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THE DAWN OF THE EARLY BRONZE AGE IN SOUTH-WESTERN SLOVAKIA

A Re-Evaluation of the Social Structure and Chronology of Výčapy-Opatovce

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This paper deals with the chronology and social structure of the Early Bronze Age cemetery of Výčapy-Opatovce (Slovakia/Nitra district). Six radiocarbon dates are presented for the Nitra culture cemetery, which date Výčapy-Opatovce to the very beginning of the Early Bronze Age (2300/2200–1500/1400 BCE), roughly contemporaneous with the first phases of the Branč cemetery (Nitra district). A small group of graves originally attributed to the Copper Age Ludanice group also seem to date at least partially to the Bronze Age. The results of the radiocarbon dating do not support a chronological division of the cemetery. Applying a burial index (Z-transformation), five grave clusters were identified within the cemetery. These concentrations of richly furnished graves are separated from each other by poor graves. Two of the clusters could be dated by the radiocarbon dates and demonstrated different areas at the burial ground were used at the same time. The authors conclude that in particular the chronological burial site model of Ch. Bernard, which she proposed in 2005 for Výčapy-Opatovce, should be rejected. The combination of the results of the analysis of the grave indices and radiocarbon dates for Výčapy-Opatovce argues for a division of the cemetery into social groups, as initially suggested by A. Točík.

Keywords: Western Slovakia, Early Bronze Age, Radiocarbon dating, Nitra culture, Ludanice group, social units, burial index.

INTRODUCTION

The Early Bronze Age in south-western Slovakia was a period of intense social and economic changes. Due to its position at the Carpathian basin's northern edge and next to the Moravian gate, the region is the scene of cultural transition and exchange between central and south-eastern Europe.

The prehistoric societies located here at the intersection between the Eneolithic Age and the Early Bronze Age are part of an intensive research discussion about chronology and forming of archaeological groups (for a summary *Bátora 2018*; *Peška/Králík 2020*). Closely intertwined in this dynamic development of Early Bronze Age societies are the areas of west and south-west Slovakia, Moravia, Lesser Poland and Silesia. The growing number of radiocarbon dates are help to further clarify existing chronologies and reshape our understanding of the dawn of the Early Bronze Age in south-western Slovakia. With this new set of radiocarbon dates from Výčapy-Opatovce (Nitra district), presented here, the authors hope to promote and contribute to further discussions about the chronology of the Nitra culture.

Since its discovery in the 1950s the Early Bronze Age cemetery of Výčapy-Opatovce is considered one of the important cemeteries of the Nitra culture (*Točík 1979*, 65 ff.). From a total of 317 graves, about 300 are assigned to the Nitra culture (*Točík 1979*, 34), while only a few others were dated to the transitional phase from Nitra to Únětice culture (*Benkovsky-Pivovarová/Chropovský 2015b*, 120; *Lichardus/Vladár 1997*; *Točík 1979*, 47). Additionally, a small number of graves dated to the Copper Age Ludanice group (*Lichardus/Vladár 1964*; *Točík 1979*, 65) were uncovered. Together with the cemeteries of Abrahám I[1] (*Benkovsky-Pivovarová/Chropovský 2015a*, 13 ff.), Branč[2] (*Vladár 1969*; *1973*; *Vladár/Lichardus 1968*) and Jelšovce[3] (*Bátora 2000a*), Výčapy-Opatovce is the largest published assemblage of graves of the Nitra culture to date (Fig. 1).

Considering the intensive ongoing debates as briefly summarized in the following (*Bátora 2018*; *Furmánek/Veliačik/Vladár 1999*; *Peška/Králík 2020*) about the dating of the Early Bronze Age in southwestern Slovakia, ^{14}C dating was overdue for Výčapy-Opatovce. Furthermore, only eight radiocarbon dates came from the Nitra culture are published so far. Four dates coming from the Branč cemetery (*Gerloff 1993*) and four from the Jelšovce cemetery (*Görsdorf 2000*).

In this paper, six new ^{14}C dates from Výčapy-Opatovce are presented and contextualized alongside

[1] 186 graves of the Nitra and Únětice culture.

[2] 307 graves of which 237 are assigned to the Nitra culture.

[3] 616 graves of which 176 are assigned to the Nitra culture.

