine when exactly it happened.

The sickle is a large, elliptical specimen, featuring a blade with a serrated cutting edge. The curved blade, 36 cm in length, is bent at a knee-like angle in the section adjacent to the shaft (which has a rectangular cross-section) for the attachment of the handle (Fig. 9). The analysis of the sickle's handle suggests that it was likely made from a material derived from diffuse-porous hardwood (such as birch, alder, or maple); however, it was poorly preserved.

4.2. SEM-EDS analysis of textiles

Fragments of a decorative woven band, called a galloon, preserved around the mandible are the only remains of clothing. The band has been preserved in 12 fragments, with a total length of about 40 cm and a width of 20–23 mm (Fig. 10). The band was woven in a compound weave, typical of 17th-century haberdashery. The main warp was made of silk. Supplementary flushing warp forming a pattern was also of silk with additional four flat metal threads on the edges of the band. Weft was made of metal wrapped-thread (Fig. 11) (CIETA 2021).

The analysis was performed for the metal wrapped-thread used as a weft, and flat metal thread used as a supplementary warp (Fig. 12a). The threads were examined on both sides, outer and internal, and on the edges of the metal strip (Fig. 12b). The results of the SEM-EDS analysis are presented in Tables 3–4. Analysis has shown that a flat metal thread was made of silver. The lamella of metal wrapped-thread was made of silver gilt. Both threads were made of flattened wire, as evidenced by analysis of the lamella edges and the presence of gold on the inner surface of the lamella of wrapped thread. The high aluminium content on the inner surface of the wrapping, in places where the silk core has almost entirely biodegraded, probably comes from the mordant used in dyeing the silk core (Table 4; Hofenk de Graaff, 2004; Cardon, 2007).

It is worth noting that both threads were made of pure silver and gold (Tables 3–4). None of the samples had a significant presence of copper, which is often found in 17th-century metal threads (Bogucka, 1956; Járó and Tóth, 1991; Cybulska et al., 2008; Śliwka-Kaszyńska et al., 2024).

4.3. Osteological analysis

Overall, the skeleton is well-preserved and complete (White and Folkens, 2005). From a taphonomic point of view, two colour alterations are evident: one in the oral cavity and one on the posterior external surface. In the oral cavity, a distinct green discoloration is visible (Fig. 7), typically associated with the oxidation of copper material in proximity. It extends across the body of the sphenoid and the occipital condyles, where it appears darker. Similar alterations can be observed on the first two cervical vertebrae.

The posterior area of the skull is characterized by a dark-brown

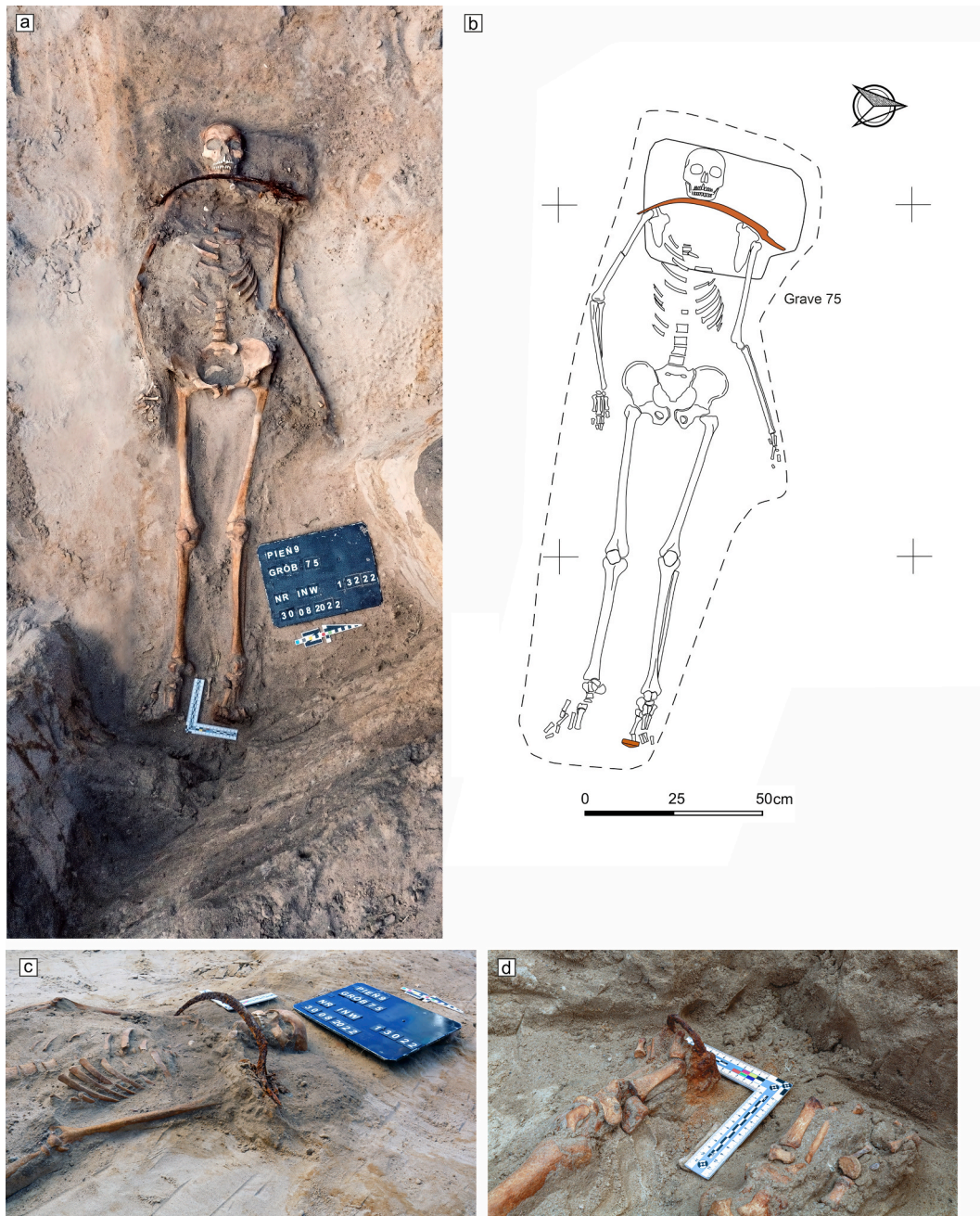


Fig. 5. Grave 75 in situ (a, c-d) and in horizontal projection (b).

staining affecting the entire occipital region and squama, extending onto the parietals above the ophryon area and laterally onto the temporals, without extending beyond the acoustic meatus (Fig. 13). This discoloration may be related to contact with funerary materials (e.g., a pillow or clothing). Minor postmortem cranial flattening (plagiocephaly) in the occipital region is consistent with prolonged supine positioning within the funerary context.

Age-at-death estimation was based on assessment of epiphyseal union and dental development and eruption patterns (Coqueugniot and Weaver, 2007; Cardoso, 2008). The degree of skeletal maturation and third molar development indicates an age-at-death estimate of 17 to 19 years.

Sex estimation suggests that the individual was female, based on pelvic and cranial morphology, and should be interpreted with caution given the developmental stage. However, considering the estimated age-at-death and the complete development of the os coxae, the expression

of secondary sexual characteristics, particularly in the pelvis, provides a reasonably reliable basis for this assessment (Phenice, 1969; Buikstra and Ubelaker, 1994; White and Folkens, 2005).

From an osteobiographical standpoint, there are no significant alterations of the muscular insertions (Donatelli and Scarsini, 2006), except for the area corresponding to the costoclavicular ligament attachment. Here, a lesion, more evident on the right side, is observable and may result from stress associated with rotary movements of the upper limb (Capasso et al., 1999). The individual's estimated height ranges between 162 and 168 cm (5 ft 3.78 in–5 ft 6.14 in), with a mean estimate of 165.49 ± 3.27 cm (5 ft 5 in $\pm$ 1.3 in) based on femoral length. There is no evidence of trauma or pathological conditions that could have led to the death of the individual buried in grave 75: no evidence of antemortem or perimortem traumatic injuries was observed. Due to the absence of preserved soft tissues, no conclusions can be drawn regarding the cause of death.



Fig. 6. Top of gravepit 75 (a) and partially uncovered grave with visible E profile (b-c).

