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A Glazed Easter Egg Rattle from a Grave in the Cemetery in Kołoząb. Technological Features and Lead Provenance

Abstract

The article presents the results of interdisciplinary research on a glazed Easter egg rattle discovered at an early medieval cemetery in Kołoząb, northern Mazovia. Although not the first find of its kind in the region, the artifact significantly contributes to the existing knowledge of such objects in Polish territories. Technological and chemical analyses (CT, XRF, SEM-EDS, and lead isotope analysis) allowed for a detailed characterization of its manufacturing technique and the identification of the raw material used for the glaze. The results indicate the use of lead sourced from the Upper Silesia and Kraków Upland regions, suggesting local production. At the same time, the ornamentation and form of the rattle show strong analogies with finds from the Rus' area, pointing to the transmission of cultural models and technologies across early medieval Slavic lands. The artifact fits into the broader context of egg-shaped rattle finds from Central and Eastern Europe, including those from child and barrow burials, emphasizing their diverse symbolic roles.

Keywords: glazed Easter egg rattle, technology, lead, isotopes, Mazovia, early Middle Ages, cemetery

Introduction

The presented glazed Easter egg rattle from the Kołoząb cemetery, Płońsk County, Masovian Voivodeship (Fig. 1), although not the first find of this type from the historical region of Mazovia, constitutes an important contribution to the current state of research. As early as 1971, during accidental earthworks related to ditch digging at the cemetery site in Podgórze-Parcele (Płock County, Masovian Voivodeship), a similar assemblage of finds was uncovered, including ceramics and a glazed Easter egg rattle.[1] However, in a later publication, only a white glazed knobbed rattle was mentioned.[2]

In this context, the artifact from Kołoząb represents a valuable addition to our knowledge of egg-shaped rattles from northern Poland, especially within Mazovia – a region that still remains something of a "blank spot" in research on this type of object. Since this is a rediscovered "old" artifact, it has been subjected to interdisciplinary analysis. One of the main goals of our study was to determine the origin of the raw material used in the production of the glaze – more specifically, to identify the source of the raw materials involved in its manufacture. The results of the provenance analysis presented here constitute the first such study of glaze on early medieval egg-shaped rattles and serve as a starting point for further research in this area.

Material and Analysis

Description of the Glazed Easter Rattle

The discussed glazed Easter egg rattle, discovered at the Kołoząb cemetery, was made of red clay. Its form resembles that of a hen's egg, measuring 4.8 cm in height, 4 cm in width at the lower part, and 1.2 cm at the upper section. At the base, there is a visible opening with a diameter of 0.4 cm. The surface of the artifact, including the interior of the aperture, is coated with a thin layer of dark brown glaze. The decorative composition is complemented by applications of yellow glaze arranged in a festoon pattern (Fig. 2).

The Cemetery at Kołoząb – A Brief Research History

In Kołoząb, located on the Płonka River in northern Mazovia, there is a settlement complex from the Roman Period (sites 1–3), discovered in 1959.[3] Excavations were carried out in the 1960s and in 1975. Documentation and finds from the Roman period cemetery were transferred in 2001 to the State Archaeological Museum in Warsaw. Documentation, finds from the settlements and early medieval artifacts discoverd in the cemetery are stored in Institute of Archaeology and Ethnology PAN in Warsaw.

So far, the results of excavations on the settlements discovered in Kołoząb have been partially published.[4] Information on the results of excavations on the cemetery has been made public to a much lesser extent.[5] However, a preliminary study of the results of these excavations has been prepared.[6] Thanks to this, it is known that in the cemetery dating back from the late pre-Roman period to the late Roman Period, over 440 cremation graves were discovered on an area exceeding 0.5 ha. Graves belonged to the population of the Przeworsk and Wielbark cultures, as well as to the unspecified culture. In addition, several dozen different types of pits and probably traces of stone structures in the form of pavements, possibly also circles and steles, were recorded.[7] In the context of the glazed Easter egg rattle presented here, the most important thing is the discovery of several, or perhaps a dozen or so, early medieval skeletal graves.[8] Grave goods found at the site – including five silver-plated bronze temple rings, an axe, two iron knives, and a clay vessel – are typical of richly furnished skeletal graves with stone constructions in Mazovia.

Based on the available field documentation, it is not possible to determine in which early medieval grave at the Kołoząb cemetery the presented Easter egg rattle was discovered. The artifact is stored together with the skull of a child, which may suggest it was part of a specific burial, but this remains uncertain.

Analysis and Instruments

The internal structure of the object has been studied using an X-Ray CT scan conducted at the National Centre for Nuclear Research with a self-built CT system. The X-Ray tube was set to 270 kV and 2.9 mA. A beam hardening filter of 1.5 mm Cu and 4 mm Al was applied. The imaging detector was a Perkin Elmer flat panel with 200 µm pixel pitch. Despite using relatively high-energy X-Rays the obtained images include metal artifacts resulting from Pb content in the object's coating. Subsequently, an elemental composition analy-

[1] Przybysz 1972, 210a.
[2] Kordala 2006, 203–204, Fig. 30:d.
[3] Pyrgała, Szymański 1962, 70, 73, Fig. 1.
[4] Pyrgała 1968; 1972; Pyrgała, Urbańczyk 1976, 107–108; Pyrgała, Tomaszewska 1986; Natuniewicz-Sekuła 2006.
[5] Pyrgała 1968; 1970; Andrzejowski 2004; Pyżuk 2004.
[6] Andrzejowski 2006. The authors wish to express their sincere gratitude to Dr. hab. Jacek Andrzejowski for kindly granting permission to use this study.
[7] Andrzejowski 2006, 6.
[8] Andrzejowski 2006, 1–2, 213–215, Fig. 2-3.

