STATISTICAL ANALYSIS OF THE LUSATIAN CULTURE FUNERARY RITUAL ON THE EXAMPLE OF THE DIVIAKY NAD NITRICOU SITE[1]

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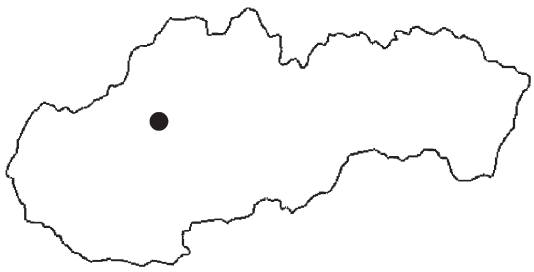

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Funerary rituals have played a crucial role in human societies throughout history, and archaeological investigation of these practices can provide valuable insights into beliefs and cultural practices. The application of statistical analysis to funerary data has emerged as a promising research direction, offering the ability to identify patterns and relationships not visible on the first sight. The article focuses on the exploration of funerary customs at the Diviaky nad Nitricou cemetery during the Late Bronze Age, using statistical approaches. The study is based on the analysis of 107 graves, which were excavated between 1940 and 1975. The analysis included the calculation of the splendour index and distinguishing wealth classes, comparing the distribution of wealth on the site with the Pareto distribution using the Kolmogorov-Smirnov test, spatial analysis, correlations of funerary rite features with each other and with biological characteristics, Kruskal-Wallis test, and correspondence analysis. The study provides insights into the funerary practices of the community using the cemetery in Diviaky nad Nitricou, but also highlights the difficulties of reconstructing past societies based on incomplete archaeological data.

INTRODUCTION

Funerary rituals have been a significant aspect of human culture and belief systems throughout history, providing an unique opportunity for archaeological research. A burial rite refers to a set of actions and behaviours performed during the disposal of the deceased, meant to symbolize the transition from life to death, and to facilitate the deceased's journey to the afterlife or to honour their memory (*Alekshin et al. 1983*, 137). Studying funerary rites in prehistory is crucial to understanding ancient societies' beliefs, values, and social structures, providing insight into human behaviour, worldview, and cultural development (*Rebay-Salisbury 2012*, 15, 16).

However, such research can be challenging due to the limited availability of sources and the difficulties in interpreting them (*Brück 2011*, 391). The analysis of funerary practices relies heavily on material remains, such as grave goods, grave constructions, and skeletal remains, as well as on the spatial and chronological distribution of burials. Although these sources provide valuable information, the data is often incomplete, and their interpretation requires careful consideration of the cultural context (*Nilsson Stutz 2015*, 1, 2).

The study of prehistoric funerary rites has been the subject of much research over the past few decades, but there is still a lot to be learned about these cultural practices (*Creţu 2015*). One promising research direction in this area is the application of statistical analysis. Key benefit of statistical analysis is that it allows us to identify patterns and relationships that might not be apparent at first sight. It can also help reconstruct the social and cultural context in which prehistoric funerary rites were performed (e.g., *Bickle 2019*; *Mandák-Niklová/Mandák 2020*; *Masotti/Mongillo/Gualdi-Russo 2020*; *Schneider 2019*; *Wallin 2010*).

There are, of course, some challenges associated with the use of statistical analysis in the study of prehistoric funerary rites. One challenge is that the data is often incomplete and fragmented – this can

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have a significant impact on the results and their interpretation. Another problem is that statistical analysis requires a large sample size in order to be meaningful. This can be difficult to achieve in the study of prehistoric funerary rites, as there are often only a limited number of burial sites available for study (*Stratton 2016*, 85, 86).

However, despite these challenges, the application of statistical analysis to prehistoric funerary rites has the potential to draw objective conclusions. It allows noting the actual relationships (or the absence of them) between the various features observable in the archaeological material. This helps to avoid the influence of researcher bias on the interpretation of the results, in order to achieve the most accurate picture of prehistoric society.

AIMS OF THE STUDY

The objective of this study is to explore the funerary customs of the Diviaky nad Nitricou cemetery using statistical approaches. Specifically, the paper will attempt to address the following research questions:

1. Do the different features of funerary rites observed in the archaeological material (such as richness of grave equipment, amount of work involved in constructing a grave, depth of the grave, presence of urn cover, and hole in the bottom of the urn) correlate with each other and with the biological characteristics of the deceased?
2. Is it possible to distinguish features of funerary rites and grave equipment that are specific to individuals of a given age and sex?
3. Is it possible to observe a spatial concentration of graves with similar characteristics, such as richness of equipment and biological characteristics of the buried individuals?
4. Is it possible to reconstruct the burial ritual of the community using the Diviaky nad Nitricou cemetery based on the conducted analyses?

The article aims to establish what the 'norm' was, the deviations from it, and the factors that caused them. By answering these research questions, the paper aims to provide a comprehensive understanding of the funerary customs of the Diviaky nad Nitricou cemetery, and to contribute to a broader understanding of the cultural and social context of prehistoric communities in the region.

Burial ground in Diviaky nad Nitricou

The Lusatian culture cemetery in Diviaky nad Nitricou is situated on the vast right bank terrace of the Nitrica River, on both sides of the road that connects Diviaky nad Nitricou and Diviacka Nová Ves. The estimated size of the cemetery is 90 × 120 m, bordered on the west side by the slopes of the Strážov Mountains (Rokoš Hill; *Pivovarová 1959*, 317; *Veliačik 1991*, 143).

The cemetery was discovered in 1940 by Š. Ďureč, who found fragments of pottery from destroyed graves. Subsequently, during research at the site by V. Budinský-Krička in October of the same year, four graves were discovered. Together with the previously destroyed burial, the author estimated the number of graves at eight (*Budinský-Krička 1962*, 124).

The site suffered continuous disturbance due to agricultural and construction works, leading to the destruction of a significant part of the cemetery. However, in 1957, the Institute of Archaeology of the Slovak Academy of Sciences was informed that construction work was to begin on the cemetery site, and archaeological excavations began there in August of the same year. These research were limited to a surveys on the area of about 100 m^2 and resulted in the uncovering of 15 graves, all of which had been mostly destroyed by ploughing (*Pivovarová 1959*, 317–319).

During the summer of 1964, an additional grave was incidentally encountered in the vicinity of the village by U. Ďuriš, the headmaster of the local primary school. This find was located in the close proximity to previously identified graves and was reported to be a part of the Diviaky nad Nitricou cemetery (*Ruttkay 1965*, 192).

In 1974 and 1975, further excavations became necessary due to the construction of houses in the southern part of the village, which were affecting and destroying a significant part of the cemetery area. These excavations took place on the last undeveloped plot of land to the east of the road. A total of eighty-two cremation graves were discovered in an area of 782.5 m^2. The last grave (83) was discovered in 1976