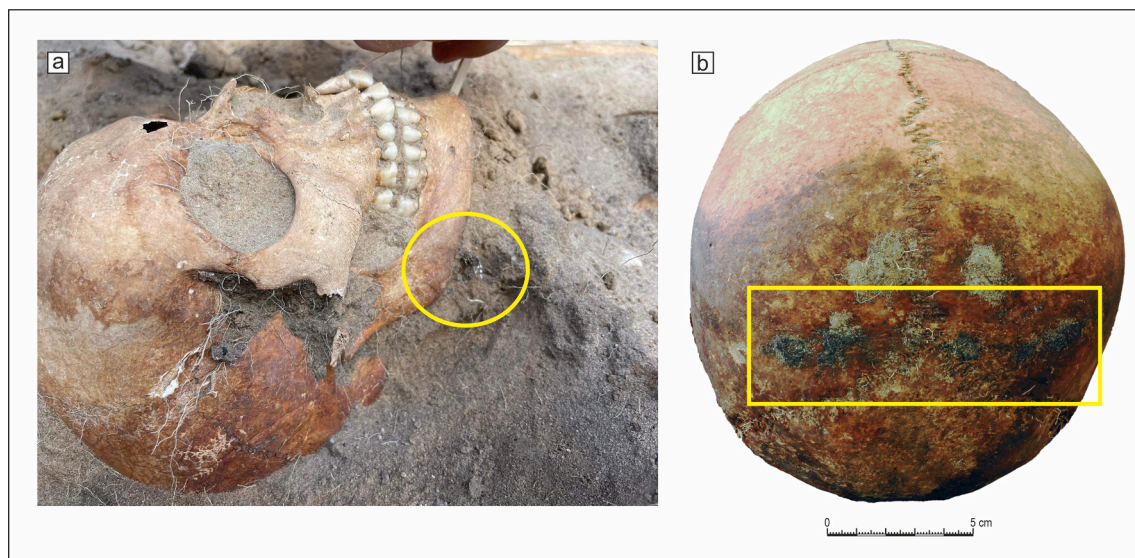


Fig. 7. Remains of silk fabric found near the mandible (a) and the occipital bone (b).

4.4. Ancient DNA analysis

Genetic sex determination revealed that the individual was female (XX). Based on the consensus haplotype (Table 5), her mtDNA was assigned to the West Eurasian haplogroup J1c2c1. It was previously found in a 4th-century CE burial in Nordland, Norway (Margaryan et al., 2020); Iron-Age, medieval, and modern sites of Fennoscandia (Översti et al., 2019), as well as in modern-day populations of Scandinavia, the British Isles, and Germany (Kristjansson et al., 2023). Interestingly, it is virtually absent in modern Slavic-speaking populations, apart from single instances observed in Slovaks, Czechs and Poles (Malyarchuk et al., 2022). Detailed phylogenetic analysis of the haplogroup J1c2c1 shows that its ancestral node is occupied mostly by samples from Scandinavia, both ancient and modern. Meanwhile, some of its younger subclades include Eastern Slavic (J1c2c1b) and Spanish samples (J1c2c1c; Appendix D; Fig. 14). Such topology might point to the Scandinavian origin of the entire haplogroup J1c2c1 and its further dispersals into different parts of Europe, presumably from the Viking period onward (Rodríguez-Varela et al., 2023).

4.5. Isotopic analysis

4.5.1. Migration

Pień individuals have an average $^{87}\text{Sr}/^{86}\text{Sr}$ value of 0.7111 ± 0.0006 (1σ), with a range from 0.7097 to 0.7131. Females (0.7111 ± 0.0006 (1σ)), males (0.7111 ± 0.0006 (1σ)), and individuals with an indeterminate sex (0.7110 ± 0.0007 (1σ)) are not statistically different from each other ($p = 0.66$; Kruskal-Wallis). The local range estimated from the hierarchical cluster analysis ranges from 0.7101 to 0.7119 (Fig. 15). Grave 75 is within the expected range of values for local with an $^{87}\text{Sr}/^{86}\text{Sr}$ value of 0.7113 ± 0.0007 (1σ).

Pień adults have an average $\delta^{18}\text{O}_{\text{VSMOW}}$ drinking water value of -7.78‰ , creating a range from -11.5 to -3.2‰ (Fig. 15). Females (-7.49‰), males (-7.91‰), and individuals with an indeterminate sex (-8.04‰) are not statistically different from each other ($p = 0.27$; Kruskal-Wallis). The 3MADnorm range estimated the local oxygen baseline to range from -10.1 to -5.9‰ . Grave 75 is within the expected range of values for 'local' with a $\delta^{18}\text{O}_{\text{VSMOW}}$ drinking water value of -7.4‰ .



Fig. 8. Padlock from grave 75: drawings (a), a photograph of the front side (b), and X-ray image (c). The X-ray image of the padlock was taken at the Polna Veterinary Clinic in Toruń (intensity: 88 kV, exposure time: 2.21 ms).

Considering both strontium and oxygen isotope values, grave 75 is likely local to the region of Pień. However, it is important to note that the dual strontium and oxygen isoscape showed a high probability (<80%) of originating from multiple regions in Poland, including northern Wielkopolska and Upper Silesia and other locations in Europe, including central Germany (Rhenish Massif, Hesse, and Saxony regions), southern Sweden (Scania region), and central Netherlands (northern Gelderland; Fig. 16).

4.5.2. Diet

The mean $\delta^{15}\text{N}$ value for all females is 10.4‰, and the male mean is 10.6‰ (Fig. 17), indicating no observable sex-based differences in trophic positions. Grave 75's $\delta^{15}\text{N}$ value was 9.4‰, which suggests that

terrestrial (mean $\delta^{15}\text{N} = 6.35\text{‰}$) rather than freshwater (mean $\delta^{13}\text{C} = 9.9\text{‰}$) animals were the primary source of dietary protein. The Pień mean $\delta^{13}\text{C}_{\text{collagen}}$ value for females is -20.1‰ , and the male mean is -19.9‰ . The herbivore mean was -21.6‰ , the omnivore was -21.5‰ , and the fish was -23‰ . The $\delta^{13}\text{C}_{\text{collagen}}$ sample value from grave 75 was -20‰ , further supporting that freshwater fish was not a significant dietary source (Fig. 18).

4.6. Analysis of discoloration on the palate and the vertebrae

4.6.1. SEM-EDS analysis

Using SEM-EDX on the bone fragments originating from the palate (P1-P3), we detected, in addition to elements typically found in bone

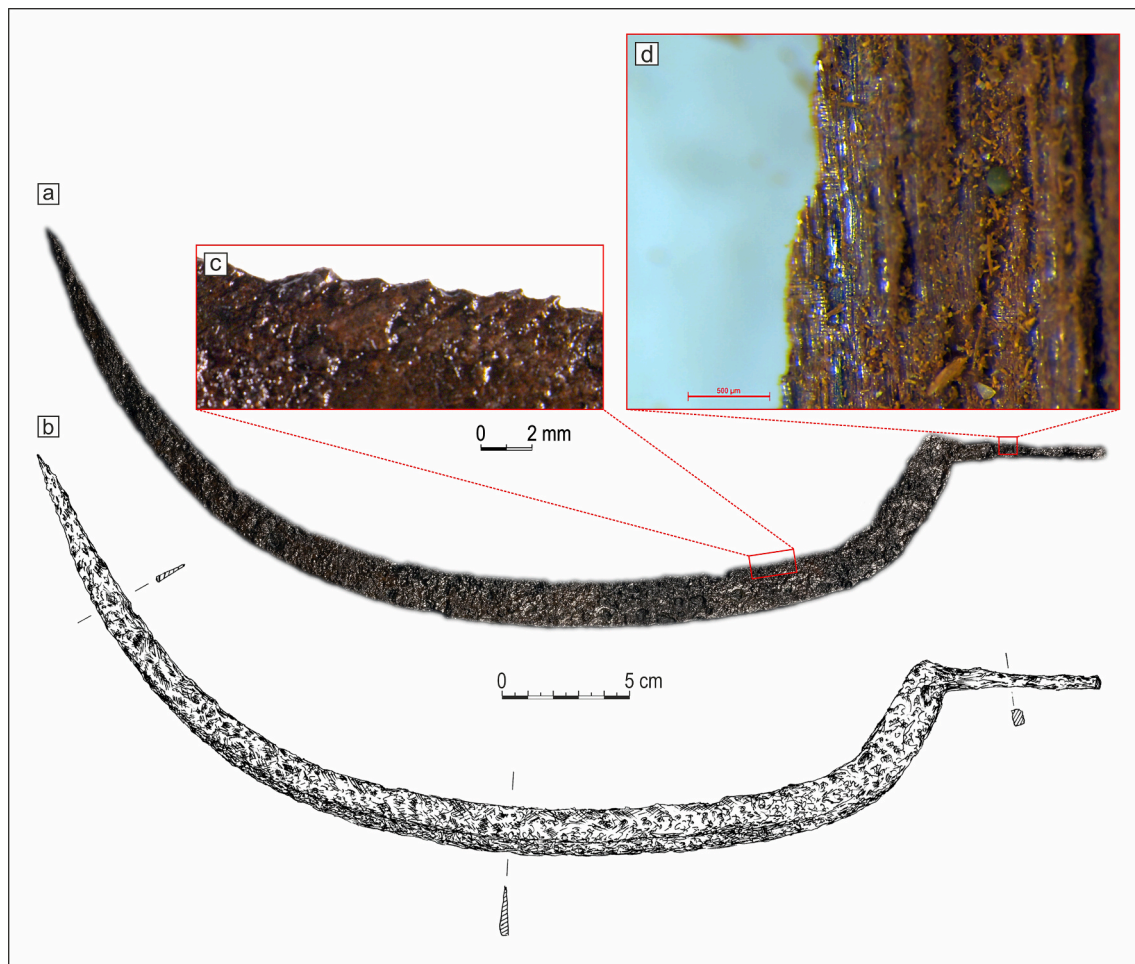


Fig. 9. Sickles from grave 75: a photograph (a), a drawing (b), a microscopic image of the blade fragment (c), and an RL cross-section of a wooden fragment of the sickle handle (d).

and sand, three unusual heavy metals: copper (Cu), manganese (Mn), and gold (Au). Table 6 presents the area-weighted mean contents of metallic elements across multiple scanned regions of each sample. Interestingly, none of the analysed samples contained all three metals simultaneously. Instead, the observed patterns were: copper alone (P3), copper with manganese (P1), and copper with gold (P1). When only copper was present (P3), its content in the analysed scans ranged from 0.2 to 3.7 at%. In the Cu-Mn sample (P1), the Cu/Mn atomic ratio was remarkably consistent, averaging $\approx 3:7$. Similarly, in the Cu-Au sample (P1), the Cu/Au ratio remained stable at $\approx 1:9$. Fig. 19 shows two representative SEM-EDX-scanned areas.