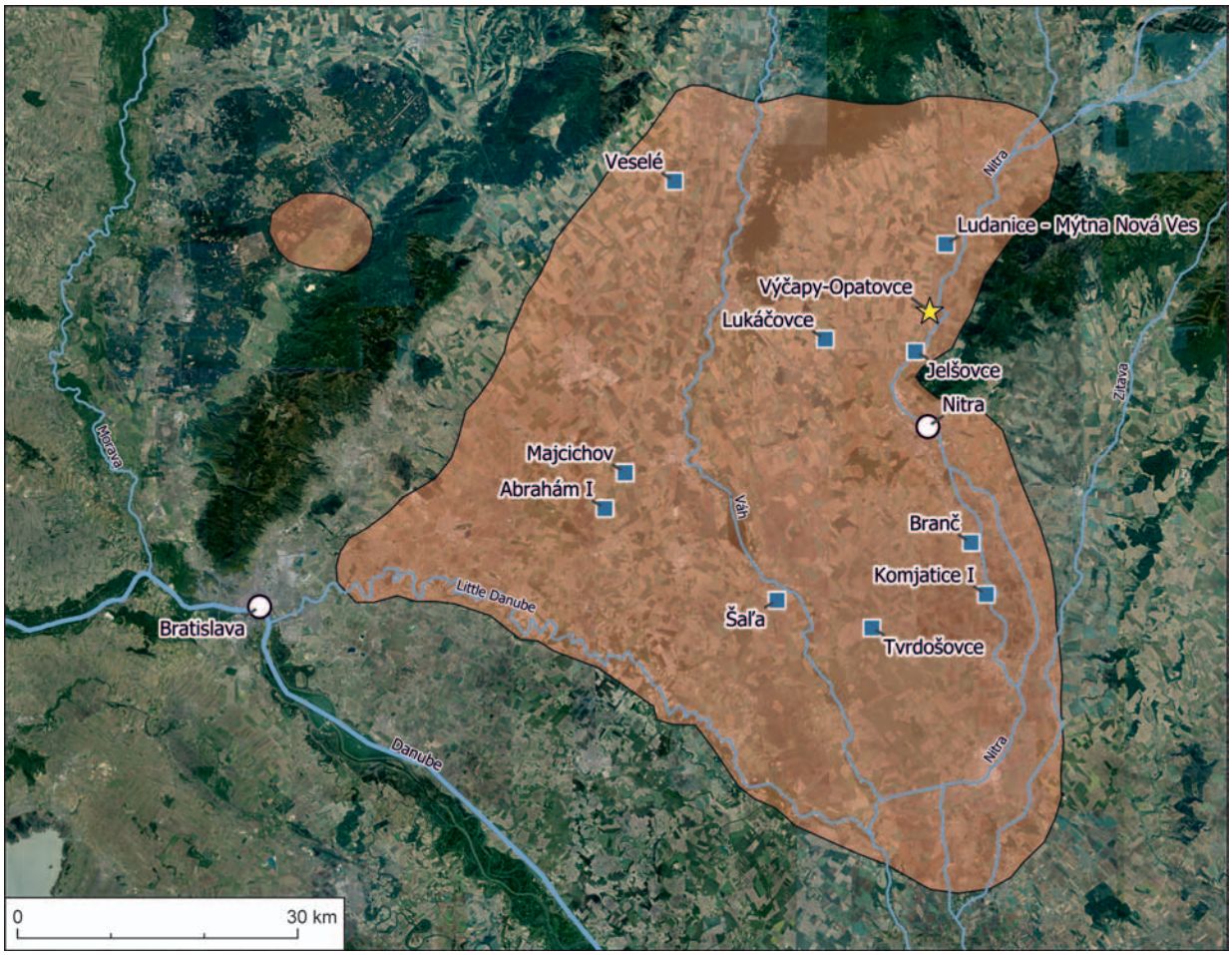

Fig. 1. Map of south-western Slovakia with the main site. Yellow star – Výčapy-Opatovce; Blue squares – sites mentioned in the text; Red area – the distribution area of the Nitra culture in south-western Slovakia (after *Furmánek/Veliačik/Vladár 1999*).

previously known Early Bronze Age dates, and their significance for the site's chronology is considered. Particular focus is put on the evaluation of the analysis of Christel Bernard, who in her dissertation in 2005 postulated a three-phase character with chronological relevance for Výčapy-Opatovce (*Bernard 2005*, 117 ff.).