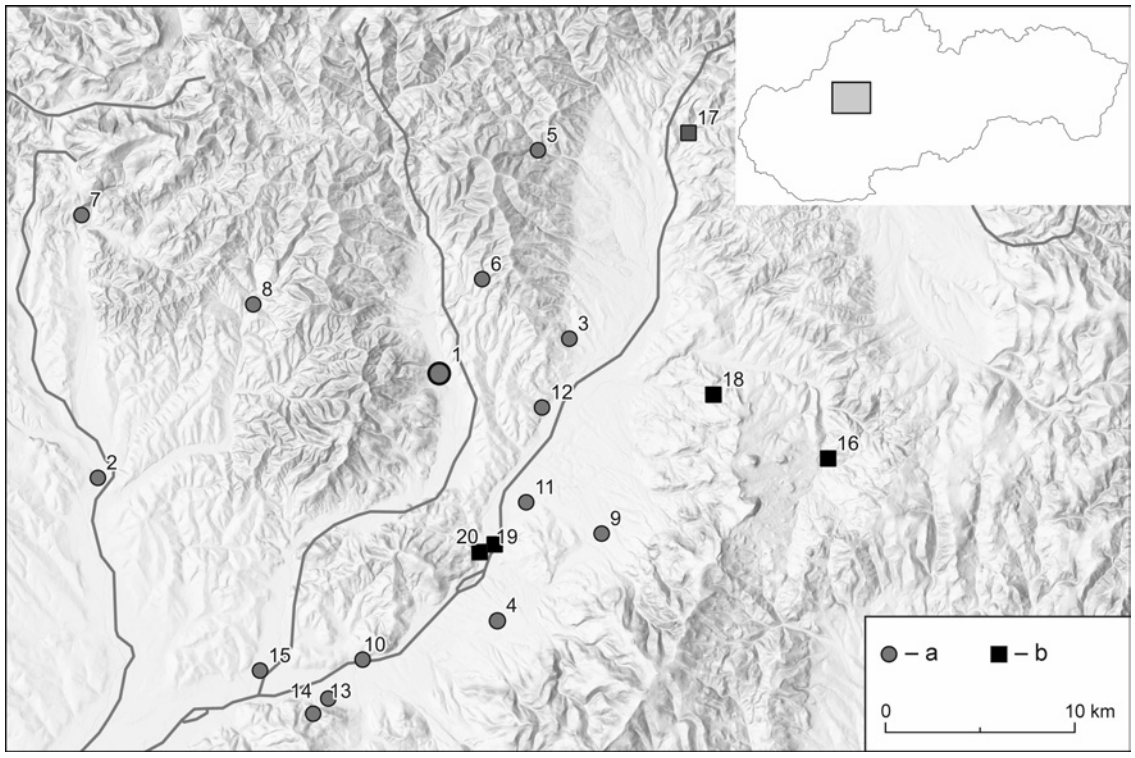


Fig. 1. Map of Lusatian cemeteries within a 20 km radius of the Diviaky nad Nitricou site. Late Bronze Age (a): 1 – Diviaky nad Nitricou; 2 – Bánovce nad Bebravou; 3 – Bojnice; 4 – Bystričany; 5 – Chvojnica; 6 – Dlžín; 7 – Krásna Ves; 8 – Kšinná; 9 – Lehota pod Vtáčnikom; 10 – Malé Kršteňany; 11 – Nováky; 12 – Opatovce nad Nitrou; 13 – Partizánske-Malé Uherce, Nad mlynom; 14 – Partizánske-Malé Uherce, Pri kostole; 15 – Partizánske-Šimonovany. Final Bronze Age (b): 16 – Handlová; 17 – Nitrianske Pravno-Vyšehradné; 18 – Prievidza-Hradec; 19 – Zemianske Kostoľany-Dolné Lelovce, Kňažská; 20 – Zemianske Kostoľany-Dolné Lelovce, Kostol Narodenia Panny Márie.

during the development of the excavated plot, in its peripheral part. Similarly to the previously uncovered graves, their relatively shallow position (at the boundary between the topsoil and the gravel subsoil) and intensive cultivation of the land resulted in the continuous disturbance of the graves and their potential stone constructions. Anthropological (M. Stloukal), archaeozoological (L. Peške) and archaeobotanical (E. Hajnalová) analyses were conducted on material from the 1974–1975 excavations (*Veliačik 1991*, 143, 144).

The Diviaky nad Nitricou cemetery has been dated to the HA1 and HA2 stages of the Central European relative chronology (*Pivovarová 1959*, 323; *Ruttkay 1965*, 193; *Veliačik 1991*, 143). Due to the cemetery's significant and chronologically uniform inventory, two of the stages in the development of the Late Bronze Age in Slovakia are named after it (*Veliačik 1991*, 143). In the contemporary chronology of Lusatian culture in Slovakia, these are stages V and VI (*Kujovský 2022*, 91–93).

The cemetery is located in an area intensively settled by a population of the Lusatian culture in the Late Bronze Age. Within a 20 km radius of the Diviaky nad Nitricou site, there are 14 other Lusatian cemeteries, which were also in use during HA, along with five others that began during the HB period (*Katkinová 2000*; *Veliačik 1983*; *Veliačik/Romsauer 1994*). Figure 1 shows a map of the Lusatian burial grounds in the vicinity of Diviaky nad Nitricou.

MATERIAL AND METHODS

Study sample

The research sample for this study comprises a total of 107 cremation graves that were discovered during all excavation seasons. It should be noted here that the surveyed area constituted only a small portion of the estimated size of the cemetery (probably between one-eighth and one-tenth; *Veliačik 1991*, 205).

Tab. 1. Summary of the results of the anthropological analysis of the bone material from the Diviaky nad Nitricou cemetery (according to *Stloukal 1991*, tab. 1).

	Infans I	Infans I–II	Infans II	Infans II–III	Infans III	Infans?	Infans/ Juvenis	Juvenis	Juvenis/ Adultus	Adultus	Adultus– Maturus	Maturus	Total
Female	–	–	–	–	–	–	–	–	1 (1.1%)	6 (6.4%)	3 (3.2%)	3 (3.2%)	13 (13.8 %)
Male	–	–	–	–	–	–	–	–	–	3 (3.2%)	2 (2.1%)	4 (4.3%)	9 (9.6%)
No data	8 (8.5%)	9 (9.6%)	5 (5.3%)	1 (1.1%)	5 (5.3%)	5 (5.3%)	8 (8.5%)	2 (2.1%)	–	11 (11.7%)	15 (16.1%)	3 (3.2%)	72 (76.6%)
Total	8 (8.5%)	9 (9.6%)	5 (5.3%)	1 (1.1%)	5 (5.3%)	5 (5.3%)	8 (8.5%)	2 (2.1%)	1 (1.1%)	20 (21.3%)	20 (21.3%)	10 (10.6%)	94 (100%)

Among the uncovered graves, 55% were found to have been disturbed by ploughing, while the remaining 45% were preserved in relatively good condition. The majority of the graves – 63% – were flat, while 22% were found under larger stone barrows measuring between 2 to 4.7 meters in diameter. Remaining 15% were located under smaller stone barrows measuring between 0.8 to 1.6 meters in diameter (*Budinský-Krička 1962*, 124; *Pivovarová 1959*; *Ruttkay 1965*, 192; *Veliačik 1991*).

In publications presenting the results of excavations conducted at the site detailed descriptions of all graves were provided, including information on the type of grave, the presence and type of grave construction, as well as descriptions of urns and other grave equipment. Information on depth of the burial pit was recorded for 65% of the graves (*Budinský-Krička 1962*, 124; *Pivovarová 1959*; *Ruttkay 1965*, 192; *Veliačik 1991*). Additionally, bone material from graves discovered during two the last two excavation seasons, underwent anthropological analysis. The age at death of 94 individuals buried in 68 graves (16 double graves, 5 triple) was established. Sex was determined in 22 cases. A summary of the data obtained by anthropological analysis is presented in Tab. 1. Information on the number of buried individuals, their age, and sex in particular graves is presented in Fig. 2 (*Stloukal 1991*). A plan of the cemetery is also available only for the part excavated in 1974–1975, so all spatial analyses will apply only to these burials.

Statistical analyses

In order to address the research questions posed, a set of statistical analyses were employed. To assess the richness of grave equipment, the so-called splendour index, initially proposed by F. Hodson for the Hallstatt cemetery, was used. The calculation of this coefficient takes into account which types of artefacts are concentrated only in the wealthiest graves. A point value is determined for each functional artefact type, which represents the mean number of items present in the graves in which this type of artefact occurred. The score for the entire grave is calculated as the sum of these values for all the artefact types that appeared in it, without considering their quantity. This method enabled the computation of a point value for each grave (*Hodson 1977*, 406–410; *Przybyła 2009*, 12). Subsequently, by using k-means cluster analysis, these graves were segregated into four wealth classes (*Drennan 2009*, 313–317).

In addition, the distribution of the richness of grave furnishings expressed by the splendour index was compared with the Pareto distribution using the Kolmogorov-Smirnov test. The distribution in question is employed to demonstrate how wealth is distributed among individuals, as it appears to reflect the fact that a smaller percentage of people in a given society own a larger share of its wealth. This concept is known as the Pareto principle, or the '80-20 rule', which suggests that 20% of the population controls 80% of the wealth (*Orton/Hodson 1981*, 108). This can provide insights into the social and economic status of the individuals buried in different graves and the social organization of the community.

The point values obtained from the splendour index for each grave were used to conduct a spatial analysis using a heat map in QGIS software (*Gandhi 2020*). The aim was to investigate the spatial distribution of equipment richness in the cemetery of interest.