The origin of copper, manganese, and gold on the palate, particularly in such significant quantities, cannot be unequivocally explained. The proportions of copper to gold do not correspond to those found in historical alloys, making it unlikely that these elements originate from a coin placed in the deceased's mouth. No traces of such a coin have been found, and its complete dissolution over several centuries would be improbable. A more plausible explanation is that these three elements originated from decorative items, like copper and gold, or coloured items, like manganese.¹¹

Considering the remaining two palate fragments, acknowledging the expected presence of bone-forming elements, samples from specimen P2

contained only pure iron (Fe), which accounted for the brightness of specific sample regions. Neither copper nor other heavy metals were detected. In samples from specimen P3, only trace amounts of copper (Cu) were identified. The relatively constant copper content suggests that Cu and Fe originated from different sources and did not form an alloy.

Fragments S1 and S2, derived from the vertebrae (C1-C2), were found to contain trace amounts of copper (Cu) and iron (Fe). Analysis of the S1 samples revealed the presence of copper exclusively, whereas the S2 samples exhibited trace levels of copper alongside bright metallic fragments identified as pure iron. Further visual inspection suggested that a portion of the observed iron was not present in the form of metallic particles but rather as oxidation products (rust) coating the bone surface.

4.6.2. MAXRF analysis

MAXRF analysis was performed on the upper maxilla of the skull, specifically the palatal region (area 1), where a light green discoloration was observed. For comparison, a segment of the cranial vault that was also examined was lacking such features (area 2) (Fig. 13). The elemental analysis revealed significant concentrations of calcium (Ca), iron (Fe), zinc (Zn), and copper (Cu) (Fig. 20). Calcium and zinc, along with a portion of the iron, are attributable to the inherent composition of bone, whereas the remaining iron, along with trace elements including potassium (K), manganese (Mn), and lead (Pb) (all $< 0.1\%$), likely originates from post-depositional soil contamination (Fig. 21). These four predominant elements were detected not only in

¹¹ It is also possible that manganese compounds were used for medicinal purposes, as the potassium permanganate and its interesting properties were discovered in XVII century (Palaniappan and Karthikeyan, 2022).



Fig. 10. Fragments of the decorative woven band – the galloon.

the palatal region (Fig. 21: palate posterior) but also in other cranial areas (Fig. 21: cranial vault); however, copper displayed a markedly higher concentration in the posterior palate – at least tenfold compared to other regions – with the highest levels localized near the pharyngeal inlet (Fig. 13). This pronounced enrichment strongly suggests the intentional introduction of a copper-containing object or substance, either deeply inserted into the oral cavity or introduced via the nasal passage.

4.7. Radiocarbon dating

The conventional radiocarbon date of grave 75 was 260 ± 30 BP, which, after calibration, provided a calibrated range of 1515–1800 CE at 95.4% probability and 1620–1674 CE at 52.6% probability (Fig. 22). It can be reasonably inferred that this grave was established approximately during the mid-17th century AD.¹²

5. Discussion

The results of the conducted research make it possible to interpret grave 75 and to assess the social status and origin of the female buried in it.

5.1. Protective items

Grave 75 contains two iron objects: a padlock and a sickle. The presence and placement of the padlock suggest the use of practices intended to protect the living from the deceased. It cannot be interpreted as a utilitarian object, but rather should be considered within a symbolic and ritual framework. The presence of padlocks in graves is most often associated with the burial customs of the Jewish population (Skóra, 2016).¹³ Padlocks and fragments of vessels found in burials are the most encountered remnants of burial practices among Ashkenazi Jews in Poland. They have been recorded in all Jewish necropolises in the former Commonwealth of Poland that have been archaeologically investigated (Fijałkowski, 1989). However, padlocks in graves, but only cylindrical specimens, had been found earlier. They are known from early medieval burial sites in Poland (Greater Poland: Poznań-Śródka and Pyzdry; Krzepakowski et al., 2015). These contexts provide important reference points for interpretation but cannot be directly applied to the burial from Pień. In the graves of the Jewish population, we encounter padlocks of various types, but specimens with a triangular body are relatively rare. Usually, in contrast to the specimen from grave 75 from Pień, they have both sides flat (types 13 and 13a; Fijałkowski, 1989). Besides two additional post-medieval graves (nonadults) from the Pień cemetery,¹⁴ padlocks were also found in graves at a Jewish

¹² Radiocarbon dates were also obtained from bones originating from two earlier burials of the post-medieval cemetery at Pień (graves 45 and 59a): 352 ± 44 BP (1454–1639 cal AD at 95.4% probability) and 345 ± 44 BP (1458–1641 cal AD at 95.4% probability) (Poliński, 2020a).

¹³ It is assumed that the custom of placing padlocks in graves appeared among the Jews in the 16th century and was associated with practical Kabbalah, as well as with magic and belief in demons (cf. Komski et al., 2014).

¹⁴ These padlocks were found in graves 3/05 (Poliński, 2020b) and 92/23; both were located on the big toe of the right foot).



Fig. 11. Galloon detail: face and reverse (a) and visualization of the structure (b).

necropolis in Vilnius, Lithuania (Žukovskis, 2000), and at another Jewish cemetery in Buckow, eastern Germany (Krügel and Kirsch, 2005/2006). Although four padlocks have been found at the burial site in Pień,¹⁵ it is important to categorically reject the idea of treating this necropolis as a Jewish cemetery. Apart from the presence of padlocks in the graves, the most characteristic features of Jewish cemeteries have not been observed, such as the absence of overlapping grave pits, the differentiation of burial zones by gender, or stone matzevot (cf. Wojcieszak, 2012). The hypothesis that only some graves in the cemetery in Pień could contain members of the Jewish community should also be dismissed. According to Jewish law, Jews could not be buried outside their own cemeteries (Wojcieszak, 2012).

¹⁵ The fourth padlock, also triangular but typologically different from the three specimens mentioned above, was found in the humus layer, without a grave context.

The Jewish funerary context can therefore be excluded as a direct explanatory framework for grave 75. Nevertheless, there are some unclear connections regarding burial practices between the local population, partly Protestant, and the Jewish community, possibly resulting in a secondary adoption of the custom of placing padlocks in graves from Ashkenazi Jews (cf. below; Kowski et al., 2014).¹⁶ Locks of various types have been obtained, notably, also from studies of post-medieval Christian cemeteries, not only in Poland but also in Germany, Czechia, and Slovakia (Skóra, 2016) as well. However, these are rare finds. Similar triangular padlocks to the specimen from grave 75 have been reported from Christian cemeteries in Slovakia. One of these padlocks was found in the village of Poltár (Dolný Poltár), dated to the 15th-16th century

¹⁶ Comparable practices involving padlocks in Christian burial contexts persisted into the 19th century, as documented among inhabitants of Polesia (Ciszewski, 1911).