Using the new ^{14}C data, the authors intend to discuss previous statements about the chronology of the cemetery. Further, this paper attempts to develop a model of social differentiation within the cemetery through a socio-economic analysis, using burial indices.

SPATIAL DISTRIBUTION OF THE NITRA CULTURE

The main distribution zones of Nitra culture in Slovakia are mainly the southern areas around and between the river valleys of the eponymous Nitra and the Váh (Fig. 1). The occurrence is limited in the east by the heights of Hronská pahorkatina. In the area of the Váh valley, the northern border is approximately at Nové Mesto nad Váhom, in the area of the Nitra valley at Topoľčany. The southern border runs approximately at the level of the small Danube. In today's Czech Republic, the Nitra culture is mainly spread in Eastern Moravia, on the eastern side of the Morava river valley up to about the height of Olomouc (*Bátora 2018*, 78; *Furmánek/Veliačik/Vladár 1999*, 27 f.).

EMERGENCE AND APPERANCE OF THE NITRA CULTURE

Due to the growing number of similar material from Early Bronze Age sites in the 1950s *A. Točík* (*1956*) was able to identify an independent archaeological culture (*Furmánek/Veliačik/Vladár 1999*, 27 f.), naming it after the biggest concentration of finds along the river Nitra – Nitra culture. Recognizing the similarities in the material of the archaeologi-

cal cultures and groups of the Epi-Corded Ware Carpathian cultural complex also in Moravia and Poland, he subsequently switched his terminology to Nitra group (detailed research history e.g. *Bátora 2018*, 71 ff.; *Furmánek/Veliačik/Vladár 1999*, 22 ff.; *Lichardus/Vladár 1997*, 221 ff.).

The primary sources for research of the so-called Nitra culture are the numerous graves found in southern Slovakia. Especially the large burial grounds, of the 63 known so far, such as Abrahám I, Branč, Jelšovce, Ludanice-Mýtna Nová Ves and Výčapy-Opatovce form the backbone of research. So far, settlement sites have only been reliably verified in Lukáčovce, Nitra-Dolné Krškany, Nitra-Horné Krškany (*Bátora 2018*, fig. 69). In the Moravian area, in addition to larger cemeteries such as Holešov or Hulín, significantly more settlement sites are known than in Slovakia (*Bátora 2018*, 77 ff.).

The typical archaeological inventory of the Nitra culture consists of bowls, jugs, pots and cups (*Bátora 2018*, 79; *Furmánek/Veliačik/Vladár 1999*, 32 f.). Other finds include copper jewellery such as willow leaf rings or simple wire – so-called 'Noppen' rings – sheet metal diadems and pins (also made of bone), necklaces consisting of beads (bone, antler, faience, dentalium and copper), bone slides, and finally, simple three-edged copper daggers and flint arrowheads (*Furmánek/Veliačik/Vladár 1999*, 28 ff.; *Točík 1978*, 99 f.).

In south-western Slovakia, the so-called Chłopice-Veselé culture is traditionally regarded as the basis from which the so-called Epi-Corded Ware Carpathian cultural complex (EPCC) developed. Additionally, the Nitra culture, the eastern Slovak Košťany culture as well as the Mierzanowice culture, widespread in Lesser Poland, Upper Silesia and parts of Moravia, are belonging to that cultural complex (first *Machnik 1967*). According to *J. Bátora* (*2018*), the Chłopice-Veselé culture builds on the Eneolithic 'substrates' (Somogyvár-Vinkovci, Kosihy-Čaka-Makó culture, Corded Ware, Bell Beaker), components of which can be found in the Nitra culture (*Bátora 2018*, 71 ff.). In this context, he also refers to the Chłopice-Veselé culture as the Proto-Nitra phase, which he prefixes to his three developmental phases of the Nitra culture:
– early phase 2200–2150 cal. BC;
– classical phase 2150–1930 cal. BC;
– late phase (Nitra-Únětice phase) 1930–1870 cal.BC.

The late phase of the Nitra culture (Nitra-Únětice phase) is at the same time his early phase of the Únětice culture, with which he considers the increased influence of the Únětice culture, whose influences he notes in the classic phase of the Nitra culture (*Bátora 2018*, 87 ff.).