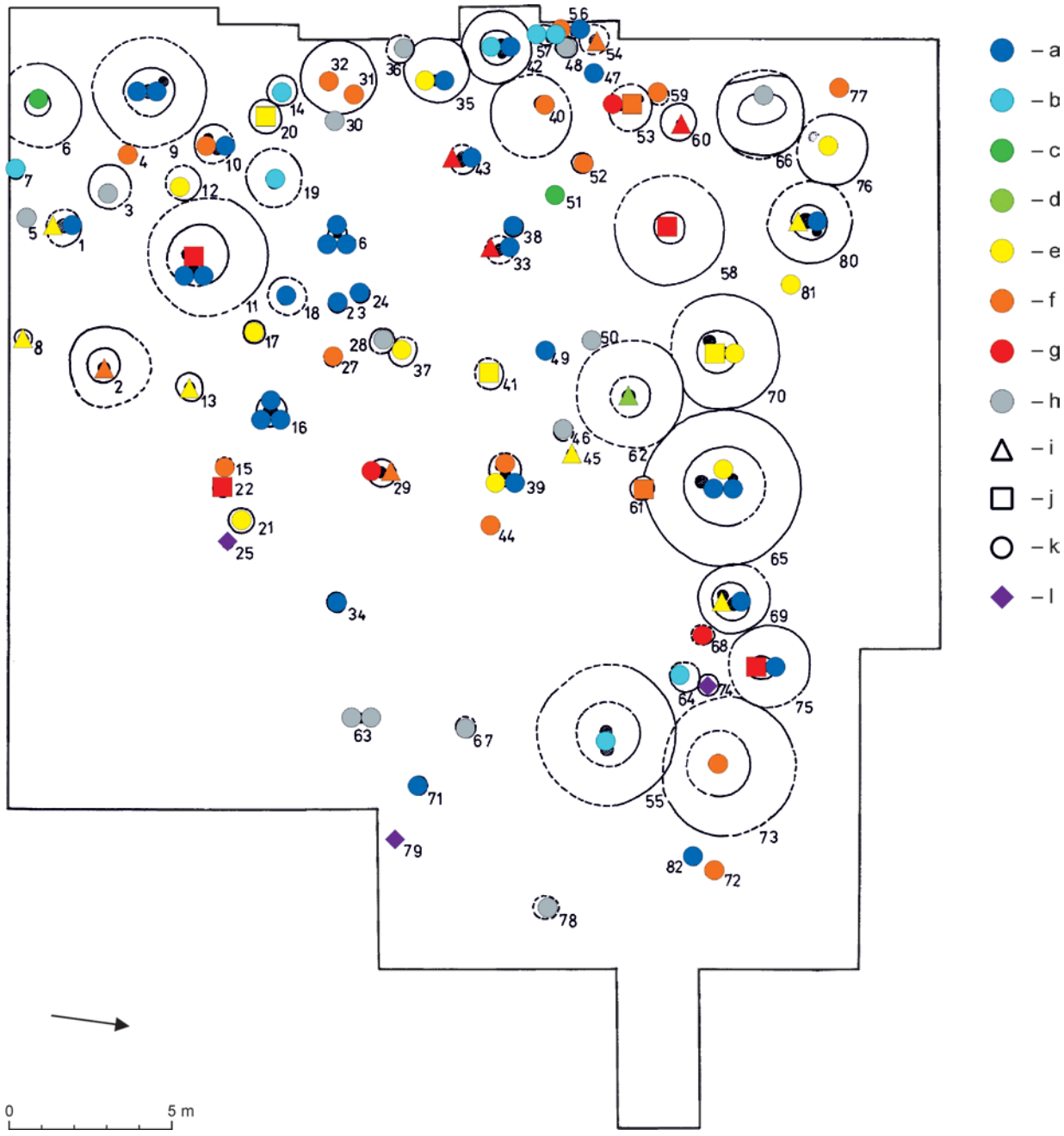


Fig. 2. Plan of the part of the Diviaki nad Nitricou cemetery excavated in 1974–1975 with information on the biological sex and age at death of the deceased (according to *Veliačik 1991*, fig. 2; modified). Legend: a – infans; b – infans–juvenis; c – juvenis; d – juvenis–adultus; e – adultus; f – adultus–maturus; g – maturus; h – age unknown; i – female; j – male; k – sex unknown; l – animal bones only.

The next stage of analysis was to investigate the relationships between different funerary rite characteristics. Burials are complex and multi-faceted events that involve a series of practices. These traditions are shaped by cultural norms and beliefs, and are often negotiated in the community. Archaeological remains are a material, incomplete reflection of these decisions (*Berggren/Nilsson Stutz 2010*). In this work, all of the characteristics of burials considered in the archaeological report have been included. This will enable the establishment of a network of relationships between various archaeological remains of the funerary ritual, identifying the elements that are interconnected. As a result, more confident inferences can be made about these features, as opposed to considering each aspect in isolation. In order to do so, correlations were calculated between the following features:

– richness of grave equipment – expressed by a value calculated from the splendour index;
– amount of work involved in constructing a grave – categorized into four levels: 1. no stone construction at all, 2. burial pit encased or covered with stones, 3. small stone barrow, 4. large stone barrow;
– depth of the grave – expressed in centimetres, representing the depth at which the bottom of the pit was located;
– presence of urn cover – expressed as dichotomous variables (presence or absence);
– presence of hole in the bottom of the urn – expressed as dichotomous variables (presence or absence).

In addition, the above-mentioned characteristics were also correlated with the biological characteristics of the deceased – their age at death and biological sex. Only biological sex was not correlated with the depth of the grave due to insufficient sample size available.

In order to verify the correlations, several statistical tests were employed. The choice of test depended on the type of data being compared. For the comparison of a quantitative variable with an ordinal one, *Spearman correlations* were used. The *Kendall's Tau test* was employed when comparing two ordinal variables with more than two categories. *Cramer's V test* was used when comparing an ordinal variable with a dichotomous one. Finally, *tetrachoric correlation* was used to compare two dichotomous variables. These tests allowed to determine whether and to what extent the analysed characteristics were related to each other (*Aggarwal/Ranganathan 2016*; *Fletcher/Lock 2005*, 123–126, 135).

The relationship between the richness of grave equipment and the effort involved in construction of the grave was further explored using the Kruskal-Wallis test (*Ostertagová/Ostertag/Kováč 2014*). Both mentioned characteristics are considered significant indicators of the deceased's social status. Conducting the discussed test allowed us to observe whether there are statistically significant differences in the wealth of grave goods between the designated groups associated with the amount of labour invested in the construction of the grave. The results were also presented on a box-and-whisker plot, which shows the median and spread of the splendour index values in each group.

Correspondence analyses were used to show the relationship between the features of burial rites and the presence of specific types of artefacts in the grave equipment with the biological characteristics of the deceased, specifically their age at death and biological sex. The aim of this approach was to determine whether these features can differentiate the treatment of the dead (*Yelland 2010*).

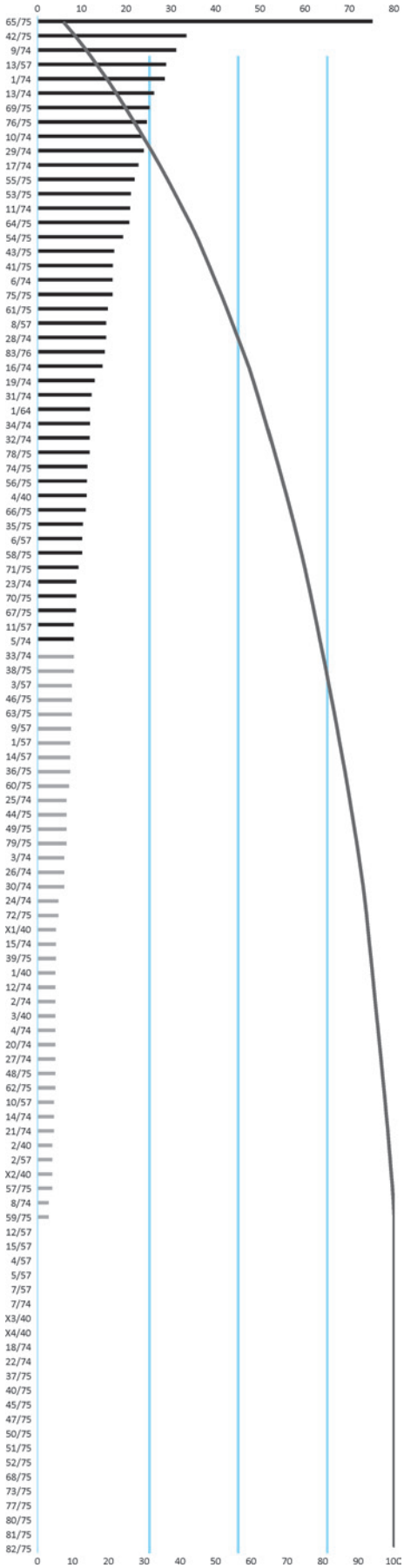
All statistical tests (with the exception of spatial analysis) were performed using PAST and STATISTICA programs.

RESULTS

The results of the study revealed the identification of four distinct wealth classes based on the values obtained through the use of the splendour index (Tab. 2). The clear distinction between the wealth classes highlights the socio-economic differences present in the burial customs of the individuals buried in the cemetery under study.

Tab. 2. Characteristics of wealth classes distinguished on the basis of the splendour index.