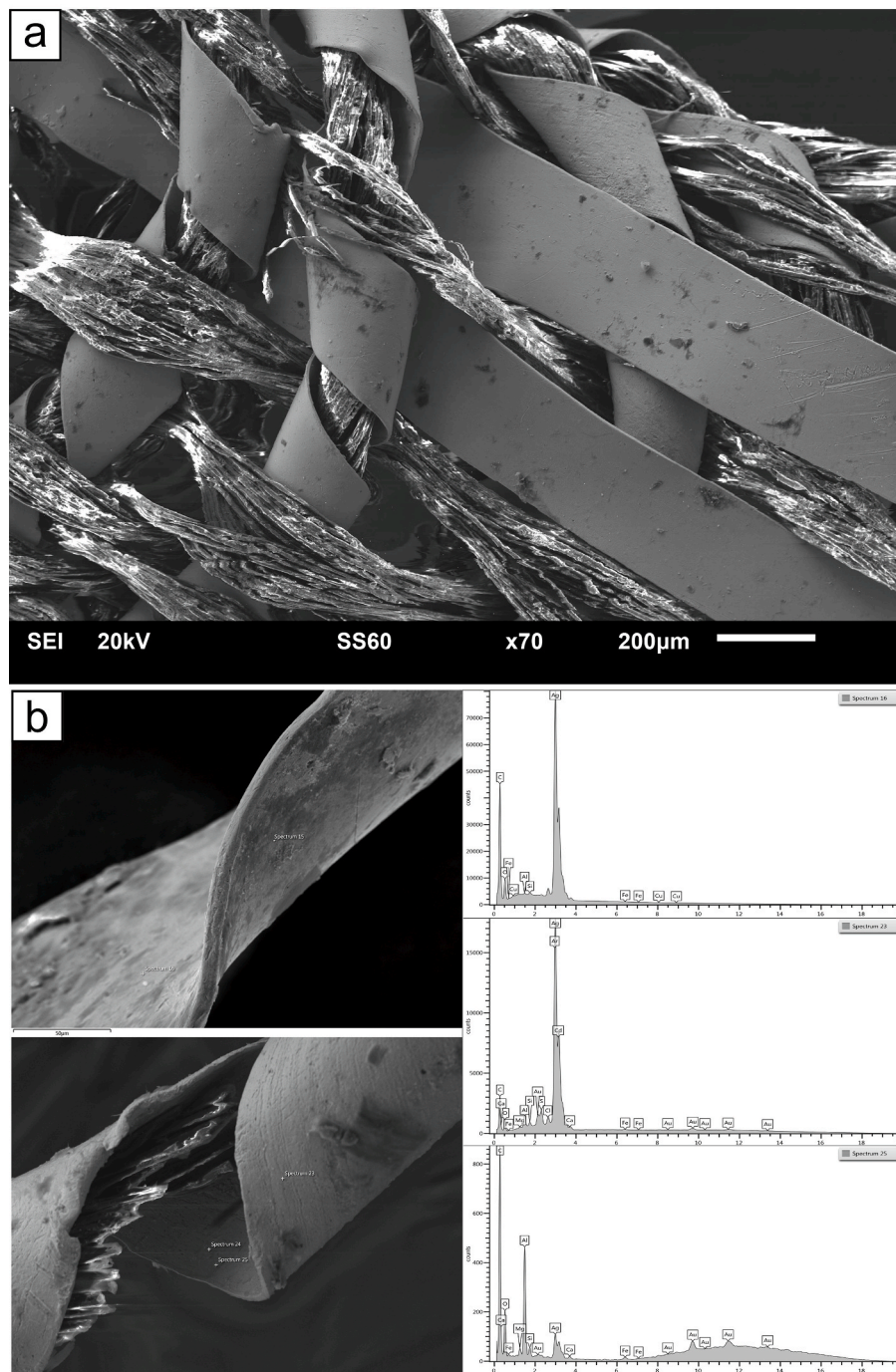


Fig. 12. SEM image of the galloon (a) and analysis of the metal thread (b): SEM image (on the left) and spectra (on the right).

(Hrubec, 1971), as well as a specimen from the village of Smolenice (in the grave of an adult: Dušeková, 1980). It is worth noting that the necropolis in Smolenice belonged to Protestants between 1562 and 1634 (Dušeková, 1980). Triangular padlocks, including specimens with cylindrical fittings, are considered very characteristic of the first half of the 17th century (Haisig, 1962). However, there are known examples originating from the 15th century (circa 1460; Weissenberger, 2011). These observations situate the padlock from grave 75 within a broader post-medieval Christian repertory rather than an exclusively Jewish funerary tradition.

The following examples are not presented as direct analogies for grave 75 but are cited to illustrate the wider circulation and functional variability of padlocks in late medieval and post-medieval Christian

burial practices. In Poland (excluding Pień), locks have been found in several non-Jewish cemeteries from the late medieval and post-medieval periods. From seven graves located in the Church of St. Nicholas in Łeba and the adjacent cemetery (15th-16th century), mainly specimens with a faceted body and a rectangular base were recovered, as well as cylindrical ones and a triangular specimen of type 13 according to P. Fijałkowski (Dąbal, 2021). Padlocks were also found in single, presumably post-medieval graves: near the Church of St. Peter and St. Paul in Kruszwica (a triangular specimen of type 13; according to Poliški, 2020b) and at the burial site in Smoldzino – a child's grave with two padlocks: one cylindrical and one rectangular (Malinowski, 2004), as well as a late medieval burial of a female from Stary Rypin (cylindrical specimen; Lewandowska, 2016). Additionally, in a collective grave from

Table 3
SEM-EDS analysis results for flat metal thread.

Elements	Weight %	
	Total	Composition of the metal thread
C	1.62	—
N	0.29	—
O	8.80	—
Mg	0.02	—
Al	0.25	—
Si	0.34	—
P	0.03	—
S	0.59	—
Fe	0.09	—
Ca	0.11	—
Cu	0.11	—
Ag	87.76	100.00

Table 4
SEM-EDS analysis results for metal-wrapped thread.

Elements	Weight %					
	Total			Composition of the metal thread		
	Outer	Edge	Inner	Outer	Edge	Inner
O	5.31	26.21	38.54	—	—	—
Mg	0.07	2.49	1.91	—	—	—
Al	0.62	37.76	26.73	—	—	—
Si	0.30	2.27	2.54	—	—	—
S	0.53	0.48	0.57	—	—	—
K	0.00	0.35	0.71	—	—	—
Ca	0.10	0.55	0.87	—	—	—
Fe	0.15	0.71	3.07	—	—	—
Cu	0.03	0.00	0.00	—	—	—
Ag	90.50	26.74	22.38	97.42	91.65	89.23
Au	2.40	2.44	2.70	2.58	8.35	10.77

one of the graves (2nd half of the 16th century?) from the necropolis near St. James' Church in Toruń (Grzyb, 2011).

The padlock in the grave is, among other things, a reference to the belief in closing a chapter of life on earth and the beginning of life after death (Drozd et al., 2009; Krzepakowski et al., 2015; see also Cirlot, 2006). The placement of a padlock in the grave could have made communication between the living and the dead more difficult/impossible, interrupted/closed an unfavourable sequence of events, or provided protection against the deceased (Poliński 2020b).¹⁷ The presence of padlocks in graves is also seen as a remedy to stop epidemics (Krzepakowski et al., 2015; Skóra, 2016). Within this interpretive framework, the padlock from grave 75 should be understood as a locally meaningful apotropaic practice embedded in post-medieval Christian folk belief rather than as evidence of direct adherence to Jewish burial customs.

Graves with sickles from the late Middle Ages and the post-medieval period are attested across Central Europe, including northern Germany (Brandenburg), Slovakia, and from northern Poland. In Slovakia, such finds come from the cemetery at Turčianský Svätý Martin and from post-medieval graves in the towns of Smolenice, Gortva-Bizovo, and Krásno (Klein, 2000; Reichenbach, 2004). Sickle-bearing graves from Slovakia, dated to the 16th–18th centuries, do not show evidence of sickles being placed across the throats of the deceased (Borzova, 2006), suggesting regional differences in the funerary use of this object. In Poland, apart from the cemetery at Pień, the largest number of graves containing sickles has been identified at the necropolis in Drawsko, where five post-medieval coffin burials yielded such implements. In four cases (three females and one male), the sickles were placed across the necks of the deceased with the blade oriented toward the throat, while in the remaining burial (a female), the sickle was found on the pelvis (Polcyn and Gajda, 2015). A further comparable example is provided by a grave

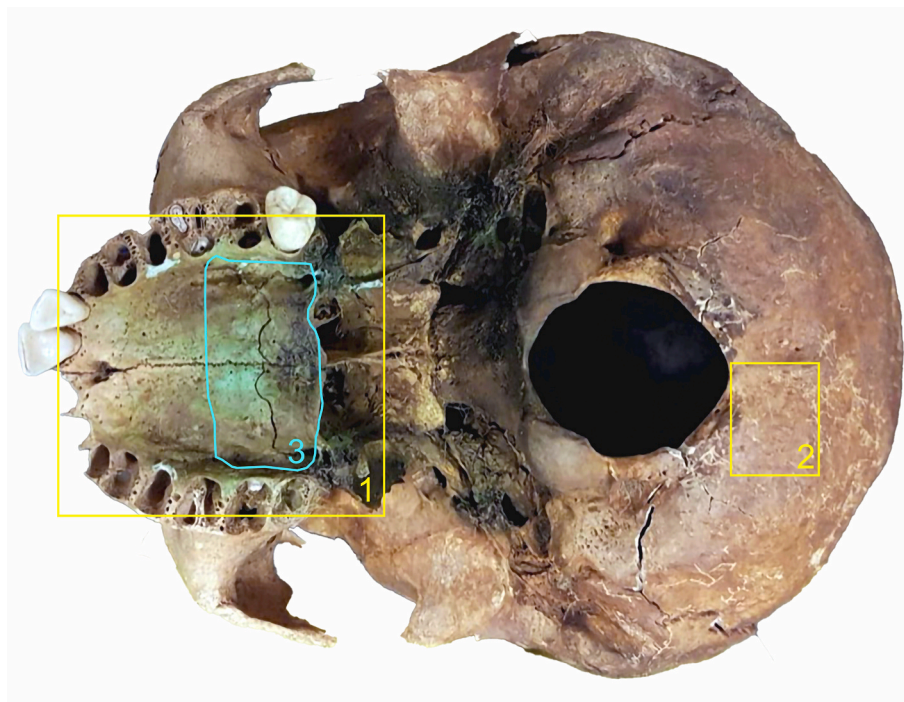


Fig. 13. The inferior view of the examined cranium: 1, 2 – areas of MAXRF scan; 3 – an area of signal integration for XRF spectrum (see Fig. 20: palate posterior), signal integration from area 2 was performed over the whole region (see Fig. 20: cranial vault).

the 17th century uncovered in Skoki, at burial no. 8 (of a young female), a specimen with a spherical body was found (Krzepakowski et al., 2015). The deceased of Protestant faith were also equipped with padlocks, as evidenced by the discovery from the cemetery in the village of Smolenice (see above), as well as the finding of a heavily damaged specimen in

¹⁷ In Polish folk culture, we find distant echoes of the belief in the possibility of sealing a person's mouth through magical rituals involving a padlock. This is reflected in very popular 19th-century sayings such as "zamknij gębę na kłódkę" ("lock your mouth with a padlock") and "gęba na kłódkę na wieki wieków" ("mouth locked with a padlock forever") (see Fijałkowski, 2003).