However, in more recent work, *J. Peška* and *M. Králík* (*2020*) argue for a new periodisation of the EPCC, at least for the Moravian and Moravian-Silesian regions. They assume that there is no chronologically uniform Chłopice-Veselé formation, but that two different time horizons exist. This division is based on the work of *S. Kadrow* and *J. Machnik* (*1997*), who postulate an older proto-Mierzanowice horizon with Chłopice material and a younger early Mierzanowice horizon with Veselé group material, based on ^{14}C data and stratigraphic observations. Based on this, *J. Peška* and *M. Králík* (*2020*, 224 ff.) analysed grave inventories in combination with ^{14}C dating using multivariate statistical methods and propose a new periodisation for the Epi-Corded Ware Carpathian cultural complex:
– proto Nitra phase (EPCC I), dating roughly on a par with the Chłopice group;
– early Nitra phase (EPCC IIa, IIb), which dates roughly on a level with the Veselé group;
– older Nitra phase (EPCC III), probably corresponds with the end of the Proto-Únětice culture and the second phase of the Únětice culture;
– classic Nitra phase, corresponds with the 2nd phase of the Únětice culture;
– postclassical Nitra phase, corresponding to the 3rd preclassical phase of the Únětice culture.

There are no clear division between the individual phases. The beginning and end of each phase are strongly interwoven. Based on typological and technological similarities with material from Lesser Poland and especially Upper Silesia, *J. Peška* and *M. Králík* (*2020*) propose a terminological designation of the finds north of the Moravian Gate as Mierzanowice. The finds from the Moravian Gate and south of it, as well as the finds from south-west of Slovakia, in view of their great similarities, they refer to as Nitra culture (*Peška/Králík 2020*, 249). It suggests that the earliest material from western Slovakia (e.g. from Kúty II), can be typo-chronologically located in the Proto-Mierzanowice stage (*Peška/Králík 2020*, 223 f.), so that the transfer of the results of the study for Moravia to Slovakia also seems possible. However, this periodisation system where Chłopice-Veselé is considered as proto-Mierzanowice and early Mierzanowice is contested by J. Bátora, who argues that this cultural sequence does not correspond to the developments in SW Slovakia (*Bátora 2018*, 72). Since the statistical evaluation of the graves of the Nitra culture in southern Slovakia is yet to published, this problem is for the time being unresolved (*Peška/Králík 2020*). We believe that the ^{14}C dating analysed in this paper will contribute to this discussion.