Number of the group	Amount of graves	Description of burial equipment	Numbers of graves assigned to a group
Group 1	46	no grave furnishing, one vessel or single small bronze artefact	1/40, 2/40, 3/40, X1/40, X2/40, X3/40, X4/40, 2/57, 4/57, 5/57, 7/57, 10/57, 12/57, 15/57, 2/74, 4/74, 7/74, 8/74, 12/74, 14/74, 15/74, 18/74, 20/74, 21/74, 22/74, 24/74, 27/74, 37/75, 39/75, 40/75, 45/75, 47/75, 48/75, 50/75, 51/75, 52/75, 57/75, 59/75, 62/75, 68/75, 72/75, 73/75, 77/75, 80/75, 81/75, 82/75
Group 2	41	up to 6 vessels in graves without any other objects or 2–3 vessels along with small bronze items	4/40, 1/57, 3/57, 6/57, 8/57, 9/57, 11/57, 14/57, 1/64, 3/74, 5/74, 16/74, 19/74, 23/74, 25/74, 26/74, 28/74, 30/74, 31/74, 32/74, 33/74, 34/74, 35/75, 36/75, 38/75, 44/75, 46/75, 49/75, 56/75, 58/75, 60/75, 61/75, 63/75, 66/75, 67/75, 70/75, 71/75, 74/75, 78/75, 79/75, 83/76
Group 3	19	up to 13 vessels, with more bronze objects and other artefacts ranging from two to seven	13/57, 1/74, 6/74, 9/74, 10/74, 11/74, 13/74, 17/74, 29/74, 41/75, 42/75, 43/75, 53/75, 54/75, 55/75, 64/75, 69/75, 75/75, 76/75
Group 4	1	11 ceramic vessels and 12 bronze objects	65/75



A Pareto distribution showed that in the case of the cemetery at Diviaky nad Nitricou, 80% of the wealth was accumulated in 40% of the burials (Fig. 3). The Kolmogorov-Smirnov test ($d = 0.208$ and $p < 0.01$) shows that the distribution of wealth at the site in question does not follow the pattern of a Pareto distribution. This can indicate either a fairly egalitarian society or the lack of a clear reflection of social position in the funerary ritual.

The spatial analysis results, which are presented in Fig. 4, revealed no clear pattern regarding the distribution of graves with different wealth categories. The heatmap illustrates the splendour index values for each grave, with darker shades of red indicating a higher level of wealth. However, no distinct concentrations of richer or poorer graves could be observed, making it difficult to determine any designated areas for specific categories.

Regarding the correlation tests, Tab. 3 summarizes the results obtained for the particular features. The tests identified seven statistically significant correlations. However, the strength of the correlation was either average or weak in all cases. Specifically, correlations were found between richness and the presence of a hole in the bottom of an urn, work effort and urn covering, richness and urn covering, richness and work effort. In addition, weak correlations were found between work effort and the depth of the grave, the depth of the grave and urn covering, and the depth of the grave and the presence of a hole in the bottom of an urn. Notably, there was no statistically significant correlation between any funeral rite feature and biological characteristics of the deceased.

The relationship between the richness of grave equipment and the effort involved in construction of the grave was further explored using the Kruskal-Wallis test. Its results are presented in Tab. 4 and on the box-and-whisker plot on Fig. 5. The results indicate that the median richness of equipment is statistically significantly different between groups 1 and 2 and group 4, indicating that graves located under larger barrows have richer equipment than flat graves. However, the graph also illustrates a considerable scatter of splendour index values in group 4, with both the poorest graves (SI = 0) and the richest grave (SI = 75.1) located under the large barrows. In contrast, the maximum values in the other groups are less than 30. These findings suggest that while barrows may be associated with richer grave furnishings, there is still considerable variation within these groups, and other factors may also influence the richness of grave goods.

Fig. 3. Pareto chart of the wealth of grave furnishings at the Diviaky nad Nitricou site. The bars show the values of splendour index in descending order and the line graph shows the cumulative percentages from left to right. The top horizontal axis contains the values of splendour index. The bottom horizontal axis represents the cumulative percentage of this measure. In black are the graves with 80% cumulative wealth and in gray those with the remaining 20%. Graves with no furnishings are indicated by the absence of bars above them.

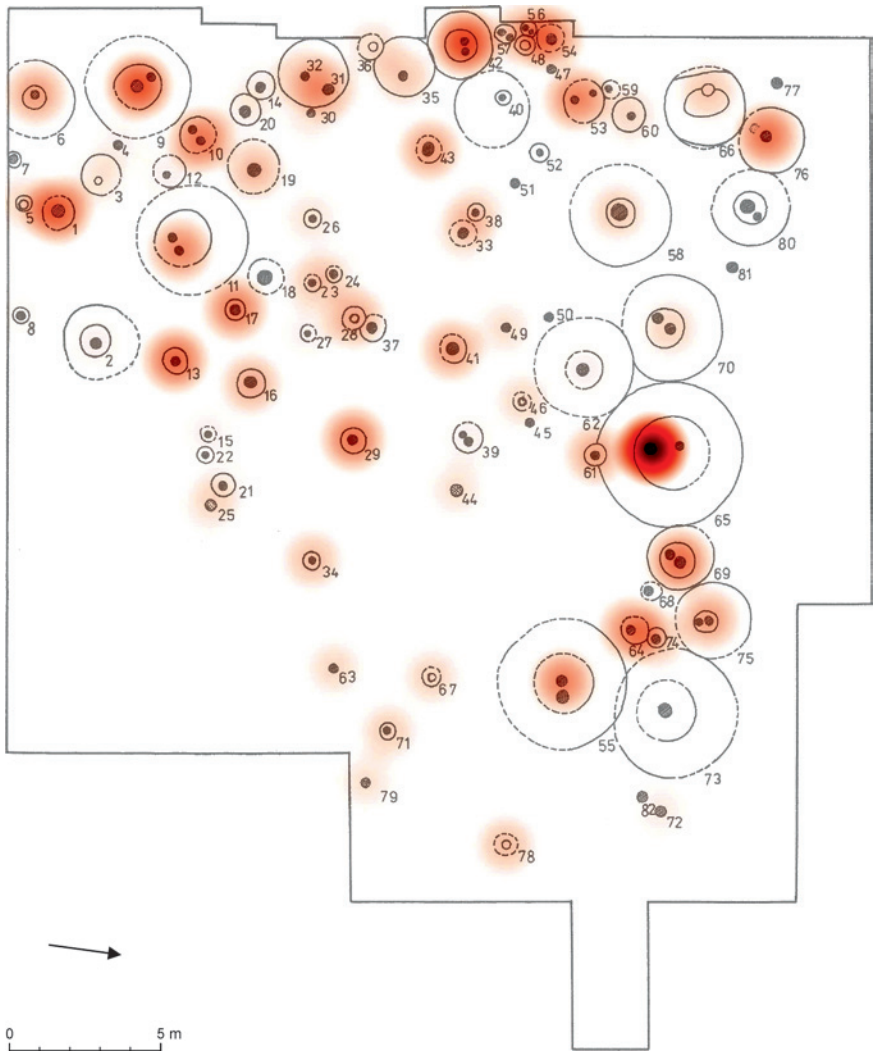


Fig. 4. Heat map showing the richness of grave equipment calculated from the splendour index – the darker the shade of red, the higher the index for a given grave (according to *Veliačik 1991,* fig. 2; modified).

Tab. 3. Correlation tests results for specific funeral rite features and biological characteristics. The colours distinguish between statistically significant (green) and non-significant (red) results. Pairs for which correlation tests have not been conducted are marked in light grey.

	Richness	Work Effort	Depth of a grave	Age at death	Urn covering	Hole in the bottom	Biological sex
Richness		0.338	0.044	–0.081	0.363	0.404	0.233
Work Effort	0.338		0.293	–0.045	0.387	0.050	0.384
Depth of a grave	0.044	0.293		0.167	0.255	0.191	
Age at death	–0.081	–0.045	0.167		0.126	0.201	
Urn covering	0.363	0.387	0.255	0.126		0.030	0.207
Hole in the bottom	0.404	0.050	0.191	0.201	0.030		–0.223
Biological sex	0.233	0.384			0.207	–0.223	

Tab. 4. Comparison of groups distinguished on the basis of grave construction in relation to the richness of grave furnishings calculated using the splendour index (Kruskal-Wallis test). The colours distinguish between statistically significant (green) and non-significant (red) results.

	No stones	Encased with stones	Small stone barrow	Stone barrow
No stones		1	0.173	0.010
Encased with stones	1		0.116	0.006
Small stone barrow	0.173	0.116		1
Stone barrow	0.010	0.006	1	

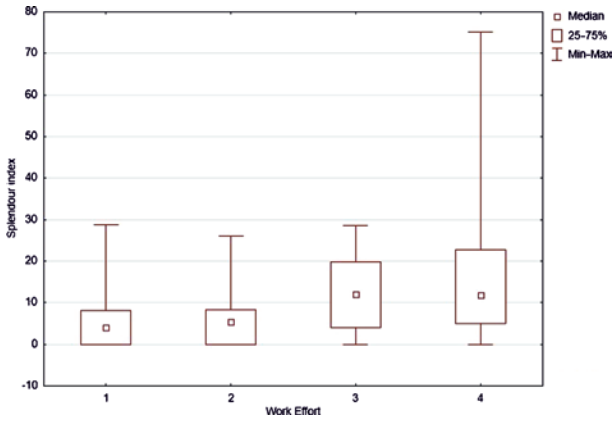


Fig. 5. Box-and-whisker plot showing the median, range of the two middle quartiles and the mininal and maximum values of the splendour index in the groups, distinguished on the basis of grave construction. 1 – no stone construction at all; 2 – burial pit encased or covered with stones; 3 – small stone barrow; 4 – large stone barrow.