Table 5
The consensus mitochondrial haplotype received from the sample from grave no. 75 (A139). Mutations were scored relative to the revised Cambridge reference mtDNA sequence (Andrews et al., 1999).

Sample ID	Haplotype
A139	73a > G 146 t > C 185 g > A 188a > G 222c > T 228 g > A 263a > G 295c > T 315insC 462c > T 489 t > C 750a > G 1438a > G 2706a > G 3010 g > A 3107deln 3221a > G 4216 t > C 4769a > R 7028c > T 8860a > N 10398a > G 10685 g > A 11251a > G 11719 g > A 12612a > G 13281 t > C 13708 g > A 13933a > G 14766c > T 14798 t > C 15326a > G 15452c > A 16069c > T 16126 t > C 16519 t > C

discovered at the cemetery in Jaksice in the Kujawy region, containing the skeletal remains of a female with a sickle embedded in the cervical vertebrae (Sikorski, 1970); despite ongoing discussion concerning its chronology, the associated grave goods strongly indicate a post-medieval date.¹⁸ These Polish examples demonstrate that the placement of a sickle across the neck constituted a recurrent and meaningful element of post-medieval burial practice, providing a particularly close parallel for the burial from Pień and indicating that this depositional use of sickles in post-medieval burials was not confined to a specific confessional context but occurred among both Catholic and Protestant communities. Further evidence of this pattern is provided by a 19th-century case reported by Łękowski (1892), in which a skeleton was found with a sickle positioned with its blade facing the cervical vertebrae at a Protestant cemetery.

The sickle from Pień also finds typological analogies in specimens commonly used from the 16th century onward (Baranowski, 1969), although such forms were already in Poland during the Middle Ages (see e.g., Pyzik, 1970; Krause, 1976). Sickle blades with serrated edges were used to cut grain close to the ground (Pawłowska, 1994). Similar sickles were found in three graves of females in a post-medieval cemetery in Drawsko, including the burial of a young female (Polcyn and Gajda, 2015) and in a post-medieval necropolis in the village of Turčianský

¹⁸ There are serious doubts regarding the chronology of this grave, which has been dated to the early Middle Ages (Janowski and Kurasiński, 2010), despite the fact that the grave goods from other burials at this cemetery (including a wreath and medallions) indicate a post-medieval period.

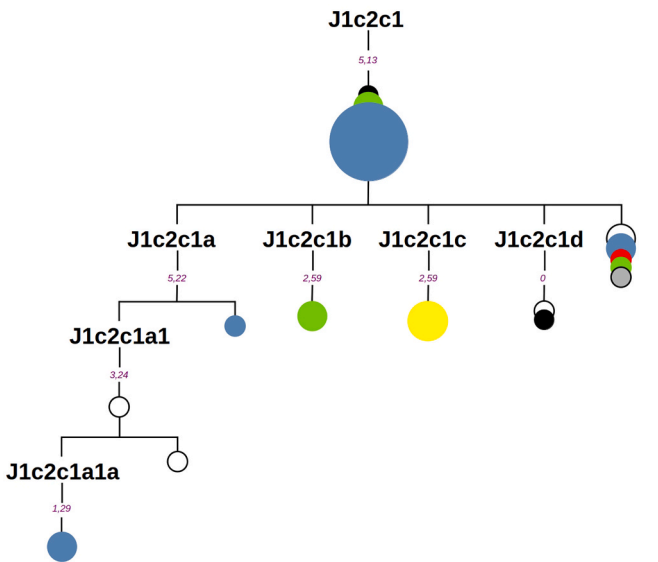


Fig. 14. A simplified mtDNA phylogenetic tree of the haplogroup J1c2c1, based on the phylogenetic tree presented in Appendix D. The size of each circle is proportional to the number of mitochondrial genomes analyzed. Time estimates (in ky) shown for mtDNA subclusters are based on the complete mitochondrial genome clock (Soares et al., 2009). Geographical origins are indicated by different colors: blue – northern Europe (Denmark, Finland, United Kingdom – UK); green – central and eastern Europe (Belarus, Russia, Slovakia, Poland); yellow – southern Europe (Spain); red – western Europe (Germany); black – Caucasian in Africa; grey – America (USA); white – unknown origin (including the grave 75's sample).

Svätý Martin, Slovakia (Budinský-Krička, 1944). However, in these cases, there is no information on whether these specimens had serrated cutting edges.¹⁹ Taken together, the placement and typology of the sickle from Pień fit well within broader post-medieval burial patterns and support its interpretation as an intentional element of mortuary practice rather than a casual or purely utilitarian inclusion. The reasons for placing and the meaning of a sickle in graves are interpreted in a few ways. The placement of a sickle in the grave guaranteed that the deceased would remain there and could not harm the living, but it could also serve to protect the dead from evil forces (Klein, 2000; Polcyn and Gajda 2015; Gregoricka et al., 2014; Gregoricka et al., 2017; Betsinger and Scott, 2014; see also Barber, 1998). However, a case in which the sickle is positioned with the blade facing the neck/throat of the buried individual is unequivocally interpreted as a precautionary measure against the deceased potentially harming the living (e.g., Kozak, 2021).²⁰ It was believed that if the deceased suspected of being a ghost (vampire, łepi) attempted to rise, the sickle would slit their throat and ultimately kill them (Kolberg, 1882; Łękowski, 1892; Moszyński, 1967; see also Barber, 1998). In religious rituals, the sickle is perceived as a means of protection against evil forces due to its iron material and sharp edge (e.g., Reichenbach, 2004; Klein, 2000; Janowski and Kurasiński, 2010).

In the 17th century, not only among the Polish people, various practices aimed at protecting the living from the dead were likely widespread. In addition to placing a sickle or axe around the neck of the deceased, it was common to pierce the heart or behead a corpse

¹⁹ Around the mid-19th century in Germany, skeletons with sickles featuring a serrated cutting edge were found in the churchyard cemetery in Seifersdorf (Eisel, 1871). Similar specimens were also discovered in 1725 at another German necropolis in Göschitz (Barber, 1998).

²⁰ In the crypt of the church in Markowice in Strzelno (Greater Poland) in the 19th century, there was a coffin in which a deceased person lay face down with a sickle placed on the back of their neck (Wyrwa, 2008).

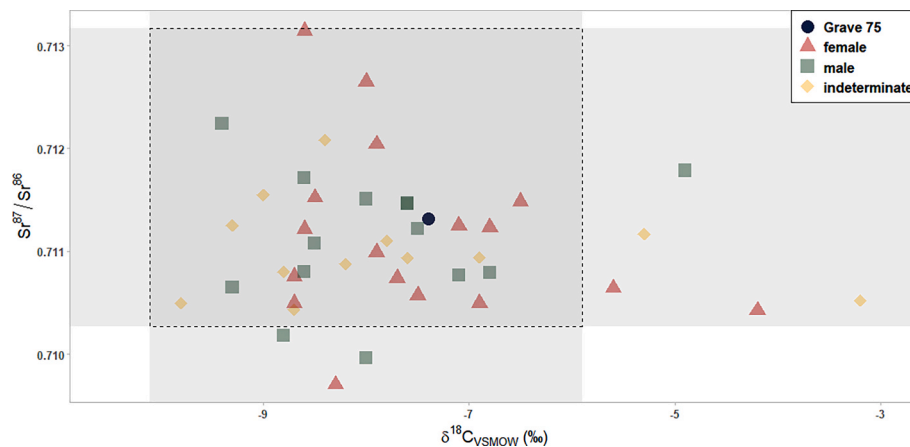


Fig. 15. Pień human enamel $^{87}\text{Sr}/^{86}\text{Sr}$ and $\delta^{18}\text{O}_{\text{VSMOW}}$ values. The grey box indicates the local ranges for strontium and oxygen. The dashed black line is where the $^{87}\text{Sr}/^{86}\text{Sr}$ and $\delta^{18}\text{O}_{\text{VSMOW}}$ values for Pień overlap. Grave 75 is the blue circle. Hierarchical cluster analysis is an unsupervised statistical approach that identifies structure in a dataset without requiring a predefined number of clusters. In the context of strontium isotope data, it groups individuals according to similarity in their isotope ratios. Outliers in oxygen isotope data were identified using the normalized median absolute deviation (3MADnorm). This approach computes the median of the absolute deviations from the dataset median, applies a normalization constant (1.4826), and classifies values exceeding three scaled MAD units as outliers.