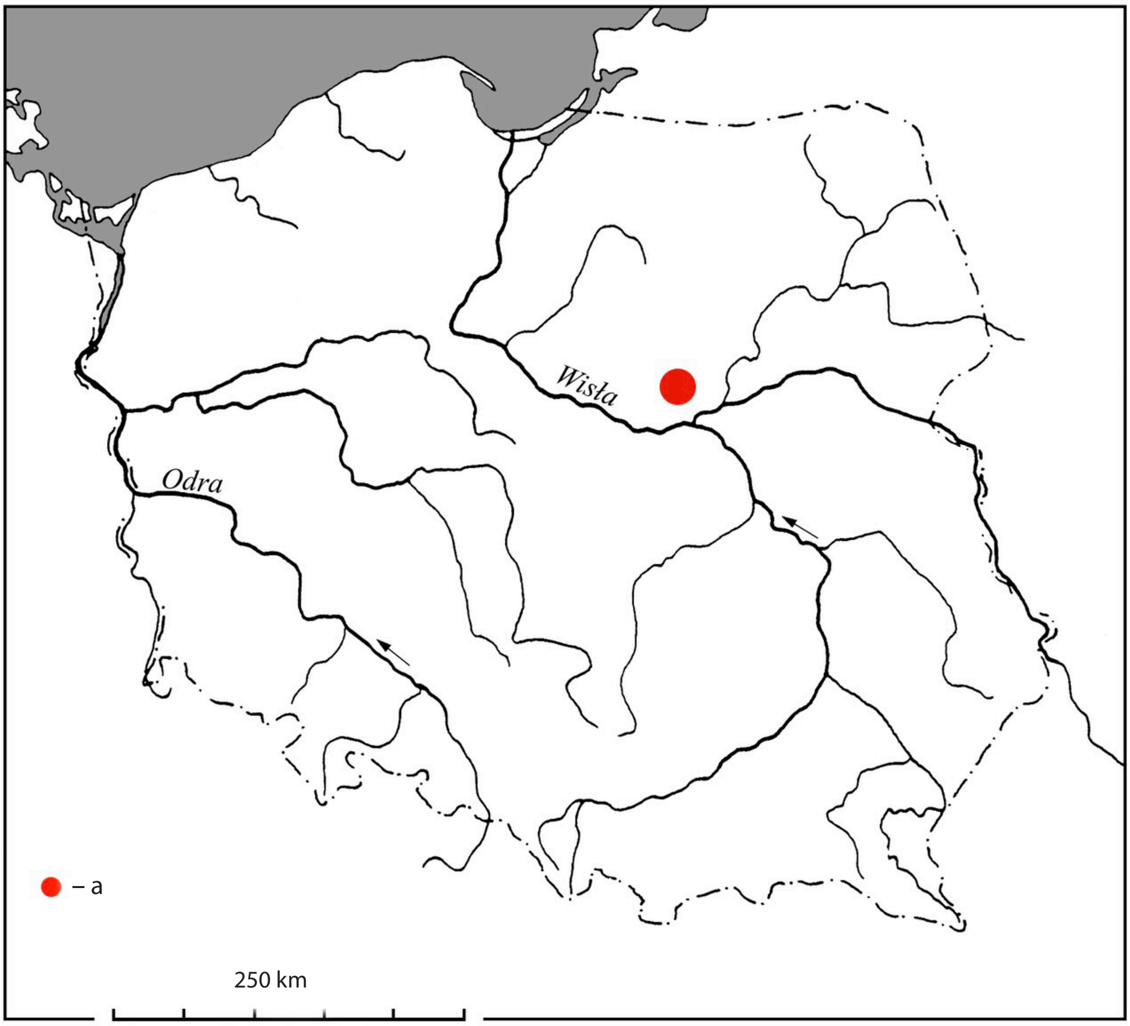

Fig 1. Location of the Kołoząb cemetery (a), Płońsk County, Masovian Voivodeship (drawing by B. Sz. Szmoniewski).

sis (semi-quantitative) was carried out at the Laboratory of Archaeometallurgy and Conservation of Archaeological Artifacts of the Institute of Archaeology, Jagiellonian University. To preliminarily distinguish the composition of the colored layers of glass enamel, X-ray fluorescence (XRF) spectroscopy was employed. A benchtop X-ray fluorescence spectrometer for microanalysis, Spectro Midex (MID03), was used for the analysis of metal alloys. XRF measurement parameters: spot analysis, spot diameter: 3.3 mm, internal standardless calibration, measurement time: 20 s, voltage: 40 kV, Mo tube. The obtained results were presented in oxide form using stoichiometric calculations (Tab. 1).

Next, to supplement the elemental composition data of the surface, measurements using scanning electron microscopy with energy-dispersive X-ray spectroscopy (SEM-EDS) were carried out on samples taken from the enamel. A Tescan Vega 3 XMU SEM with an Aztec X-Max 50 EDS analyzer (resolution: 124 eV) was used. Parameters: E = 20 kV, and the EDS spectrum acquisition time was adjusted to the characteristics of each sample. Due to the condition of the surface, which did not allow for sampling while preserving the technological stratigraphy of the object, the samples for SEM-EDS analysis were in the form of chips (cf. Fig. 4). Tab. 1 shows the obtained EDS results.

The lead isotope analysis of the Easter egg rattle was carried out at the Biological and Chemical Research Centre, University of Warsaw. Full procedural details can be found in the studies by Karasiński *et al.*[9] Samples un-

[9] Karasiński *et al.* 2023.

Fig. 2. Glazed Eastern egg ratlle from Kołoząb cemetery, Płońsk County, Masovian Voivodeship (photo by R. Czech-Błońska).

Table 1. XRF and EDS results (wt%, ±1σ) with descriptions of the sampling. Data are normalized to 100%

No.	Sampling area	CuO	SnO_2	PbO	ZnO	Fe_2O_3	Al_2O_3	SiO_2	P_2O_5	CaO
	XRF surface analysis:									
1	yellow glaze	0.4 ±0.003	9.8 ±0.04	86.8 ±0.1	0.03 ±0.001	3.0 ±0.01	-	-	-	-
2	dark brown glaze	0.8 ±0.006	0.3 ±0.02	85.8 ±0.1	0.05 ±0.001	13.0 ±0.03	-	-	-	-
	EDS analysis of the glaze samples **(see Fig. B)**:									
1	**(a)** Pigment mixing area – dark in BSE image / dominance of yellow Sn.	<0.1	6.5 ±0.2	23.1 ±0.4	<0.1	1.4 ±0.1	0.8 ±0.1	66.6 ±0.4	1.2 ±0.1	0.4 ±0.1
2		<0.1	6.5 ±0.2	18.2 ±0.3	<0.1	2.1 ±0.1	1.0 ±0.1	70.6 ±0.4	1.2 ±0.1	0.4 ±0.1
1	**(b)** Pigment mixing area – bright in the BSE image / dark brown Fe/Cu.	2.2 ±0.3	3.4 ±0.3	64.9 ±0.5	<0.1	5.5 ±0.3	1.9 ±0.1	13.3 ±0.2	7.7 ±0.2	0.9 ±0.1
2		3.2 ±0.4	2.7 ±0.2	41.2 ±0.5	<0.1	18.4 ±0.3	2.12 ±0.1	27.5 ±0.3	4.1 ±0.2	0.7 ±0.1
1	**(c)** Pigment mixing area along with: – an outer layer (~25 μm) containing contamination with P and Ca of organic origin (components of human body decomposition) – points 1–3.	<0.1	<0.1	77.0 ±0.3	<0.1	0.6 ±0.1	0.4 ±0.1	2.8 ±0.1	13.6 ±0.2	3.0 ±0.1
2		<0.1	<0.1	74.4 ±0.4	<0.1	0.5 ±0.1	0.6 ±0.1	4.7 ±0.2	13.4 ±0.2	4.07 ±0.1
3		<0.1	<0.1	79.4 ±0.3	<0.1	<0.1	<0.1	<0.1	14.2 ±0.2	3.5 ±0.1
4		<0.1	2.0 ±0.2	32.8 ±0.4	<0.1	5.4 ±0.2	1.7 ±0.1	56.4 ±0.4	1.8 ±0.1	<0.1
5		<0.1	15.04 ±0.3	41.9 ±0.4	<0.1	5.5 ±0.2	2.8 ±0.1	31.0 ±0.3	3.8 ±0.2	<0.1
6		<0.1	3.4 ±0.2	31.1 ±0.4	<0.1	4.3 ±0.2	1.4 ±0.1	58.2 ±0.4	1.4 ±0.1	<0.1
7		<0.1	24.7 ±0.4	59.0 ±0.4	<0.1	2.2 ±0.2	0.8 ±0.1	13.3 ±0.2	<0.1	<0.1
8		0.8 ±0.2	8.2 ±0.3	27.1 ±0.4	<0.1	4.1 ±0.2	0.7 ±0.1	58.0 ±0.4	1.1 ±0.1	<0.1