The results of correspondence analyses are presented in Fig. 6–9. Fig. 6 compares funeral rite characteristics with age at death. Most of the features group together in the middle part of the graph and are therefore not particularly characteristic for any age group. However, the use of cups as urns stands out as a distinctive feature of the infans and juvenis categories. Additionally, graves under barrows are more common in the adultus and maturus age categories.

Figure 7 compares burial characteristics with the gender of the deceased. Males stand out with more frequent burials under barrows and the use of cups as an urn cover. On the other hand, it is not possible to conclude that any of the features taken into account are particularly characteristic for women.

Two further analyses were performed to examine the equipment present in the graves (excluding urns). Notably, a greater degree of variation was observed between the age categories in comparison to the funeral rite characteristics. As illustrated in Fig. 8, bronze bracelets and necklaces were equipment items commonly found in

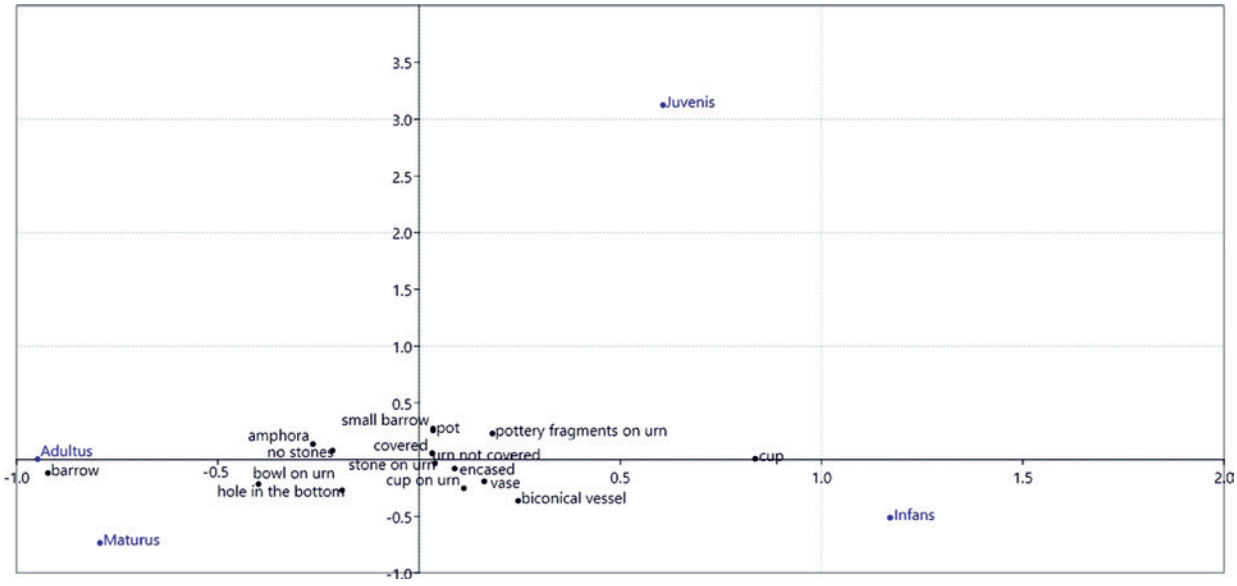


Fig. 6. Results of correspondence analysis for age at death and funeral rite features.

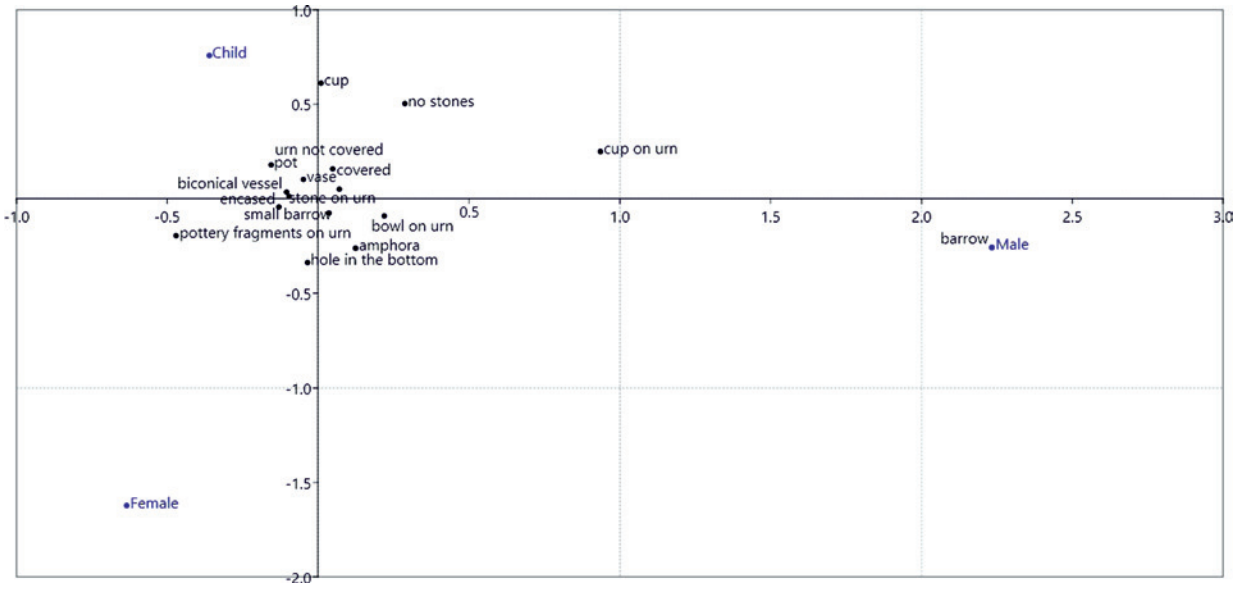


Fig. 7. Results of correspondence analysis for biological sex and funeral rite features.

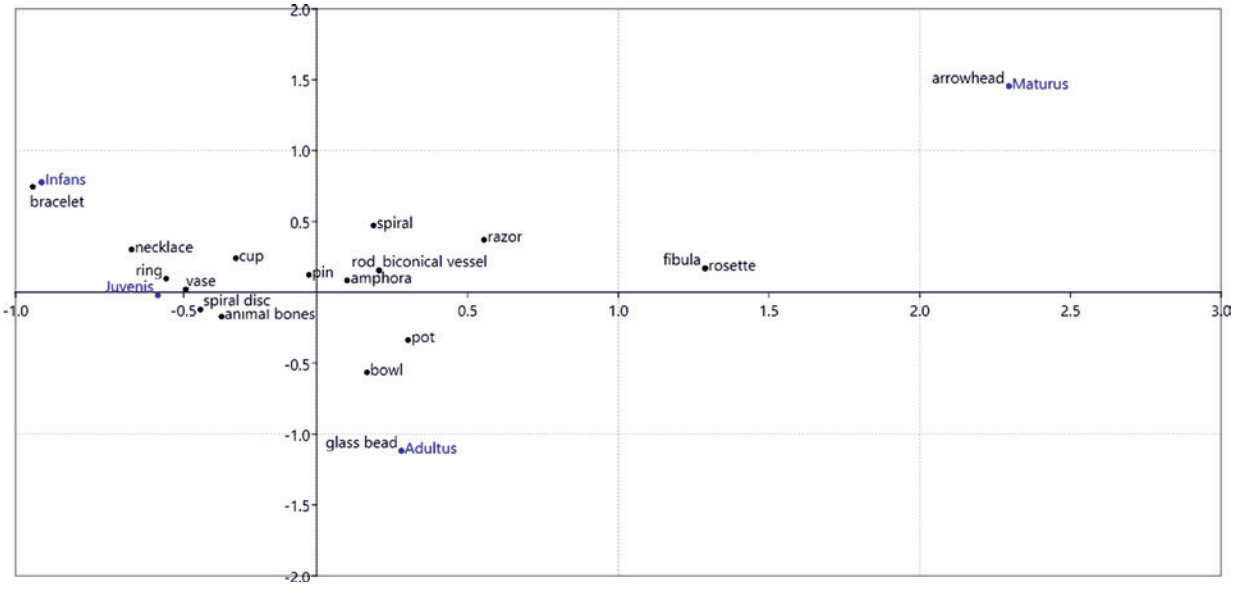


Fig. 8. Results of correspondence analysis for age at death and grave equipment.

the graves of infans and juvenis individuals, with bronze rings being more prevalent in the latter age group. Vases, bronze spiral discs, cups, and animal bones were also more frequently present in the graves of infans and juvenis categories than in other age groups. On the other hand, glass beads, bowls, and pots were the typical furnishings for the adultus age group, with biconical vessels, bronze rods, and amphorae also being significantly more common. Additionally, artefacts such as razor, a bronze fibula, and a rosette, which were scarce in the cemetery, were also present in the graves of adultus individuals. The graves of maturus age group were characterised by the presence of bronze arrowheads, with addition of bronze fibula, rosette, and razor. Furthermore, older individuals were more frequently furnished with bronze spirals and rods, as well as biconical vessels, pots, amphorae, and bowls.