Map of ID Grave 075

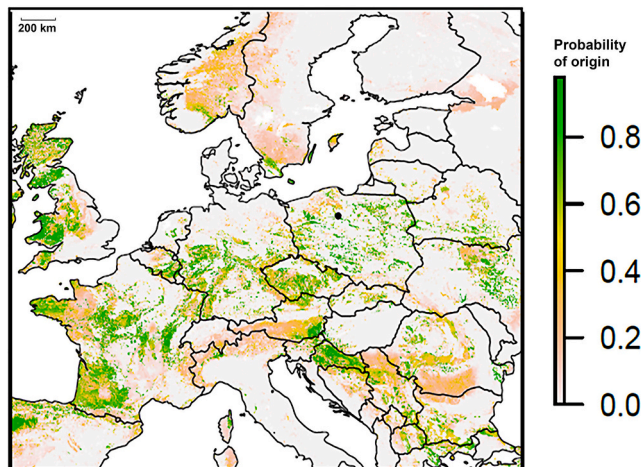


Fig. 16. Dual strontium and oxygen isoscape of Europe showing the probability that grave 75 is from a given location. The coloured legend represents the 'high-probability zone', or the top third of probability (≥ 0.667). The darker the green the colour, the higher the likelihood that the individual is from there. The black dot is the location where grave 75 was excavated.

suspected of being a vampire (wieszci) (Biegeleisen, 1930). A very interesting piece of information, especially in the context of grave 75 from Pień, is the information obtained from the Romanian context that unmarried individuals are more likely to become strigoi (strzyga) after death. Therefore, preventive measures should be taken, meaning that a sickle should be driven into the heart to protect oneself and one's loved ones. If this is not done, the strigoi will attract its relatives to the grave (Perkowski, 1982). Among Polish people, there was a belief that when burying a strzyga, one should place copper on its eyes or a sickle on its throat or turn its face to the ground; otherwise, it would come back to life on the third day (according to Wyrwa, 2008). Based on the xylological analysis of the handle remnants of the sickle from grave 75 in Pień (see above), it was determined that the handle was most likely made from birch/alder or maple wood. It is worth recalling that birch wood was believed to have protective properties against demons, evil spirits, and witchcraft (see Kopaliński, 1990).

The function, symbolism, and placement in relation to the body/

skeleton in grave 75 of both iron objects evoke clear associations. The sickle, with its blade facing downward, was placed on the neck of the deceased young female, while the triangular padlock (Figs. 5 and 6) was hung on the big toe of her left foot. These actions clearly indicate protective practices, referred to as anti-vampiric/anti-demonic. In the case of placing objects in graves intended to protect the living from the dead, preventing their harmful activities, an important question arises: when did this occur? Presumably, most objects with apotropaic significance were placed in the grave at the time of burial and/or at the time the grave was disturbed due to suspicions of the deceased's harmful activities (e.g., Calmet, 1746).

During archaeological research, disturbance of a grave and possible exhumation of the deceased can be confirmed, for example, by observing excavations that disrupt the original grave pit or significant secondary transformations of it (a poorly defined grave pit). Disturbance of the grave may also be indicated by an unusual arrangement of bones/remains or the absence of certain skeletal parts. Graves were often disturbed in cases of legal proceedings against the deceased (e.g., Wojtucki, 2019).

The pit of the grave 75 was poorly defined, with a rather large and irregular top layer. At the skeletal level, distinct disturbances in the outline of the grave pit were observed from the northwest side. Additionally, during the exploration of the grave, mixed layers were identified, especially at the upper part. This could indicate that the grave had been disturbed.²¹ It is likely that at that point, a sickle was placed (driven) with its blade facing the neck of the deceased female as an additional precaution. However, since the anatomical connections of the skeletal elements are preserved, if a reopening of the burial did occur, it can be hypothesized that it took place before the body was fully decomposed, when the soft tissues were still intact and holding all elements, including the weaker joints, in articulation (Duday, 2005; Duday and Guillon, 2006). As can be inferred from the analysis of the

²¹ Numerous cases of grave violations of individuals suspected of harming the living can be learned about from Augustin Calmet treatise from 1746 (Calmet, 1746). In Silesia, for instance, in 17-18th century effective methods of dealing with harmful deceased were developed. From the preserved source materials it follows that the primary action was to locate the grave of the "revenant" in the cemetery, exhumate the body, and destroy it. However, the elimination did not always mean the complete destruction of the unfortunate corpse (Wojtucki, 2019). In Romania, the Dobies of children were exhumed after 3 years, those of young people after 4–5 years, and those of older individuals after 7 years (Petoia, 2004).

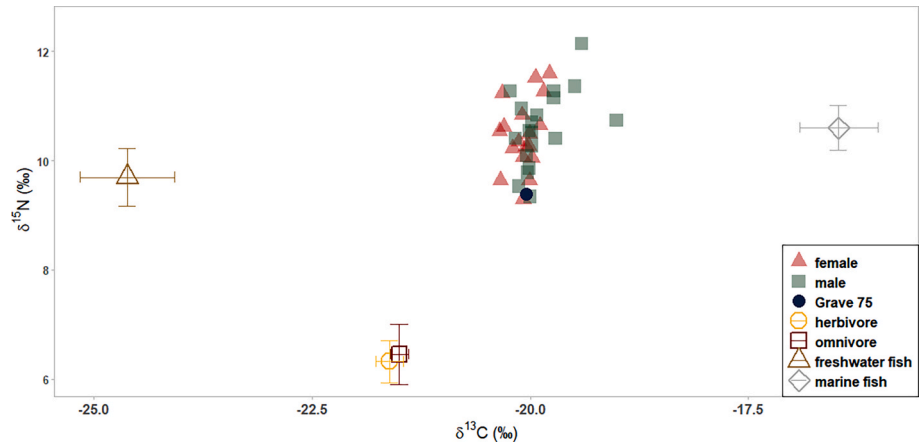


Fig. 17. $\delta^{13}\text{C}_{\text{collagen}}$ and $\delta^{15}\text{N}$ from Pień adults.

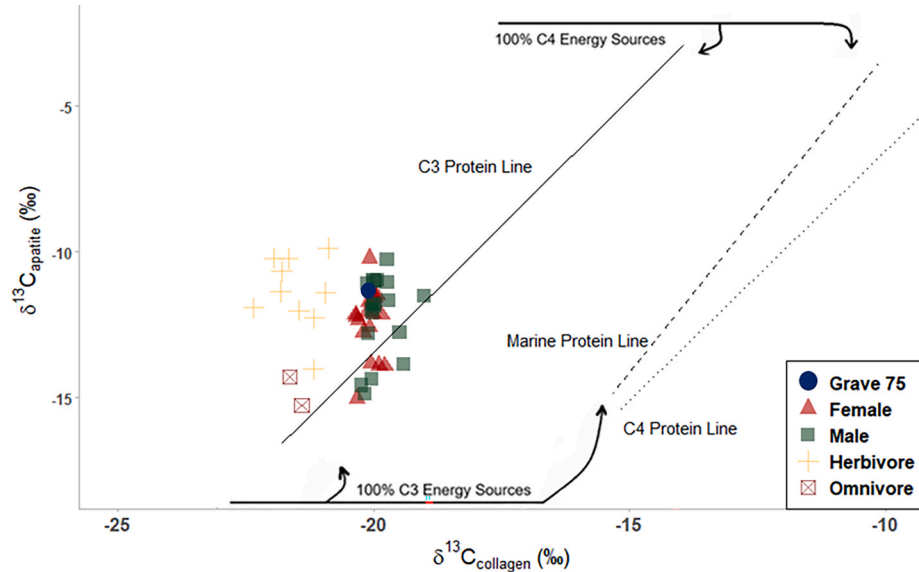


Fig. 18. A regression of $\delta^{13}\text{C}_{\text{collagen}}$ and $\delta^{13}\text{C}_{\text{apatite}}$ of Pień adults ($n = 45$), herbivores ($n = 10$), and omnivores ($n = 2$) is superimposed over the regression lines modeled by Kellner and Schoeninger (2007). The regression lines represent diets based on C_3 , C_4 , or marine protein sources. The endpoints of each line represent a diet based solely on either C_3 or C_4 energy sources. Grave 75's location suggests that their diet is primarily C_3 protein with a mixture of C_3 and C_4 energy sources.

Table 6

Average metal content in individual samples collected from the palate and vertebrae, expressed as weight percent of the total mass of the scanned areas, as determined by SEM-EDS analysis.

Specimen	Average copper (Cu)	Average gold (Au)	Average manganese (Mn)	Average iron (Fe)
Palate (P1)	8.6%	51.9%	20.2%	—
Palate (P2)	—	—	—	80%
Palate (P3)	19.4%	—	—	4%
Vertebrae (S1)	0.3%	—	—	—
Vertebrae (S2)	0.9%	—	—	6.5%

arrangement of the postcranial skeleton, especially the leg bones, the padlock must have been on the left foot's big toe at least since the time of the original burial.

Another protective measure against the deceased was most likely applied as well. The extensive greenish discoloration (due to copper

oxide) on the palate is noteworthy, with a concentration near the throat extending to the base of the skull, the interior of the nasal cavity, and the first two cervical vertebrae (C1-C2). It is therefore possible that a larger object made of, or containing, a copper alloy was inserted into the individual's mouth. However, the conducted elemental analyses (SEM-EDS and MAXRF) did not allow for a definitive determination of the nature of the object responsible for such extensive discoloration. A coin, however, can be ruled out. Archaeological studies have documented finds of coins in mouths, but with relatively minor discolorations primarily on the inner side of the mandible (e.g., other examples from the burial sites in Pień and Drawsko; cf. Poliški, 2020b; Polcyn and Gajda, 2015), which serve as evidence for the practice of such anti-vampiric/anti-demonic rituals (e.g., Moszyński, 1967). The placement of stones, bricks, and other objects in the mouth of the deceased appears to represent a similar practice (e.g. Biegeleisen, 1930; Nuzzolese and Borriani, 2010; Kozak, 2021).