derwent microwave-assisted digestion using a closed-vessel system (Milestone, Ethos Up). The resulting solutions were diluted with deionised water (Millipore, MilliQ Q Pod system). Potential spectral interferences, particularly from thallium (Tl) and mercury (Hg), were assessed using a quadrupole inductively coupled plasma mass spectrometer (PerkinElmer NexIon 300D). Due to the substantial lead concentration in the material, ion-exchange chromatography was deemed unnecessary.

Lead isotope ratios were determined using a multi-collector inductively coupled plasma mass spectrometer (MC-ICP-MS), specifically a Nu Instruments Plasma 3 system equipped with 16 Faraday cups. The instrument operated in dry plasma mode, with a Cetac Aridus 3 desolvating nebuliser (100 μL/min). For ^{208}Pb, the sensitivity was approximately 1.0 V per 1 μg/L of Pb, and thus, sample solutions containing roughly 50 μg/L of Pb were analysed. Each solution was spiked with a NIST 997 Tl standard (25–30 µg/L). Internal standardisation using Tl was applied to all measurements without separating lead from the matrix, following the procedures outlined in Karasiński *et al.*[10] Each measurement involved 20 integrations, each lasting 15 seconds, and the "Zero by ESA" method was used for background correction. The ^{202}Hg isotope was monitored, and a mathematical correction was applied to account for any ^{204}Hg interference with ^{204}Pb.

During the session, the NIST SRM 981 lead standard, spiked with Tl (NIST SRM 997), was analysed five times. The measured isotope ratios were corrected based on the deviation between the in-house recommended values[11] and the average results for NIST SRM 981. The final average values (n = 5) with 2SD uncertainties were as follows: ^{208}Pb/^{204}Pb 36.699 ± 0.001; ^{207}Pb/^{204}Pb 15.492 ± 0.0004; ^{206}Pb/^{204}Pb 16.938 ± 0.001; ^{208}Pb/^{206}Pb 2.1666 ± 0.0001; ^{207}Pb/^{206}Pb 0.91463 ± 0.00003. Tab. 2 presents the obtained results.

Results

Technology aspects

As shown in Fig. 3, an empty space was left inside the object, in which a single oval clay ball was placed – the element responsible for producing sound (Fig. 3:a-c, blue arrows).

The entire outer surface, including the interior of the opening (Fig. 3:d,e), was covered with a thin layer of dark brown high-lead glaze, colored with iron and copper compounds (Tab. 1). This decorative composition is complemented by applications of yellow glaze in the form of festoons, colored with tin oxides (see Fig. 3 – yellow arrows, Tab. 1).

Assessing Provenance

During the 8th–12th centuries, sources of lead that reached the territory of present-day Poland likely included mining operations in both Western and Central Europe.[12] These comprised regions such as the British Isles, Germany, and territories within Poland itself. Evidence indicates that by the 6th century, polymetallic deposits in Slovakia were also being utilized, likely by the Avars,[13] as well as Slavic lands in the 6th and 7th centuries.[14]

In the area that is now Germany, the Harz Mountains have been a consistent centre of lead and silver extraction since at least the 3rd century CE.[15] In Britain, early medieval mining has been most intensively investigated in Derbyshire and the Mendip Hills,[16] though more recent research highlights the North Pennines as a potentially more influential region. Both archaeological data and lead isotope studies suggest that metal from this area may have been part of trade networks reaching Scandinavia.[17] Further indications of mining during the Anglo-Saxon era have been identified in Cornwall, supported by lead isotope analyses conducted on early medieval church structures in Britain.[18]

In southern Poland, radiocarbon dates from mining sites in Upper Silesia and the Kraków-Częstochowa Upland show activity spanning from the 11th to the early 13th century (1039–1211), with the oldest known date being 915 ± 79 CE at Dąbrowa Górnicza-Strzemieszyce.[19] Lead isotope analysis from the Olkusz region, however, indicates metallurgical activity as early as the 6th century BCE.[20]

The possibility of lead being imported into what is now Poland from areas such as Romania, Serbia, or Turkey cannot be excluded, though direct evidence remains limited. Elemental analysis of arsenic-containing glass from the elite early medieval burial site at Bodzia in central Poland points to Romania as a likely source of raw material.[21] Studies on the origins of tin in early medieval Polish contexts[22] and research into the circulation and refining of silver dirhams[23] further indicate that long-distance trade routes likely extended deep into southeastern Europe and the Near East. Mining activity that began during the Roman period persisted into the medieval era in several Balkan regions, including parts of modern-day Kosovo, Serbia, and Croatia.[24] On Thasos, a Greek island in the northern Aegean, silver and lead metallurgy was continuously practiced from prehistoric times through the Byzantine period.[25] However, lead isotope data from glass found in the Serçe Limanı shipwreck of the Turkish coast, which shows sourcing from Iran and Bulgaria,[26]

10 Karasiński *et al.* 2023.
11 Karasiński *et al.* 2023.
12 Duczko *et al.* 2022.
13 Mozgai *et al.* 2024.
14 Saprykina *et al.* 2017; Szmoniewski, Miśta-Jakubowska, forthcoming.
15 Klappauf 1989; Steuer 2004.
16 Tylecote 1986.
17 Kershaw, Merkel 2023, Mathur *et al.* 2024.
18 Pankiewicz *et al.* 2025.
19 Rogaczewska 2005.
20 Miśta-Jakubowska *et al.* 2024.
21 Czech-Błońska *et al.* 2023.
22 Mathur *et al.* 2024.
23 Miśta-Jakubowska *et al.* 2024.
24 Škego 1998; Bogosavljević, Vuković, 1993; Merkel 2007.
25 Hauptmann *et al.*, 1988; Matschke 2002.
26 Stos-Gale 2004.