In contrast to the findings regarding age at death, no discernible differences between men and women were identified in relation to the presence of grave furnishings (Fig. 9). The only distinguishing feature of

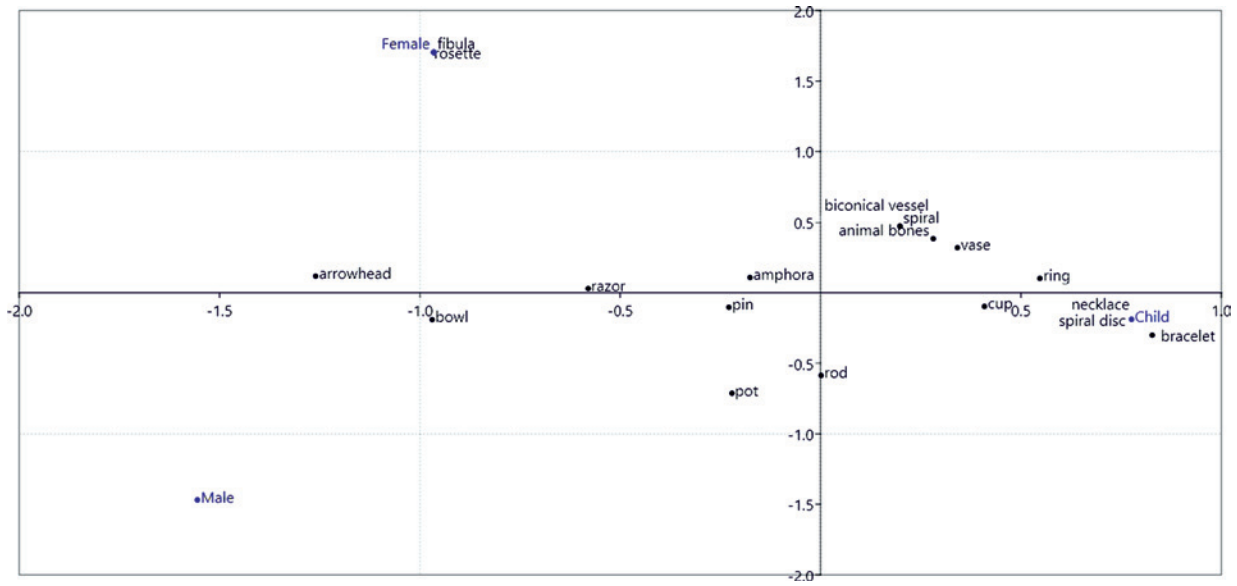


Fig. 9. Results of correspondence analysis for biological sex and grave equipment.

the female graves was the presence of a fibula and a rosette, but it should be noted that the sex could only be established in the case of one burial equipped with each of this two artefact types. For this reason, it is not possible to state unequivocally that these were exclusively female items. Beside this, both sexes were characterised by the presence of the same elements.

INTERPRETATION OF RESULTS – AN ATTEMPT TO ANSWER THE RESEARCH QUESTIONS

The following subsection aims to provide an interpretation of the results obtained from the statistical analysis of funerary rites in the Lusatian cemetery in Diviaky nad Nitricou by an attempt to answer the research questions posed in the introduction.

1. The results of the correlation tests reveal that while some features of the funerary rites were related, these relationships were not particularly strong. Specifically, the analysis showed a tendency towards richer equipment of graves located under barrows, such as grave 65, as well as graves 1, 9, 29, and 42. However, this trend was not universal, as some poorly furnished graves were also found under barrows (e.g. graves 2, 52, 62, 70, 73, and 80). Conversely, richly furnished flat graves were also present, although less commonly observed (e.g. graves 13, 17, and 43).
   Moreover, a correlation was found between the richness of grave furnishings and the presence of various types of urn covers and holes in the bottom of the urn, although these correlations were only of average strength. Nevertheless, these findings suggest a certain degree of preference for covering urns and drilling holes in their bottoms in wealthier equipped graves.
   The analysis also revealed that both the presence of different types of urn covers and the holes in the bottom of the urn were more commonly found in graves with greater depth. However, caution is required when interpreting this result, given that shallower graves are more likely to have sustained damage during agricultural work, leading to the loss of the urn cover or damage to the urn. Similarly, the prevalence of urn covers in graves under barrows was higher, which can be attributed to the protection provided by the mounds against destruction.
   Another finding of the study was a low but statistically significant correlation between the depth of the grave and the degree of labour invested in its construction. The data indicated that deeper graves were associated with more complex construction techniques.
   The results for the other features of the burial rite, and for their juxtaposition with biological characteristics, did not show statistically significant correlations. This suggests that there is no clear relationship between these factors.

2. The results of the study revealed that there were few differences between adult and child individuals in terms of funerary rite features, whereas more pronounced differences were observed for grave equipment. This suggests that certain preferences existed with regarding the inclusion of items in the grave equipment of a deceased individual based on their age.
   The only funerary rite feature that showed significant differences between men and women was the frequency of burials under barrows, with men being buried under such structures more often. The set of features statistically more frequent in female burials shows more similarities with the graves of children, due to the higher frequency of double graves of children with women than with men (5 : 2). No clear differences were found between the furnishing patterns of graves according to the sex of the deceased.
   The study concluded that age at the time of death was more significant factor in determining how a person was buried and what they were equipped with than biological sex. Moreover, the high number of features that were not specific for individuals of particular age of sex suggests that other factors influenced the decision-making process regarding the burial practices and grave equipment of the deceased, which cannot be inferred from archaeological sources.
3. The spatial analysis conducted on both the biological characteristics of the deceased and the richness of the grave equipment revealed no discernible concentrations of graves with similar features. This suggests that neither of these elements played a significant role in determining the location of burial, and that other considerations must have been taken into account (e.g. sequence of burials, family relationship, or other unidentified factors).
4. The reconstruction of the funerary ritual of the community using the cemetery at Diviaky nad Nitricou is possible only to a certain extent. It is evident that burning the corpse of the deceased at the pyre (all cremation burials) and placing the burnt remains in an urn (only 3% of pit graves) was a common practice. The high percentage (63%) of urns that were covered, together with the information about the relatively high degree of damage to the cemetery by ploughing, means that this element could also be considered part of the basic burial ritual on the cemetery in question. Other features of the funerary rite and grave furnishings show considerable variation. The analysis shows that certain elements were characteristic of particular age groups, suggesting that the age at death was one of the factors that influenced the community members' decisions on how to bury a particular person. However, the wide variation in the treatment of the dead and their equipment indicates that other factors were also involved. Unfortunately, the archaeological material cannot provide us with information about the thoughts or motivations of those involved in specific burial rites, making it challenging to fully reconstruct these factors.
   Overall, the analysis of the cemetery at Diviaky nad Nitricou sheds light on the funerary practices and beliefs of the community, but it also underscores the challenges of reconstructing past societies based on fragmentary archaeological material.

DISCUSSION

Comparison of the results with the findings of earlier publications on Diviaky nad Nitricou site

The results of conducted analysis can be compared with earlier publications on the site, particularly with *L. Veliačik's* work (*1991*), which covers the largest part of the cemetery. As a result, the author was able to draw more conclusions from the surveyed graves than in earlier works. As mentioned before, according to *L. Veliačik* (*1991*, 205), the excavated area represents approximately one-eighth to one-tenth of the total area of the cemetery. This estimation was possible thanks to sporadically salvaged or recorded graves in different parts of the site during intensive construction activities or smaller rescue excavations (*Budinský-Krička 1962*; *Pivovarová 1959*; *Ruttkay 1965*). It is therefore important to note that the data analysed in this study represent only a fragment of the actual cemetery. This fact may affect the results of the conducted tests and the conclusions drawn from them.

The results of correlations and the Kruskal-Wallis test, support the findings presented in Veliačik's work regarding the graves located under larger barrows. Such graves are more frequently equipped with a richer inventory, especially in comparison to flat graves. The small number of graves in which the sex of the buried individuals could be determined – only nine male and 13 female graves – makes it difficult

to establish gender differentiation and determine the distinctive features or typical equipment of male or female graves. According to Veliačik's conclusions, the cremated remains of only three men were placed in flat graves, four men in graves under a barrow, and two under a small barrow. Female burials occurred in six flat graves, four barrow graves, and three small barrow graves (*Veliačik 1991*, 206). Based on the available data, men were statistically more often buried under barrows, as confirmed by the results of the correspondence analysis. Furthermore, the analyses have shown that adults are buried under barrows more often than children. Despite some observed trends, it should be noted that the dead of different ages and both sexes occurred in both flat graves and under barrows. Thus, gender and age did not solely determine the way in which a person was treated after death, but rather may have been one of several aspects taken into account in the decision-making process.