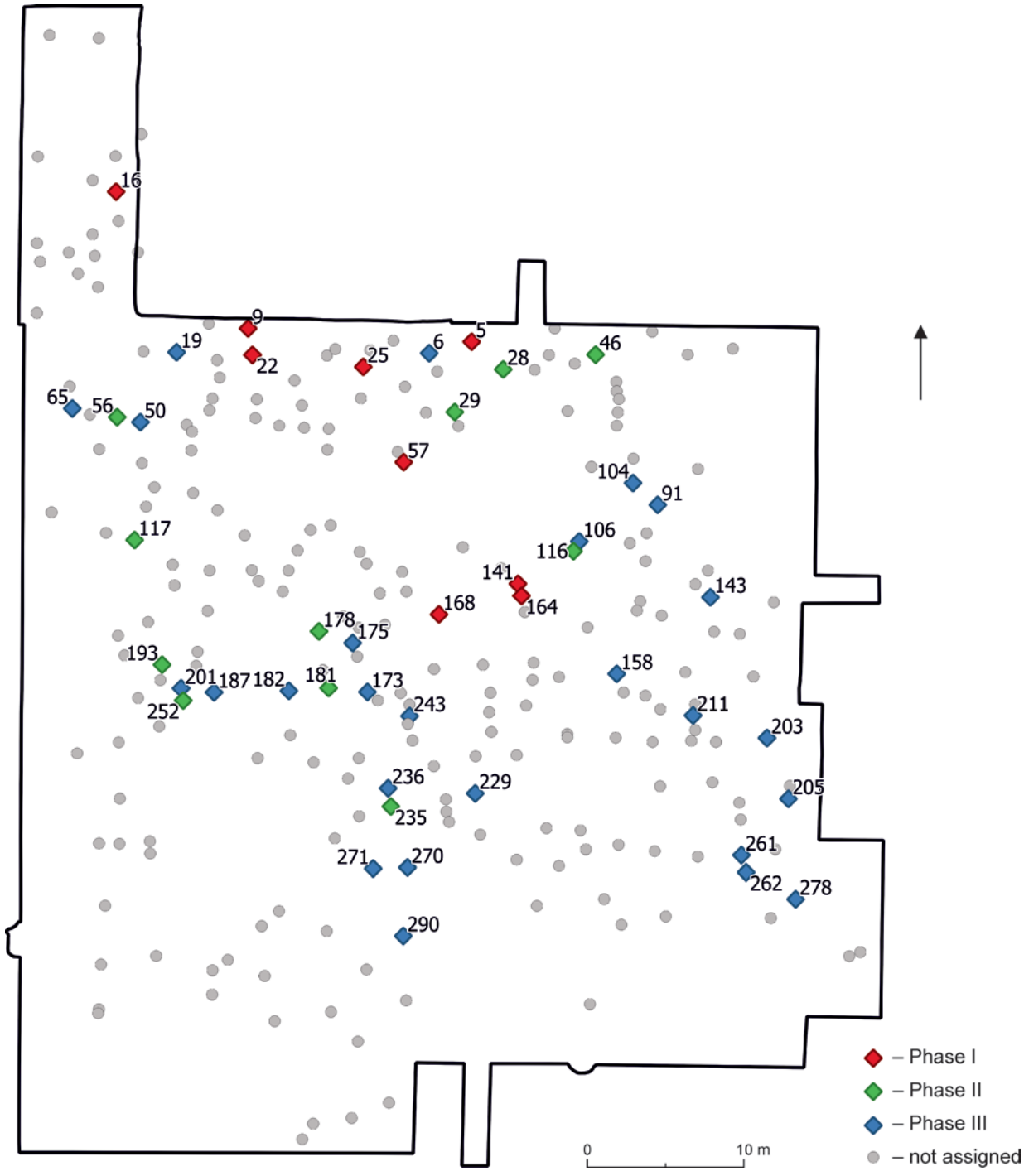

Fig. 2. Výčapy-Opatovce. Excavated area of the burial site. Highlighted are the phases based on Ch. Bernard's typo-chronological work (after *Bernard 2005*).

THE BURIAL SITE

Výčapy-Opatovce is located on the western bank of the Nitra river, c. 11 km north of the city of Nitra (Fig. 1; *Bernard 2005*, 117; *Točík 1979*, 65 ff.). Between 1951 and 1954 a total of 319 inhumation graves (330 individuals) were excavated under the lead of *A. Točík* (*1963*; *1979*). Due to its proximity to a brickyard and road construction work nearby, it is believed that more than 60–80 graves had been destroyed before the excavations (*Točík 1979*, 65 f.). Of the 319 graves 64 (21%) show signs of disturbance (Fig. 2; *Bernard 2005*, 133).

With a proportion of around 300 graves the site is mainly occupied by the Nitra culture (*Benkovsky-Pivovarová/Chropovský 2015b*, 117–120; *Točík 1979*, 65). A small number of graves was assigned to the transition of the Nitra and Únětice culture (*Benkovsky-Pivovarová/Chropovský 2015b*, 120; *Točík 1979*, 47) and the Eneolithic Ludanice group[4] (*Lichardus/Vladár 1964*; *Porubský 1955*; *Točík 1979*, 65). The spectrum of grave goods represents the typical forms of the Early Bronze Age, mostly of the Nitra culture, mainly the large number of willow leaf rings is to be emphasised here.

The anthropological analysis of 205 individuals was conducted by E. Strouhal but never published in detail. The short overview dealing with sex determination of the buried individuals at the cemetery is available, where *E. Strouhal* (*1978*, 132) states that the sex determination via archaeological information (burial goods, orientation) is to 97% correct. In the published catalogue of Výčapy-Opatovce it remains unclear in which cases the sex determination is based on the anthropological or archaeological assessment (*Točík 1979*, 65).