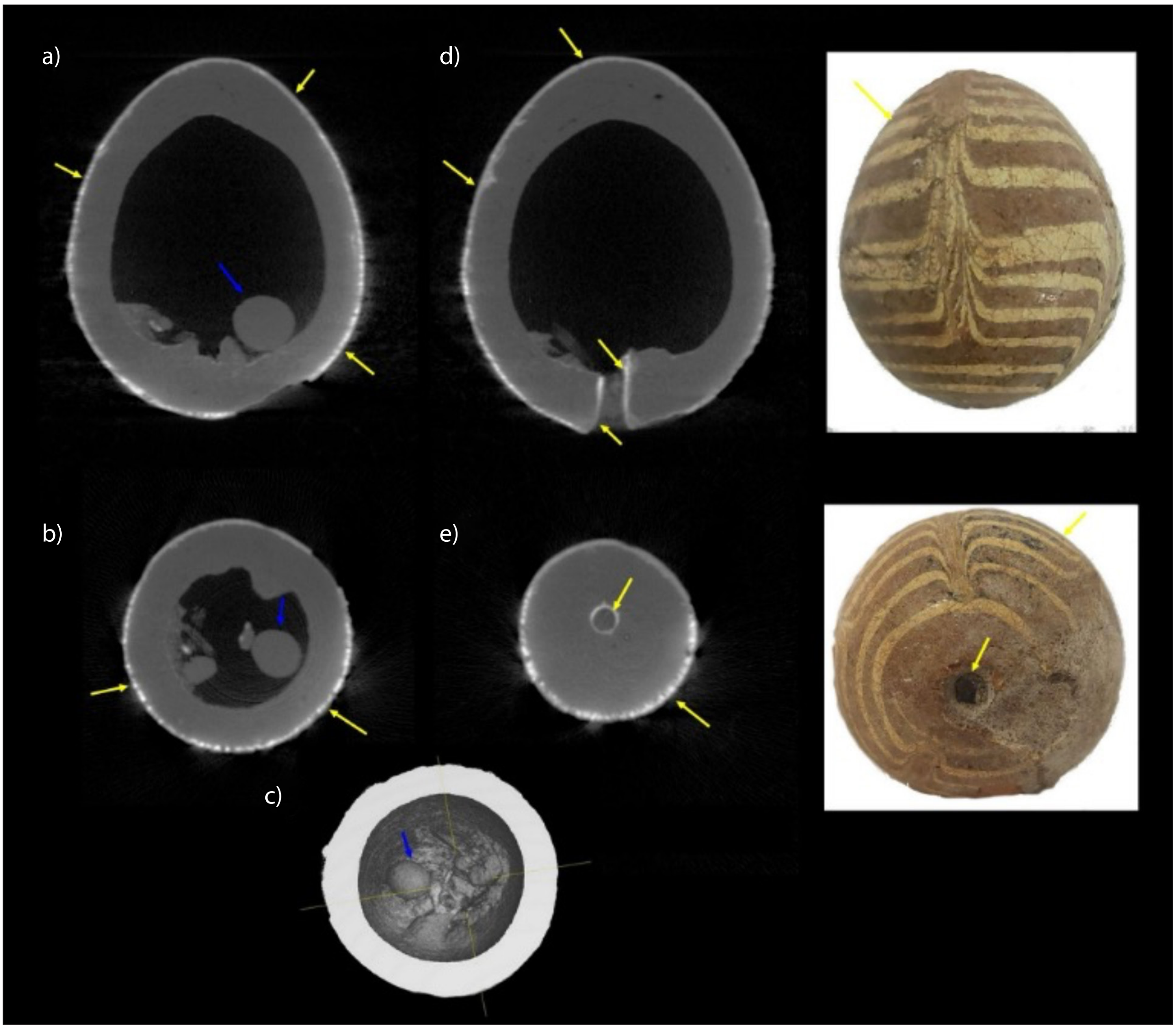

Fig. 3. RTG-CT images of the Easter egg rattle, corresponding to the artifact photographs. Sections: (a) longitudinal; (b) and (c) transverse, showing the rattling element (indicated by blue arrows) and traces of shaping in the form of clay lumps; (d) longitudinal and (e) transverse views of the hole area. Yellow arrows indicate the presence of Pb-glaze within the clay-based structure (photo by T. Kosiński).

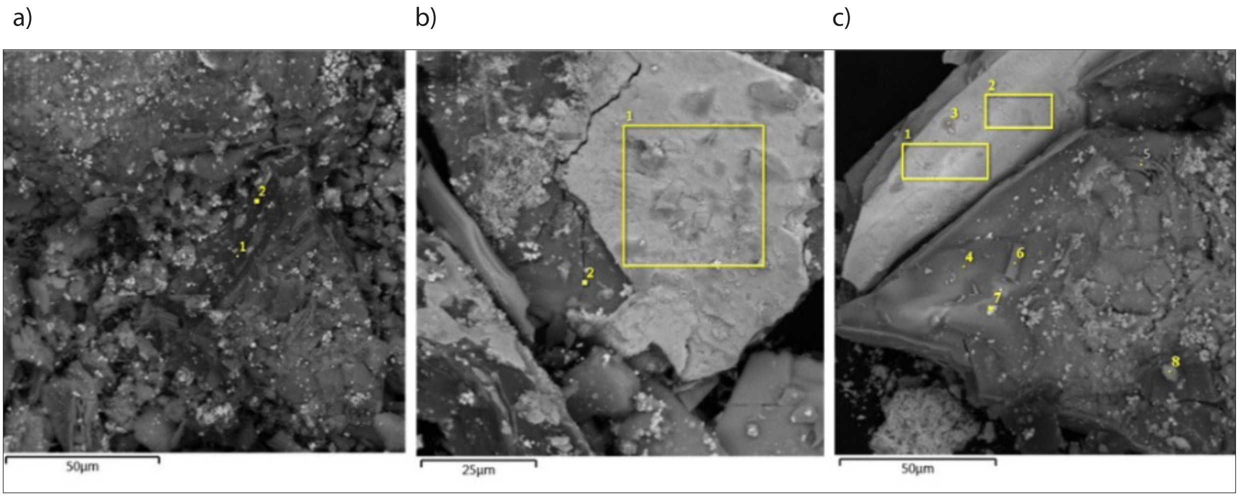

Fig. 4. SEM-BSE images of Pb-based glaze morphology with marked EDS sampling points (in yellow), as described in Table 1: (a) magnification 1.6k×, (b) 2.4k×, (c) 1.6k× (photo by E. Miśta-Jakubowska).

do not correspond with the isotopic signature observed in the analysed lead glazed of the egg from Kołoząb.