Qualitatively and quantitatively, the grave inventory is standardised and, apart from ceramics, consists only of limited personal equipment, which only exceptionally indicates a different social position or gender of the buried individuals (*Veliačik 1991*, 206). It is noteworthy that spiral rings, which are relatively common, were not found in any male grave. Correspondence analysis suggests that rings, and also other ornaments, like bracelets, and necklaces were associated with children and juvenile individuals. The female inventory includes a rosette and a fibula fragments, but since these were found in only two examples, it is difficult to conclude with certainty that these were female-specific pieces of equipment. Interestingly, artefacts typically considered to be part of the male inventory, were found in both male graves and in the burials of a woman (arrowhead), as well as of a woman and a child (razor; *Veliačik 1991*, 207).

Based on the archaeological material from the Diviaky nad Nitricou site and the statistical analyses conducted on its basis, it can be concluded that the basic funerary rite on this cemetery required the exclusivity of cremation, but offered a wide range of options for the other features of burial. These options included urns, pit and cenotaph graves, and double graves or burials. Additionally, the construction of graves was also varied and included flat graves, larger and smaller barrows (*Budinský-Krička 1962*; *Pivovarová 1959*; *Ruttkay 1965*; *Veliačik 1991*). This level of flexibility in burial practices suggests that the cultural and social norms surrounding death and mourning at the site were relatively diverse.

Comparison of results with data from other Lusatian cemeteries in the immediate vicinity

Detailed studies of archaeological finds are available for only six of the nineteen sites around Diviaky nad Nitricou. Of these six, five date back to the Late Bronze Age and one to the Final Bronze Age. No similar statistical analysis has been conducted for these sites so far. However, based on the available evidence, it is possible to make general comparisons.

The archaeological analyses conducted have revealed a weak but statistically significant correlation between the richness of grave furnishings and the amount of labour invested in grave construction. This indicates that although social differentiation within the Lusatian culture population may have been a factor in the decision to construct barrows over some of the graves, it was also possible that other factors influenced the choice regarding a particular grave structure (*Kujovský 2006*, 64). The cemeteries in the area of the site in question have varying proportions of barrows to flat graves. At Diviaky nad Nitricou burials under barrows account for 37% of all graves. In the nearby cemeteries dating to the Late Bronze Age, the proportion of burials under barrows varies from absence of this type of burial in Dlžín (*Budinský-Krička 1962*, 127–129), through 31% in Malé Kršteňany (*Porubský 1959*, 55–66; *Šuhajíková-Pivovarová 1961*, 769–807), 48% in Opatovce nad Nitrou (*Remi*ášová 1976), 72% in Partizánske (*Benkovská-Pivovarová 1975*, 35–54; *Kujovský 2002*), to 83% in Krásna Ves (*Budinský-Krička/Veliačik 1986*). It appears that burials under barrows in Malé Kršteňany and Krásna Ves were typically richer in grave goods than flat graves, whereas no such relationship was observed in Partizánske and Opatovce nad Nitrou. Although these observations provide an initial understanding of burial practices and social differentiation among the Lusatian culture population, further statistical analyses are required to confirm them.

Anthropological analyses have only been conducted on the material from Krásna Ves cemetery, apart from discussed site. The analyses reveal a significantly lower proportion of individuals who died before the age of 14 (infans I–III age categories), which suggests that infants and young children were not frequently buried at the site (*Pavelková/Furmánek 2018*, 100). Given the considerable proportion of graves

located beneath barrows at this archaeological site, it is possible to observe a tendency, similar to that at Diviaky nad Nitricou, to cover the graves of adults with burial mounds more frequently than children. In addition, the Krásna Ves cemetery has a significantly richer grave inventory, particularly those buried under barrows, compared to the site under study (*Budinský-Krička/Veliačik 1986*). However, further analyses will be necessary to determine whether there are any variations in the frequency of occurrence of different types of artefacts in the graves of individuals of particular age categories and gender.

The cemeteries in the immediate vicinity of the Diviaky nad Nitricou site offer further evidence of the variability in burial practices among the Slovak group of Lusatian culture. These cemeteries exhibit differences in both the construction and the inventory of graves, as well as in the types of urns used and specific customs such as covering the urn or the presence of a hole in its bottom. However, a common feature shared by all of the cemeteries is the exclusive use of cremation burials (with the exception of a few fragments of an unburnt human skull discovered in one of the barrow mounds in Krásna Ves; *Budinský-Krička/Veliačik 1986*) and the predominance of urn graves.

Comparison of the results with the general picture of the funerary rites of the Lusatian culture

The Lusatian culture is typically associated with urn graves, usually located in relatively small pits whose diameter and depth is dependent on the urn's size or the number of accompanying vessels. In all phases of the Lusatian culture, urns are usually covered with another vessel, although flat stones are also commonly used. Furthermore, different stone constructions are often present (*Kujovský 1994*, 263). The situation on the Diviaky nad Nitricou site is, in general, consistent with this description. However, various studies of Lusatian cemeteries in Slovakia and other regions occupied by this culture indicate significant variation in burial rituals both within single cemeteries and between particular sites (*Kowalczyk-Matys 2017*; *Kujovský 2006*; *Przybyła 2004*).

The variation in burial practices observed on the cemeteries of Lusatian culture may have been influenced by various factors. *T. Rysiewska* (*1996*, 6) proposed six hypotheses to explain this variation. The first two (related to changes in the community and burial practices over time) can be rejected due to chronologically homogeneous inventory of the site in Diviaky nad Nitricou, indicating a relatively short period of usage (*Veliačik 1991*, 143). Two further hypotheses concern the differentiation of the deceased in terms of sex and age (*Rysiewska 1996*, 6). The dependence of the features of the funerary rites and equipment on these factors was tested by means of correlation tests (which did not show statistically significant relationships) and correspondence analysis. Thanks to the latter it was indeed possible to observe some relationships, especially of age with the frequency of occurrence of certain elements of the burial inventory, but also of age and sex with the features of the funerary rites. However, it should be noted that, at the same time, this analysis showed a number of features independent of the biological characteristics of the deceased (features located close to the centre of the graph), so that their variation cannot be explained by these factors. This suggests that other factors may have influenced the funerary rites and equipment used, highlighting the need for further research to understand the complex social and cultural contexts in which these practices took place. Hypotheses 5 and 6 proposed by *T. Rysiewska* (*1996*, 6) relate to social status and the belonging of the deceased to different kinship groups during their lifetime. However, the available data from the Diviaky nad Nitricou cemetery do not provide sufficient evidence to test the validity of these hypotheses. The relationship between the social status of individual community members during their lifetime and its reflection in the funerary ritual remains unclear (*Parker Pearson 1982*, 99, 100). Even when variations in the wealth of grave furnishing or the level of effort invested in grave construction can be observed within a cemetery, the reasons underlying the differential treatment of the deceased cannot be definitively determined. Regarding hypothesis 6, DNA testing serves as the most reliable method to establish genetic kinship of individuals discovered in archaeological context. Nevertheless, it is not feasible for remains found in cremation graves. Furthermore, a kinship group may also encompass individuals who are not biologically related, such as those included in the group through marriage or adoption (*Rysiewska 1996*, 30). Consequently, we lack the means to ascertain the affiliation of individuals from the cemeteries associated with the Urnfield cultures to specific kinship groups.

It is important to note that the reasons for the variation in burial practices and their relationship to the individual deceased may differ across time and regions of the Lusatian culture. The significance of burial

practices may have changed over time, and the social and cultural contexts in which they were practiced must be carefully considered to fully understand their meaning and significance (*Kujovský 2006*, 64).

The presence of burial mounds, or barrows, often leads to assumptions about the wealth and status of the individuals buried within them. At the Diviaky nad Nitricou site, the correlation between the richness of grave equipment and the effort put into grave construction is relatively low, indicating that the furnishings of graves under the barrows may not always be significantly richer than those of flat graves. Furthermore, some burials belonging to the poorest class were found under the barrows. Similar findings have been observed at other Lusatian sites in Slovakia. According to *R. Kujovský* (*2006*, 64), during earlier phases of the Lusatian culture the social status was emphasised by the mound construction itself. On the other hand, in younger phases, when the custom of building burial mounds seems to have declined, the role of these mounds as, for example, family tombs can be considered. This can be confirmed by examples of multiple burials under barrows from the Diviaky nad Nitricou cemetery, including graves no. 11, 16, 26, 39 or 65.