Taken together, the evidence suggests that the use of both padlock and sickle in grave 75 should be understood as part of a broader repertoire of apotropaic practices in post-medieval Central Europe, rather than as an indicator of affiliation with any single cultural or religious tradition.

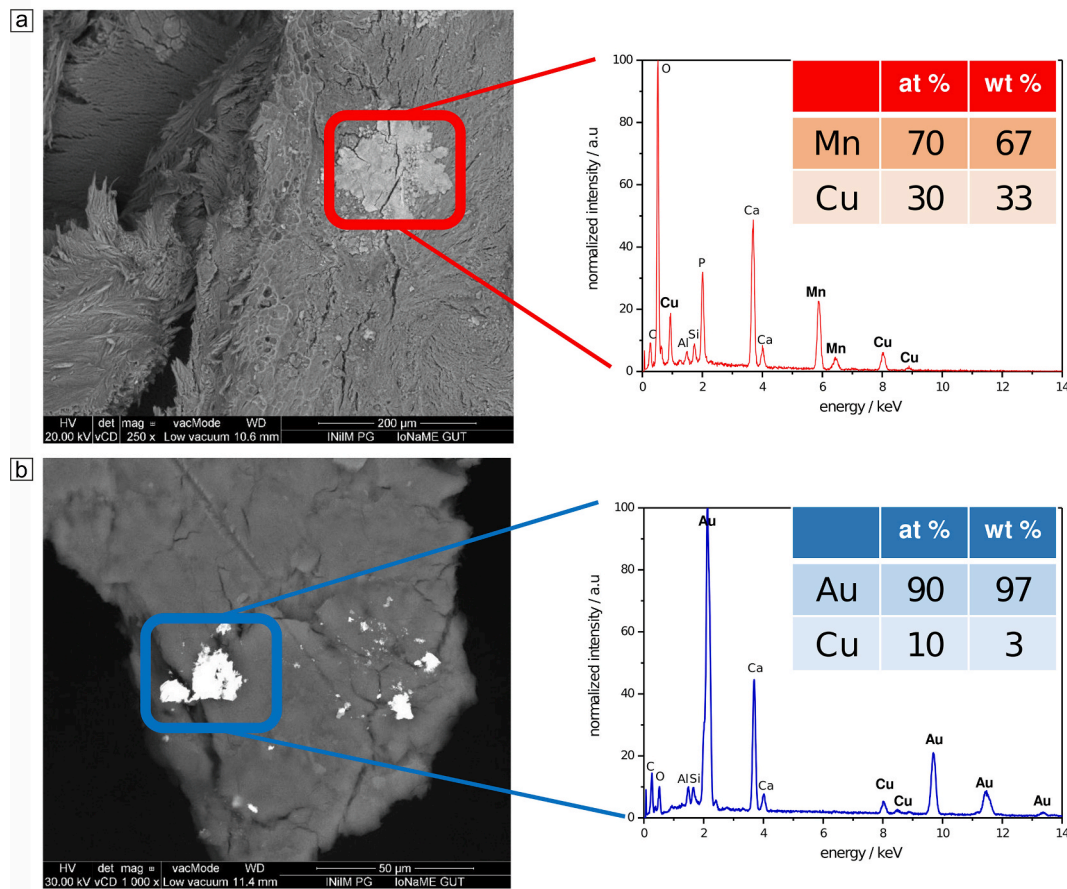


Fig. 19. Representative images of bone fragments originating from the palate (sample 001), captured using FEI Quanta FEG250 electron microscope. The brighter areas stand out against the darker bone matrix due to the presence of heavier elements: copper (Cu), manganese (Mn), and gold (Au). Abbreviations: at% – relative atomic percentages; wt% – relative weight percentages of heavy metal content.

5.2. The origin

The female's mtDNA has been assigned to the West Eurasian haplogroup J1c2c1. Based on the phylogeographic peculiarities and the evolutionary age of this haplogroup, one potential scenario is that the female buried in grave 75 may have had maternal-line ancestry ultimately linked to Scandinavian populations; however, this represents only one of several plausible geographic origins for this lineage.

While the isotope values of $87\text{Sr}/86\text{Sr}$ and $\delta^{18}\text{O}$ suggest grave 75 was within the range of Pień's local values, there is an overlap with other regions of Poland and other locations in Europe, including southern Scandinavia, the Netherlands, and German territories. All of these regions are justifiable considering the history of Pień and its surroundings in the 16th-17th centuries (see cf. 2.3.). Although this female spent her childhood in the Pień region, her mtDNA may indicate a possible non-local maternal ancestry, consistent with a second- or later-generation migrant, potentially linked to southern Scandinavia. Further analysis with dental morphology and considering sulphur isotopes could provide more insight. It is important to emphasize that neither mtDNA nor isotope ratios alone can determine an individual's geographic origin with certainty; each reflects different aspects of biogeographic history and therefore allows only a probabilistic, multi-scenario interpretation.

5.3. The social status

The female from grave 75 was originally, and most likely, buried in a coffin. As for the grave clothing, it was almost completely degraded

in the destructive grave conditions, like all organic matter. Only small amounts of silk fibres survived, mainly due to the presence of metal components of the threads. Due to the location of the only surviving part of clothing, the galloon, it was most likely used as a cap trimming. Various types of trimmings were extremely fashionable in the 17th century, as one can see in the portraits from this era – galloons, ribbons, strings, and lace were used to decorate the clothing along cuts, seams, and on edges. Sometimes all of the clothing was decorated with golden galloons applied every few centimetres along the entire length (Turnau, 1991; Cybulska and Drązkowska, 2023; Śliwka-Kaszyńska et al., 2024). It is worth noting that both metal threads of the galloon were made of pure silver and gold (Tables 3-4). None of the samples had a significant presence of copper, which is often found in 17th-century metal threads. During this period, threads made of gold were rarely used; most often, so-called gold threads were made of gilded silver and sometimes also gilded copper. For comparison, among the metal threads from the burial robes of King Sigismund III Vasa and Queen Constance of Habsburg, there is not a single thread made entirely of gold (Cybulska and Drązkowska, 2023; Śliwka-Kaszyńska et al., 2024). Galloons made of silk and gold or silver threads were intended for the richest: aristocracy, nobility, and wealthy burghers. To poorer citizens, merchants offered cheaper haberdashery products, made of materials such as flax, cotton, copper and iron. Therefore, the galloon belongs to luxury products and testifies to the social status of a buried person (Bogucka, 1956). Taking into account the above considerations, it can be concluded that the woman originated from a higher social class (perhaps a noblewoman); she was likely not a peasant.

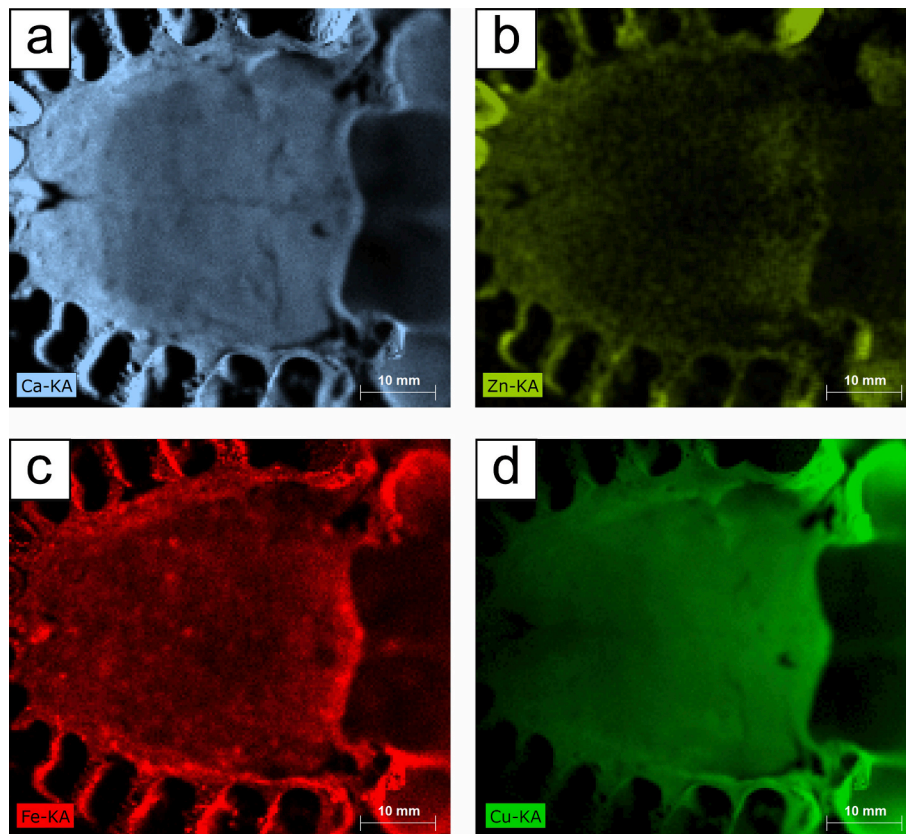


Fig. 20. Elemental maps of the skull palate (area 1) acquired by MAXRF (macro X-ray fluorescence spectroscopy): Ca (a), Zn (b), Fe (c), Cu (d).