Figure 5 presents selected ore deposit data that closely correspond to the isotope ratios measured in the glass sample from the Easter egg rattle (see Tab. 2). Comparative data from archaeological artefacts are also included, as detailed in the figure caption.

As shown in the summary presented in Fig. 5, the obtained lead isotope data for the glaze on the Easter egg rattle from Kołoząb fit perfectly within the isotopic fingerprint range of deposits from the Upper Silesia and Krakow Upland regions (black squares in Fig. 5). Therefore, it is highly likely that local ore was used in the production of this glaze.

The Kołoząb Glazed Easter Egg Rattle in the Context of Analogous Finds from Europe

The discussed artifact can be classified as a Type 1 rattle – an Easter egg rattle – according to the typological-chronological scheme proposed by Konrad W. Ślusarski.[27] Based on the characteristic festoon-like decoration in the form of S-shaped arches or clamps, it stylistically corresponds to subtype 1a.[28] Rattles decorated in this manner are known from Slavic territories in the Early Middle Ages, with concentrations primarily in the northwestern and eastern regions,[29] and more sporadically south of the Carpathians.[30] Beyond these areas, Easter egg rattles have also been discovered in southern Scandinavia,[31] in areas of early medieval Baltic tribes habitation[32] as well as in the mixed settlement zone along the lower Danube, in Dobruja and northeastern Bulgaria[33] (Fig. 6).

In the Polish lands, glazed Easter egg rattles are unearthed with varying frequency, from the Baltic coast through Kuyavia, Greater Poland, Silesia, and Lesser Poland, to the Polish-Rus' borderlands in the east[34] (Fig. 7). Their dating ranges from the 10th to the 13th century, with the peak of their production occurring between the 11th and 12th centuries.[35] A similar trend is observed in Rus', where the greatest spread of these rattles occurred in the 11th century, followed by a gradual decline in the 12th century.[36]

The diversity of contexts in which these ceramic rattles have been discovered – including cemeteries,[37] settlements and hillforts,[38] Byzantine fortresses,[39] in in graves dug into older barrows[40] and even lakes[41] – necessitates an individualized approach to their interpretation.

In northwestern Slavdom, among 26 burials with egg-shaped rattles with anthropological data, they were most frequently found in children's graves (13 cases), followed by women's (8) and men's graves (5). The rattles were typically placed near the feet, less commonly at the waist or near the skull.[42] In the context of the possible discovery of an Easter egg rattle in a child's grave at the Kołoząb cemetery, it should be emphasized that this scenario is highly probable. As previously noted, the majority of such rattles have been found in children's graves, which is a notable phenomenon.[43] It is also worth pointing out that egg-shaped rattles are predominantly discovered in children's burials across the Eastern Slavdom as well.[44]

According to recent interpretations, the placement of grave goods held significant symbolic meaning. Some were utilitarian, intended for use in the afterlife, while others were included for non-utilitarian or symbolic reasons.[45] Thus, the arrangement of grave goods can be seen as a reflection of eschatological beliefs.[46]

Some contemporary musicological studies have revealed that the sound produced by glazed Easter egg rattles falls near or below the threshold of human hearing, often in infrasonic ranges.[47] The hole at the base of the rattle likely served not only a practical function during production but also acted as a resonator, enhancing narrow frequency bands around 1 kHz. While largely inaudible to humans, these sounds may have been perceived as audible to spirits, ancestors, or animals – particularly dogs, which played a symbolic role in Slavic eschatology.[48]

[27] Ślusarski 2004.
[28] Ślusarski 2004, 80.
[29] Bukowska 1958; Makarova 1966; Šovkopläs 1980; Gabriel 2000; Suško 2011; Suško 2020; Szmoniewski, Stanica 2024; Makouskaya 2024.
[30] Merínský 2013, 49; Fusek 2013; König 2014, 67–68; Poláková 2022; Szmoniewski, Stănică 2024, Fig.2.
[31] Arbman 1948, 469, Fig. 2:6; Edberg *et al.* 2025.
[32] Širouhov, 2014, 393.
[33] Szmoniewski, Stănică 2024.
[34] Ślusarski 2004; Siemianowska 2008; Kajkowski 2020; Pankiewicz, Siemianowska 2020; Szmoniewski, Stănică 2024.
[35] Makouskaya 2024, 162.
[36] Makarova 1966, 144.
[37] Kajkowski 2020, Tab. 1; Gurănov, Čubur, 2022.
[38] Kajkowski 2020, Tab. 3.
[39] Szmoniewski, Stănică 2024, 379, 383, Fig.5:1, 3, 4.
[40] Szmoniewski, Stănică 2024, 383–384, Fig. 6, 7, 9.
[41] Kontny 2018.
[42] Kajkowski 2020, 35, Tab.1.
[43] Wawrzeniuk 2004, 147.
[44] Makarov, Zajtseva, 2007, 178; Gurănov, Čubur 2022, 131.
[45] Kościelecki 2000, 74.
[46] Kajkowski 2020, Tab.1.
[47] Gruszczyńska-Ziółkowska, Tatoń 2021.
[48] Kajkowski 2020, 51.