THE CEMETERY ANALYSIS BY A. TOČÍK

A. Točík (*1963*) observed three different grave groups in Výčapy-Opatovce, each with approximately 100 graves. This is based on considerations of the spatial distribution of the graves, but it remains unclear which burials belong to which grave group. Neither in the first overview of the archaeological material (*Točík 1956*), nor in the contemporary overview of the Nitra group (*Točík 1963*) or in the final draft of the cemetery catalogue (*Točík 1979*) is an allocation apparent.[5]

In the three aforementioned groups, *A. Točík* (*1963*; *1979*) proposed that extended family groups burying their dead simultaneously across all three phases of the Nitra culture.[6] The (partial) statistical evaluation of the large and some small cemeteries by *A. Točík* (*1979*, 26), on which the phase classification is based, was not published, however. An overview of which graves belong to which phase is therefore not available.

The chronological phase division of the Nitra culture and the Výčapy-Opatovce cemetery has subsequently been repeatedly taken up and expanded (e.g. *Bátora 2000b*; *2018*; *Furmánek/Veliačik/Vladár 1999*). *A. Točík* (*1979*, 25) sees a similar spatial division according to extended families as in Výčapy-Opatovce in other large cemeteries of the Nitra culture in Branč, while an internal structure is not present in the smaller cemeteries.

THE CEMETERY ANALYSIS BY J. LICHARDUS AND J. VLADÁR

In their 1997 contribution, Ján Lichardus and Jozef Vladár synchronise the graves from Výčapy-Opatovce with the first five burial horizons from Branč and propose a chronological division into four horizons. Due to the poor quality of the published illustrations, they only refer to a limited selection of the most important graves and their characteristic furnishings:

Výčapy-Opatovce I – graves of the Veselé group (e.g. grave 8, 164). The willow leaf decoration without a midrib is characteristic;

Výčapy-Opatovce II – corresponds to the early Nitra culture (e.g. grave 25, 26, 32, 44, 65, 80, 83, 85, 87, 132, 141, 153). Early Nágyrev culture pottery, bone and shell ornaments and isolated willow leaf ornaments are characteristic;

Výčapy-Opatovce III – corresponds to the classical Nitra culture (e.g. grave 6, 116, 120, 168, 176, 178, 179, 182, 188). Willow leaf ornaments as well as bone and shell ornaments are characteristic;

Výčapy-Opatovce IV – corresponds to the late Nitra culture (e.g. grave 104, 165, 175, 183, 205, 235, 270, 271, 278).

Different to *A. Točík's* (*1963*, 761 ff.; *1979*, 24 ff.) they make a clearer (chronological) distinction between of the graves with Veselé characteristic and graves with pottery of the early Nágyrev culture. Therefore, they are separating the earliest graves into two different phases (I, II).

THE CEMETERY ANALYSIS BY CH. BERNARD

In her doctoral thesis from 2005 at the Universität des Saarlandes, Ch. Bernard deals with the costume and burial customs within the Nitra culture. In addition to typological evaluations, she includes data from extensive metal analyses in her evaluation.

[4] Ludanice burials are graves 1, 2, 3, 5, 7, 195, 202a, 259, 218, 225, 280 and 286 (*Lichardus/Vladár 1964*).

[5] *J. Lichardus* and *J. Vladár* (*1997*) refer to a never published monograph by A. Točík (1960), in which the Nitra culture is described in detail. The basis for this is the evaluation of the material from Výčapy-Opatovce.

[6] 1. Proto-Nitra or Early Nitra phase; 2. classical Nitra phase (older phase); 3 Nitra-Únětice phase (younger phase; *Točík 1979*, 26 ff.).

Her work is divided into two parts, with the aim of the work being to explore the development of chronological and social groups within the cemeteries. In the first part she deals with the typological and archaeological evaluation of the cemeteries of Branč, Komjatice I, Šaľa I, Tvrdošovce and Výčapy-Opatovce. The second part presents the results of the metal analyses.

Focusing on the undisturbed female burials, she elaborates several so-called 'costume groups' through combination statistics.[7] However, she pointed out that already J. Lichardus and J. Vladár consider the possibility of a typological division of the material from Branč and Výčapy-Opatovce as difficult (*Bernard 2005*, 108; *Lichardus/Vladár 1997*, 282).