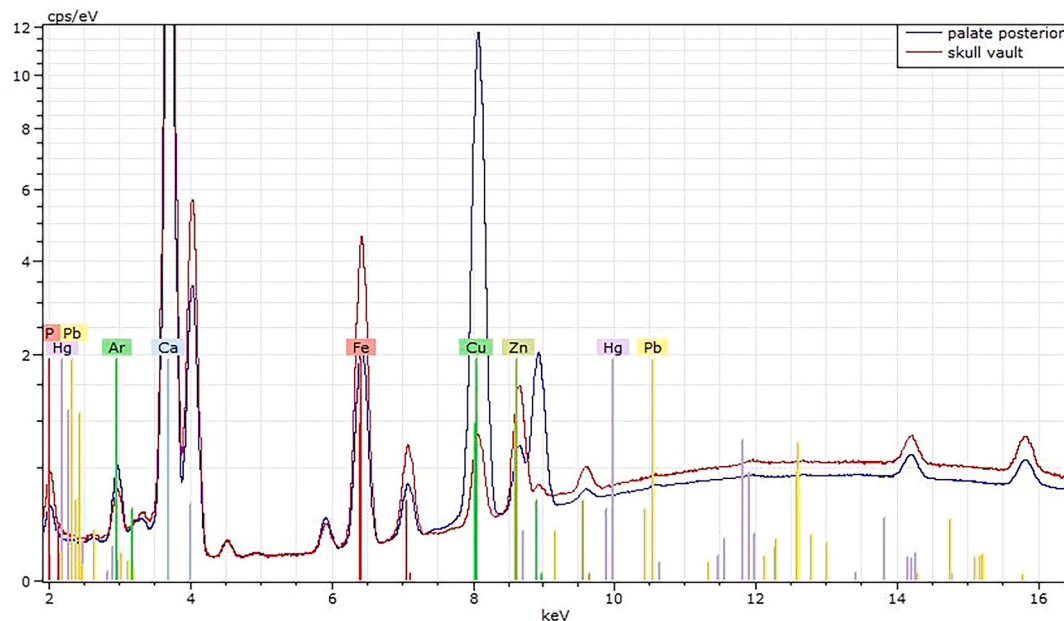


Fig. 21. MAXRF spectrum of the posterior region of the palate (cf. Fig. 13: area 3) and cranial vault (cf. Fig. 13: area 2).

5.4. The diet

By determining the high social status of the person buried in grave 75, mainly based on the luxurious material from which the cap was made, one would expect this to be confirmed in the results of stable isotope analyses and osteological studies. However, it is important to remember that the 17th century in Europe was characterized by challenging living conditions

resulting from a significant deterioration in climate (the so-called Little Ice Age), ongoing wars, including those with religious motives, and rampant epidemics (Mann, 2002; Wandycz, 1984). Thus, general malnutrition may have been quite characteristic. The $\delta^{13}\text{C}_{\text{collagen}}$ value of the sample from grave 75 falls within the expected range for individuals consuming C_3 resources, likely grains such as wheat, barley, rye, and vegetables; yet it shows one of the lowest nitrogen levels among other Pień adults. However, grave

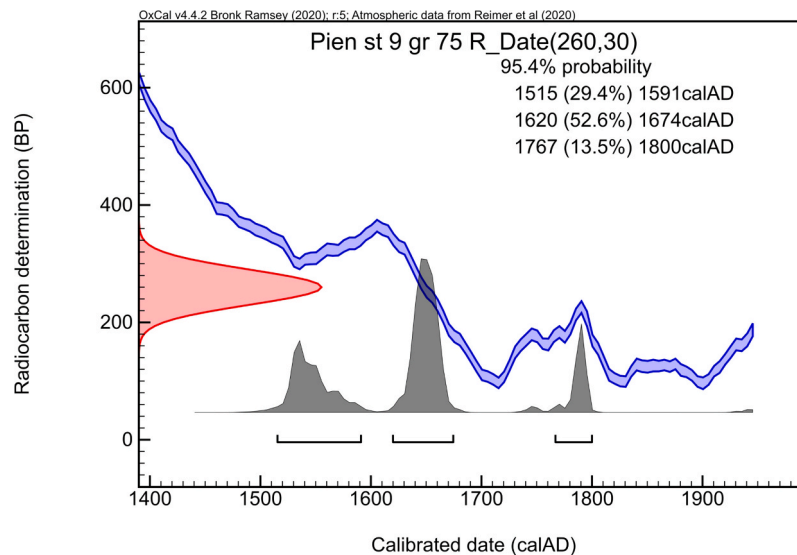


Fig. 22. Grave 75. Radiocarbon test results.

75 is still $\sim 3\text{--}5\%$ above the average herbivore, suggesting that animal protein was part of their diet. Relative to the rest of the human sample from Pień, grave 75 is in the 8th percentile for animal protein consumption. On the $\delta^{13}\text{C}_{\text{Capitite-collagen}}$ plot, grave 75 does not plot at the base of the C_3 protein regression line, suggesting there was a combination of C_3 and C_4 carbohydrates and lipid consumption (i.e., direct consumption of millet and C_3 -based plants) (Fig. 17). If grave 75 was consuming fish or millet indirectly via animals with a millet-based diet, then they would plot closer to the C_4 protein line. Consistent with Fig. 15, grave 75 primarily had a diet of C_3 animal-based protein.

5.5. The fear of the dead

The original burial, involving a padlock placed on the toe, may indicate that there was a fear of the deceased's return (thanatophobia) (cf. Stomma, 2000). This practice may be interpreted as an attempt to symbolically limit the deceased's postmortem agency, symbolically constraining her potential return to the world of the living and interaction between the realms of the living and the dead. The female's partial Scandinavian ancestry may have influenced how she was perceived within her community, though current mtDNA or isotope evidence does not definitively demonstrate that she herself was a first-generation migrant or socially viewed as non-local. If she were a second- or later-generation descendant of immigrants, she may have been considered fully local despite ancestral ties elsewhere. Consequently, while aspects of her ancestry could have contributed to perceptions of social difference or potential risk, numerous other factors, including age-at-death, possible violent or unusual circumstances surrounding her death, disease, social behavior or other situational factors not archaeologically visible (Gregoricka et al., 2014; Betsinger and Scott, 2014; Gregoricka et al., 2017; Scott et al., 2020), may also explain her treatment, underscoring the complexity of interpreting such burial practices from the archaeological record. The original burial secured with a padlock, her possible foreign origin (as a second- or later-generation migrant), and the probability that her death was perceived as a 'bad' one could together have been sufficient²² for the local population to blame this deceased woman

for misfortunes (e.g., disease, epidemic, famine). These interpretations should be regarded as hypotheses grounded in analogical reasoning and ethnographic parallels, rather than definitive statements about 17th-century beliefs or motivations, as multiple cultural, situational or practical factors could also explain the observed burial practices.

6. Conclusions

A non-normative 17th-century burial of a young female (grave 75), discovered at the cemetery in Pień, is distinguished within the current body of published research by the rare co-occurrence of two apotropaic measures, a sickle and a padlock, within a single grave. Evidence of practices aimed at protecting the living from the deceased is provided not only by the objects found in this grave (a padlock and a sickle) but also by their specific location within the grave. The observed layers connected with grave 75 may indicate its later disturbance. The specialized analyses conducted so far have yielded new information about the female buried in this grave, particularly regarding her high social status (grave clothing with an expensive decoration on the cap), her diet, and aspects of her biological background revealed through genetic and isotopic analyses. Grave 75, as well as other non-normative graves in the cemetery in Pień, demonstrate practices of a protective/anti-demonic nature and vividly illustrate superstitions, including the tendency to blame the deceased for misfortunes and the fear of the unknown in the 17th-century Polish-Lithuanian Commonwealth.

CRediT authorship contribution statement

Dariusz Poliški: Writing – original draft, Methodology, Investigation, Interpretation. **Magdalena Zagrodzka:** Project administration, Funding acquisition, Investigation. **Tomasz Grzybowski:** Investigation (DNA analysis), Writing – original draft. **Matteo Borrini:** Investigation (Osteological analysis), Writing – original draft. **Paige A. Lynch:** Investigation (Isotopic analyses), Writing – original draft, Visualization. **Maria Cybulska:** Investigation (Textile analysis, SEM-EDS analysis), Writing – original draft, Visualization. **Jacek Grabarczyk:** Investigation (SEM-EDS analysis), Visualization. **Magdalena Kowalska:** Investigation (MAXRF analysis), Visualization. **Tomasz Laskowski:** Investigation (SEM-EDS analysis), Visualization. **Jakub Karczewski:** Investigation (SEM-EDS analysis), Visualization. **Paweł Molewski:** Investigation (Geographical analysis), Visualization. **Piotr Engelhardt:** Investigation (Osteological analysis). **Łukasz Czyżewski:** Software (GIS & 3D data processing and modelling), Visualization.

²² Post-medieval superstitions suggest that the greatest fear was associated with individuals who died a "bad" or violent death, such as by drowning, accidents, etc., especially at a young age (e.g., Stomma, 2000). Such beliefs provide a cultural framework within which deviant or unusual burial practices may be interpreted.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendices A–D. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jasrep.2026.105967>.

Data availability

Data will be made available on request.

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