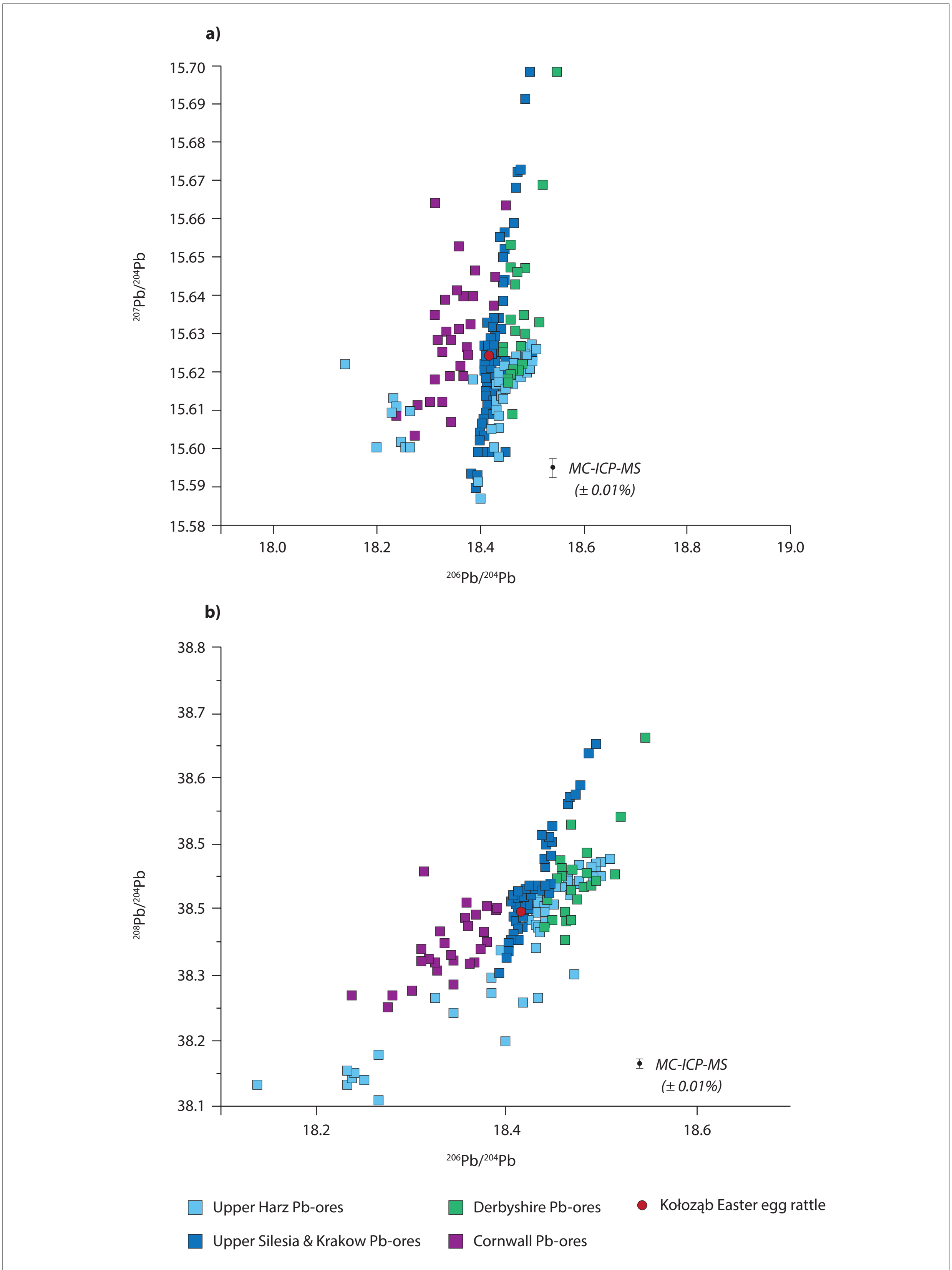

Fig. 5. The lead isotope data (LIA) for the lead-glass coating of the Kołoząb Eastern egg rattle (see Table 2) are plotted alongside geological reference datasets (sourced from http://oxalid.ox.ac.uk, Rohl 1996, Lehmann, 2011, Zartman *et al.* 1979, Church, Vaughn, 1992). The plots also incorporate comparative data from archaeological artefacts identified in the literature as being produced from lead and silver sourced in the Upper Silesia and Krakow Upland regions (Stos-Gale 1993; Miśta-Jakubowska *et al.* 2024, 2024a; Wajda *et al.* 2023; Merkel *et al.* 2024; Pankiewicz *et al.* 2025) (compiled by E. Miśta-Jakubowska).

Table 2. MC-ICP-MS lead isotope data for the lead glaze from the analysed glazed Easter egg rattle.

$^{208}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{206}Pb/^{204}Pb$	$^{208}Pb/^{206}Pb$	$^{207}Pb/^{206}Pb$
38.397±0.008	15.624±0.002	18.417±0.005	2.0849±0.0004	0.8484±0.0001