CONCLUSION

Burial practices are determined by a combination of social, philosophical-religious, political, physical, and circumstantial factors. These may affect what is ultimately found in the archaeological material to varying degrees and in different forms (*Carr 1995*, 107; *Rebay-Salisbury 2012*, 15, 16). Therefore, it is important to acknowledge the multiple and intricate events surrounding the creation of both individual graves and entire cemeteries when analysing the funerary rites of any archaeological culture. Furthermore, the symbolism and religious ideas of the time can make it challenging to connect the specific properties of sepulchral objects to the intentions of their creators (*Rysiewska 1996*, 51).

Statistical analyses can, at least to some extent, help overcome these issues. They allows researchers to objectively identify patterns and trends in the data related to funerary rites. By using quantitative methods, it is possible to determine the frequency of certain practices and establish upon what the variability of burial rituals depended. This avoids the influence of the researcher's opinions and beliefs on the interpretation of the material and therefore allows for a better understanding of what actually of what funerary rites were actually like in prehistory.

The statistical analysis of funerary rites in the Lusatian cemetery in Diviaky nad Nitricou has provided insights into the burial practices of this community. While some features of the funerary rites were related, the relationships were not particularly strong, indicating that there was considerable variation in the treatment of the dead and their equipment. Nevertheless, certain preferences existed, such as the tendency towards richer equipment of graves located under barrows, as well as to the more frequent presence of urn covers and holes in their bottoms in wealthier burials.

The study revealed that age at the time of death was a more significant factor in determining how a person was buried and what they were equipped with than biological sex. The spatial analysis conducted on both the biological characteristics of the deceased and the richness of the grave equipment revealed no discernible concentrations of graves with similar features, suggesting that other considerations, such as family relationships or sequence of burials, may have influenced the location of grave.

The analysis of the cemetery at Diviaky nad Nitricou also highlighted the challenges of reconstructing past societies based on fragmentary archaeological material. Future studies that apply similar statistical analyses to other cemeteries could provide more detailed data on the funerary rites of the Lusatian culture in Slovakia and help to build a more comprehensive understanding of this community.

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Štatistická analýza pohrebného rítu lužickej kultúry na príklade lokality Diviaky nad Nitricou

U r s z u l a Ś m i g i e l s k a

Súhrn

Rituály spájané s pohrebom zohrávali kľúčovú rolu v ľudskej spoločnosti počas celej histórie a archeologické skúmanie týchto praktík môže poskytnúť cenné poznatky o viere a kultúrnych zvyklostiach. Použitie štatistickej analýzy na tieto dáta sa stalo sľubnou cestou výskumu, ktorá napomáha ich poznaniu. Tento článok sa zameriava na skúmanie funerálnych zvykov na pohrebisku v Diviakoch nad Nitricou v mladšej dobe bronzovej s použitím štatistických metód. Štúdia je založená na analýze 107 hrobov, ktoré boli vykopané medzi rokmi 1940 a 1975 (*Budinský-Krička 1962*; *Pivovarová 1959*; *Ruttkay 1965*; *Veliačik 1991*). Analýza je zameraná na sledovanie bohatstva hrobovej výbavy v prepojení na spoločenské postavenie zomrelých, porovnáva distribúciu bohatstva na lokalite s Paretovou distribúciou

pomocou Kolmogorova-Smirnovho testu, priestorovú analýzu, korelácie rysov pohrebných rituálov navzájom s biologickými charakteristikami, Kruskalov-Wallisov test a korešpondenčnú analýzu. Výsledky štúdie ukázali identifikáciu štyroch odlišných spoločenských tried. Test Kolmogorova-Smirnova naznačil, že distribúcia bohatstva na mieste nevykazovala očakávaný vzor Paretovej distribúcie. Výsledky priestorovej analýzy neodhalili žiadne jasné vzory týkajúce sa rozmiestnenia jedincov daného veku alebo pohlavia, alebo s rôznymi kategóriami výbavy. Štúdia identifikovala sedem štatisticky významných korelácií. Ich sila bola v každom prípade priemerná alebo slabá. Výsledky Kruskalov-Wallisovho testu ukázali, že medián bohatstva výbavy bol štatisticky významne odlišný medzi určitými skupinami. Korešpondenčná analýza ukázala výrazné rozdiely výbavy hrobov medzi dospelými a deťmi, ale menšie rozdiely v prvkoch pohrebného rítu. Celkovo štúdia poskytuje cenné poznatky o pohrebných praktikách komunity v Diviakoch nad Nitricou a zároveň poukazuje na problémy rekonštrukcie minulých spoločností s neúplnými archeologickými údajmi.

Obr. 1. Mapa lužických pohrebísk vo vzdialenosti do 20 km od lokality Diviaky nad Nitricou. Mladšia doba bronzová (a): 1 – Diviaky nad Nitricou; 2 – Bánovce nad Bebravou; 3 – Bojnice; 4 – Bystričany; 5 – Chvojnica; 6 – Dlžín; 7 – Krásna Ves; 8 – Kšinná; 9 – Lehota pod Vtáčnikom; 10 – Malé Kršteňany; 11 – Nováky; 12 – Opatovce nad Nitrou; 13 – Partizánske-Malé Uherce, Nad mlynom; 14 – Partizánske-Malé Uherce, Pri kostole; 15 – Partizánske-Šimonovany. Neskorá doba bronzová (b): 16 – Handlová; 17 – Nitrianske Pravno-Vyšehradné; 18 – Prievidza-Hradec; 19 – Zemianske Kostoľany-Dolné Lelovce, Kňažská; 20 – Zemianske Kostoľany-Dolné Lelovce, Kostol Narodenia Panny Márie.

Obr. 2. Plán časti pohrebiska v Diviakoch nad Nitricou preskúmanej v rokoch 1974–1975 s údajmi o biologickom pohlaví a veku pri úmrtí zomrelých (podľa *Veliačik 1991*, obr. 2; modifikované). Legenda: a – infans; b – infans–juvenis; c – juvenis; d – juvenis–adultus; e – adultus; f – adultus–maturus; g – maturus; h – vek neznámy; i – žena; j – muž; k – pohlavie neznáme; l – len zvieracie kosti.

Obr. 3. Paretov graf bohatstva hrobovej výbavy na lokalite Diviaky nad Nitricou. Na stĺpcoch sú znázornené hodnoty indexu bohatstva v zostupnom poradí a na čiarovom grafe sú znázornené kumulatívne percentá zľava doprava. Na hornej horizontálnej osi sú uvedené hodnoty indexu bohatstva. Dolná horizontálna os predstavuje kumulatívne percento tejto hodnoty. Čiernou farbou sú označené hroby s kumulatívnym bohatstvom 80 % a sivou farbou hroby so zvyšnými 20 %. Hroby bez výbavy sú označené absenciou stĺpcov nad nimi.

Obr. 4. Teplotná mapa ukazujúca bohatosť výbavy hrobov vypočítanú z indexu bohatstva – čím tmavší odtieň červenej, tým vyšší index pre daný hrob (podľa *Veliačik 1991*, obr. 2; modifikované).

Obr. 5. Graf zobrazujúci medián, rozsah dvoch stredných kvartilov a minimálne a maximálne hodnoty indexu bohatstva v skupinách rozlíšených na základe konštrukcie hrobu. 1 – bez kamennej konštrukcie; 2 – hrobová jama obložená alebo prekrytá kameňmi; 3 – kamenná mohylka; 4 – kamenná mohyla.

Obr. 6. Výsledky korešpondenčnej analýzy pre vek pri úmrtí a charakteristiky pohrebného rítu.

Obr. 7. Výsledky korešpondenčnej analýzy pre biologické pohlavie a charakteristiky pohrebného rítu.

Obr. 8. Výsledky korešpondenčnej analýzy pre vek pri úmrtí a výbavy hrobov.

Obr. 9. Výsledky korešpondenčnej analýzy pre biologické pohlavie a výbavy hrobov.

Tabela 1. Súhrn výsledkov antropologickej analýzy kosteného materiálu z pohrebiska v Diviakoch nad Nitricou (podľa *Stloukal 1991*, tab. 1).

Tabela 2. Charakteristika spoločenských tried rozlíšených na základe indexu bohatstva.

Tabela 3. Výsledky korelačných testov pre konkrétne pohrebné obrady a biologické charakteristiky. Farby rozlišujú štatisticky významné (zelená) a nevýznamné (červená) výsledky. Páry, pre ktoré neboli vykonané korelačné testy, sú označené bledo sivou farbou.

Tabela 4. Porovnanie skupín vyčlenených na základe konštrukcie hrobu z hľadiska bohatosti hrobovej výbavy vypočítanej pomocou indexu bohatstva (Kruskalov-Wallisov test). Farby rozlišujú štatisticky významné (zelená) a nevýznamné (červená) výsledky.

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