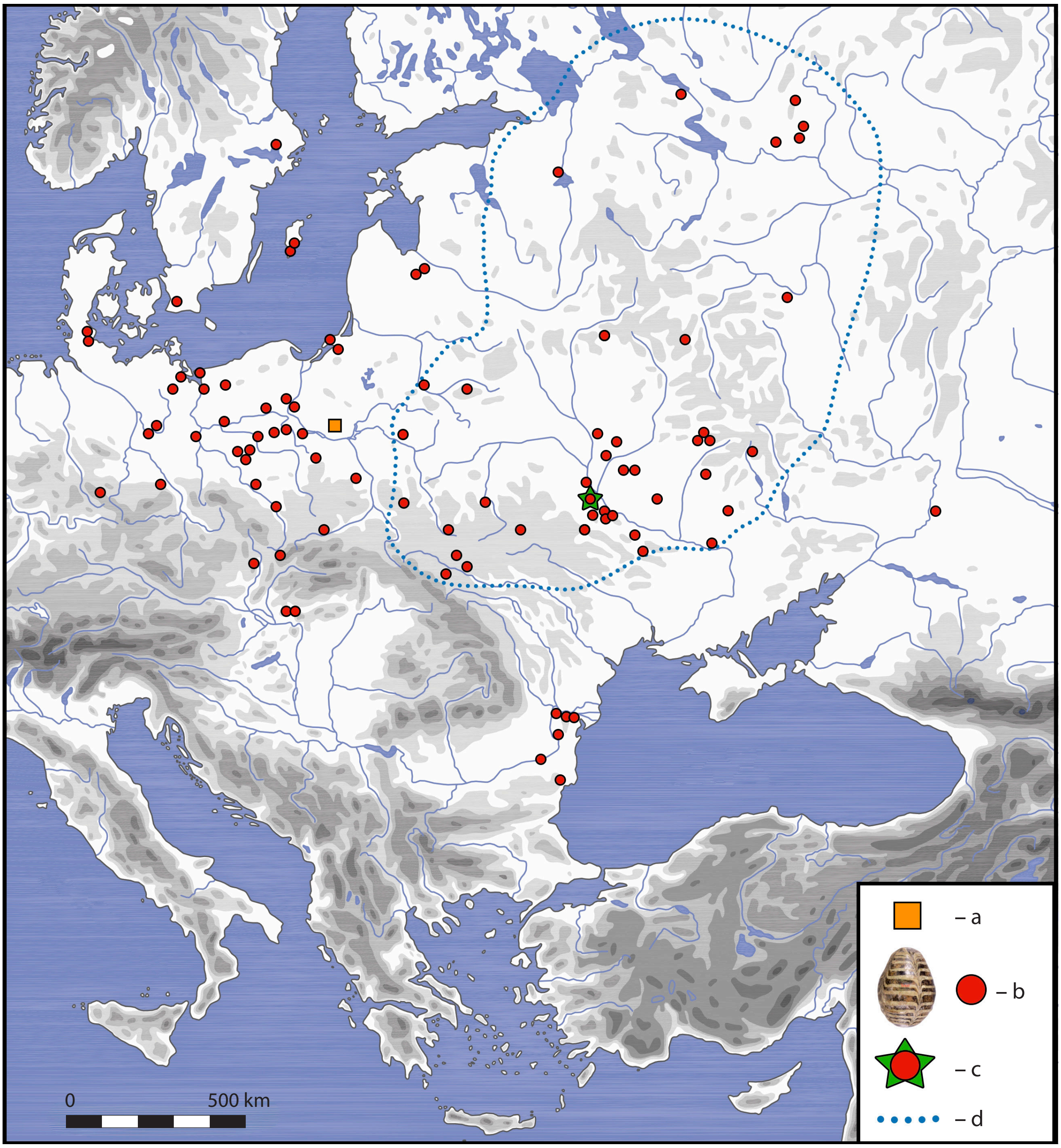

Fig. 6. Distribution of the early medieval glazed Easter egg rattles in Europe: a – cemetery in Kołoząb, Płońsk County, Masovian Voivodeship; b – place of the find, c – Kyiv, d – approximate borders of Kyivan rus, 11th-12th centuries (after: Szmoniewski, Stănică 2023, with B. Sz. Szmoniewski's supplements; drawing by B. Sz. Szmoniewski).

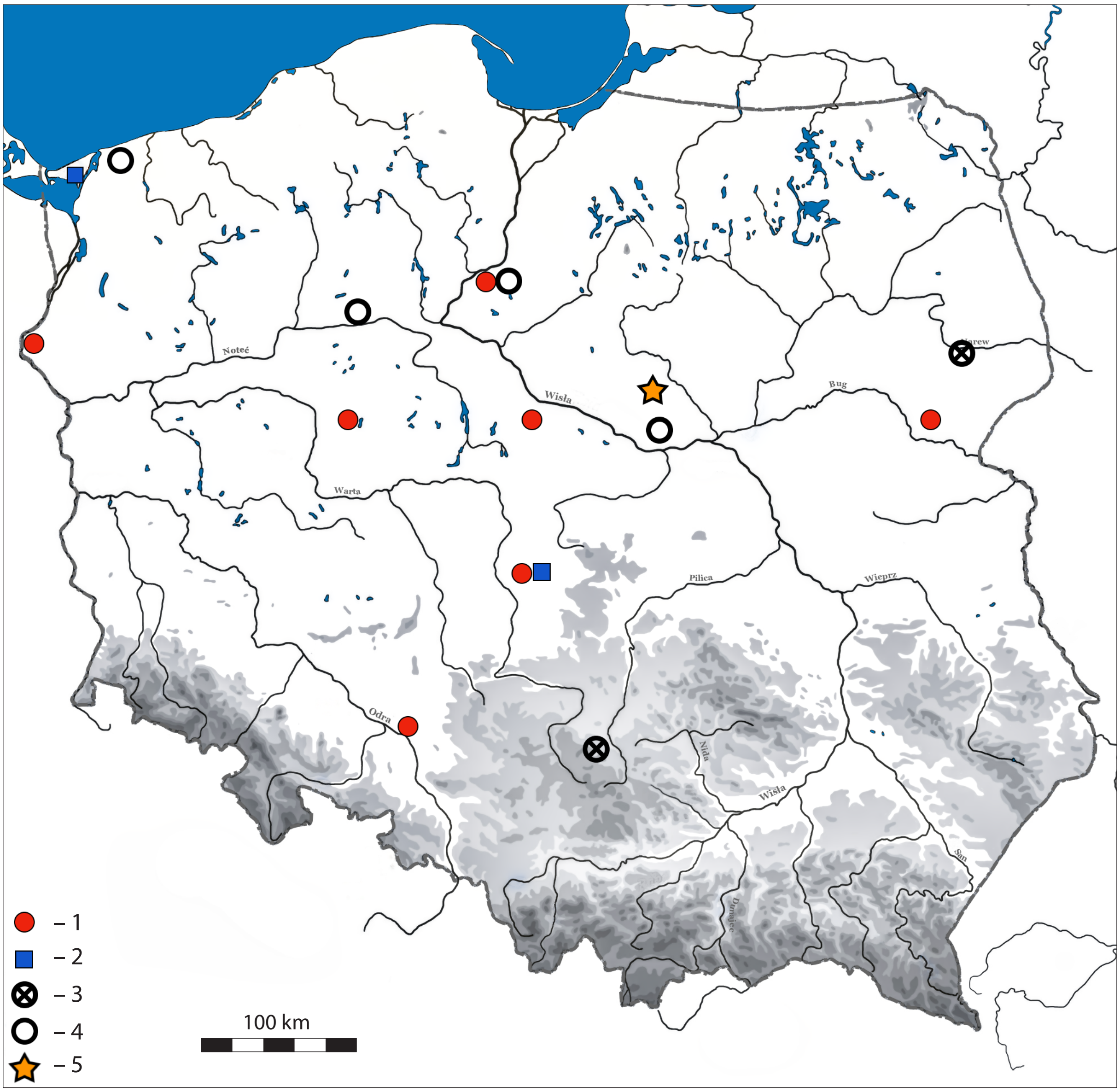

Fig. 7. Distribution of the early medieval glazed Easter egg shaped rattles in funeral context (after: Wawrzeniuk 2004, with B. Sz. Szmoniewski's supplements; drawing by B. Sz. Szmoniewski).

1 – children's graves; 2 – female graves; 3 – male graves; 4 – graves of indeterminate sex; 5 – Kołoząb, Masovian Voivodeship (Poland).

This suggests that rattles may have been ritual tools aimed at engaging with the otherworld.

Regarding the manufacturing techniques of such rattles, few ceramic forming methods are described in the literature.[49] Most commonly, they were created by coiling clay strips or modeling from one or two lumps of clay.[50] A less frequently used technique involved the lost-wax method, in which a wax core was coated with clay and then fired, leaving a hollow cavity after the wax burned out.[51] However, this method can be excluded in the case of the specimen under discussion. CT scanning (Fig. 3) revealed clear traces of clay joining in the lower part of the object and irregular wall thicknesses (Fig. 3), which clearly indicates hand-forming from one or two lumps of clay.

[49] Kaczmarek 1998; Sushko 2020; Siemianowska *et al.* 2023 with further references.

[50] Suško 2020; Siemianowska *et al.* 2023, 248.

[51] Kaczmarek 1998, 553; Siemianowska *et al.* 2023, 255–256.

The final stage in the production of these rattles involved firing, glazing, and surface decoration. Based on experimental studies, it is likely that the process began with thorough drying of the formed vessel, followed by bisque firing. It is generally accepted that glaze applied to previously fired ceramics forms a uniform coating of even thickness.[52] Such an even glaze layer is also observed on the Kołoząb specimen (see Fig. 4, yellow arrows). Similar observations have been made for glazed rattles from Silesia.[53] Notably, in the Kołoząb glazed Easter egg rattle, glaze is also present within the aperture of the item.

The dark glaze was achieved by using iron oxide (5.5 to 18.4 wt%) combined with copper oxide (2.2 to 3.2 wt%) as coloring agents, while the opaque yellow glaze owes its coloration to the presence of tin oxide (6.5 to 25.7 wt%) (cf. Tab. 1 – EDS data). Chemical analysis has shown that the lead oxide (PbO) content in the glaze exceeds 80%, allowing for its classification as a high-lead glaze.[54] One of the key features of such glazes is their low melting point: for compositions containing 65–85% PbO, this range falls between 740–760°C, making them particularly suitable for achieving gloss and intense color during the firing process.[55]

The Place of the Cemetery in Kołoząb in the Local Settlement Network and Its Chronology

Key issues concerning the early medieval cemetery at Kołoząb include the number and types of graves, associated grave goods, and the site's role within the local settlement network. Excavations revealed several stone clusters, such as circles and pavements, possibly remnants of older Roman structures. One early medieval burial (grave bn/65)[56] contained a male skeleton with a knife and axe, and eight irregularly placed large stones – suggesting the former presence of a stone grave structure.[57] While most early medieval graves lacked visible stone elements, it is possible that such constructions did not survive or coexisted with simpler pit graves, as observed in other Mazovian and Podlasie cemeteries.[58]

The cemetery lies within the densest cluster of graves with stone surroundings in Mazovia – the Płonka River group – which includes 19 sites spaced 1–3 km apart. Kołoząb is the easternmost site in this group,[59] and fits typologically with the so-called Płońsk concentration of richly furnished skeletal cemeteries with stone constructions. Finds such as silver-plated temple rings, an axe head, iron knives, and a cylindrical-necked clay vessel, though not linked to specific graves, support this classification. These object types are characteristic of weapon-rich, elite burials. There was a suggestion that these cemeteries were used by warrior groups tied to the Płońsk stronghold, possibly tasked with local defense or regional military support.[60] The mentioned stronghold was located on a convenient route for military expeditions from Ruthenia and the Baltic areas, which could head this way towards the capital of Mazovia, Płock.[61] Of course, this does not explain the origins of the cultural phenomenon of graves with stone constructions in Mazovian and Podlasie cemeteries from the younger phases of the Early Middle Ages, which have been discussed for decades.[62]

Due to the lack of certain information about the context of the finding of the Easter egg rattle at the cemetery in Kołoząb and fragmentary information about the graves there from the Early Middle Ages, only its general dating is possible. The aforementioned axe, temple rings, and a vessel with a cylindrical neck have some value as indicators of the chronology of the entire cemetery. The axe from grave bn/65 belongs to type IVa, according to A. Nadolski.[63] Such axes have a long period of use; the closest example from Kołoząb (not of an identical shape) is known from a grave in a stone casing at the cemetery in Korzybie Duże to the 2nd half of the 11th – 1st half of the 12th century.[64] Temple rings with fluted ears, type III variety A, according to H. Kóčka-Krenz, to which four of those from Kołoząb belong, were used from the 10th to the beginning of the 13th century.[65] The vessel with a cylindrical neck can also be generally dated within the period of use of this group of vessels to the 2nd half of the 10th – 13th century. To sum up, at the current stage of research, the framework chronology of the Easter egg rattle from Kołoząb has been established at the 11th–12th century, or possibly to the beginning of the 13th century.

[52] Siemianowska *et al.* 2023, 249–250.
[53] Siemianowska *et al.* 2023, 249.
[54] Siemianowska *et al.* 2023, 251; Pankiewicz *et al.* 2025.
[55] Wedephol *et al.* 1995, 65; Mecking 2013, 646.
[56] It is an early medieval skeleton grave above a Wielbark culture pit grave no. 216/65.
[57] All preserved early medieval finds from Kołoząb are kept in IAE PAN in Warsaw.
[58] Dzik 2014, 92.
[59] Kordala 2006, 108, Fig. 1.
[60] Pacuski 2024, 20–21.
[61] Błoński 2018, 23–24, 218.
[62] Dzik 2014.
[63] Nadolski 1954, 44.
[64] Kordala 2006, 52–54.
[65] Kóčka-Krenz 1993, 47–48; Jaskanis 2008, 195.

Summary

At the current stage of research, it remains difficult to determine with certainty whether the analyzed artifact was imported or produced locally. The literature has repeatedly highlighted strong analogies – in terms of production techniques and decorative motifs – between Easter egg rattles and glazed ceramic objects such as floor tiles, widely attested in the territory of medieval Rus'. The occasional use of white clay as a raw material has also been cited by some scholars as further supporting the hypothesis of an eastern (Rus') origin for such artifacts found in Polish contexts.

However, chemical analysis of the glaze composition reveals the use of lead compounds originating from local ore sources in the Olkusz region. This suggests that at least some rattles of this type may have been produced within the territory of present-day Poland, using locally available raw materials. It should be emphasized that the most recent research demonstrates the export of lead from the Upper Silesia and Krakow Uplands to the Rus', indicating that this raw material circulated beyond its primary extraction areas.[66] For this reason, the identification of lead from Polish deposits cannot be treated as independent or conclusive evidence that these glazed Easter eggs were manufactured in Poland, as the material itself may have been transported and utilized in workshops located elsewhere.

It is important to stress that "eastern provenance" in this case may refer more to the transmission of technologies and cultural patterns than to the trade of finished goods.[67] High craft mobility within the early medieval Slavdom likely facilitated the spread of manufacturing techniques and decorative conventions. It is therefore plausible that itinerant artisans from Eastern Slavdom – regions often linked to the origins of egg-decoration traditions – played a significant role in transmitting this form of symbolic material culture westward across the Slavic lands, including the North European Lowlands.

Thus, the glazed rattle from Kołoząb provides a valuable contribution to the broader discussion of artifact circulation and cultural connectivity in the early medieval landscapes of the Polish Lowlands.

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[66] Wajda *et al.* 2023; Merkel *et al.* 2024; Chugaev *et al.* 2017.

[67] Siemianowska *et al.* 2023, 261–162.

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