For Výčapy-Opatovce, Ch. Bernard elaborates on three costume groups each for female (group A–C) and male burials (group 0, a and b; *Bernard 2005*, 152 ff.). Next, she summarizes these groups into three chronological phases (Phase I–III[8]; *Bernard 2005*, 155 f., map. 82–88). In phase I typical objects for a buried female are willow leaf earrings and belts or necklaces made of bone beads. Male burials are characterized by pottery as grave goods. In phase II typical objects for a buried female are willow leaf earrings, wire rings, necklaces with faience beads and copper objects as well as bone and antler bead applications. Male burials are characterized by finger and/or ear rings made of wire. In phase III typical objects for a buried female are willow leaf ear rings, so called 'Noppenringe', ear rings made of wire, necklaces and applications made of beads of various materials (antler, bone, copper and faience), pins, arm- and finger rings, head bands and shell artefacts. Male burials are characterized by finger rings, 'Noppenringe', willow leaf knives, boar tusks and shell artefacts.

In her discussion of the material from Výčapy-Opatovce she concludes that the costume groups – and thus also the phases – are not social groups, but chronological groups. She states that in none of the groups is a concentration of wealth recognizable, since in every of the three groups there are graves with a high number of bronze rings and also burials with a high number of beads and therefore wealth is present in every group and no wealth disparities are visible, so these groups are not social groups (*Bernard 2005*, 158 f.).

Within the cemetery, from Ch. Bernard's point of view, the cemetery developed from the inside to the outside and thus neighbouring graves can probably be assigned chronologically to the same group (*Bernard 2005*, 155). She briefly states the possibility that rich neighbouring burials from different phases, might indicate a family connection between them (*Bernard 2005*, 159 ff.), but does not elaborate on this idea. At this point, however, it should be stated that only 53 of about 300 graves of the Nitra culture could be classified into one phase by Ch. Bernard.

Since Ch. Bernard's model is the latest model of the historical and social development of the cemetery, we will use it as a baseline for the chronological and social analysis using radiocarbon dating and burial index.

METHODOLOGY AND RESULTS

^{14}C dating

While consulting finds assemblages from Výčapy-Opatovce the question arose as to what extent the chronological phases of Ch. Bernard were correct. Basically, the selection of samples was limited to the available finds in the Malé Vozokany archive, access to the skeletal material was not possible. Due to a lack of access to the complete find's assemblages, the sampling strategy could not be constructed according typo-chronology. Instead, ^{14}C samples were limited to available fragments of antler beads. In order to achieve a good coverage of the cemetery with a small sample set, samples were taken from two areas of the cemetery. Of the graves sampled, one falls into Phase I, three into Phase II, and two into Phase III of Ch. Bernard. Consideration was given to possible temporal offset caused by material culture inheritance in the past, where some beads were passed on as family heirlooms. However, given the undocumented example of such practices in the study region, these initial reservations were dismissed.

From the available antler beads six samples were selected based on their assignment in Ch. Bernard's phases and their accompanying objects and sent to Curt-Engelhorn-Center Archaeometry gGmbH (CEZA) for analysis. Collagen was extracted at CEZA according to the Longin method, filtrated and freeze-dried. In the following step, samples were combusted and converted into graphite. The isotopic ratios were then measured with a MICADAS-type AMS-system.

For the calibration and analysis of the dating results the software OxCal version 4.4.4 (*Bronk*

[7] The sex determination is based on the information provided by *A. Točík (1979)*.

[8] Phase I: grave 5, 9, 16, 22, 25, 57, 141, 164, 168; Phase II: grave 28, 29, 46, 56, 93, 96, 116, 117, 129, 178, 181, 193, 235, 252; Phase III: grave 6, 19, 50, 65, 91, 92, 104, 106, 118, 143, 155, 158, 170, 173, 175, 182, 187, 201, 203, 205, 211, 229, 236, 243, 261, 262, 270, 271, 278, 290.

Tab. 1. Výčapy-Opatovce. Results of the ^{14}C analysis on six samples. 1 and 2 sigma (σ) ranges are based on calibration with OxCal v4.4.4 (*Bronk Ramsey 2009*; *Reimer et al. 2020*).

Lab. Code	Grave	Phase after Bernard	^{14}C yr BP	Date (cal. BC.; 1σ – 68%)	Date (cal. BC.; 2σ – 95%)
MAMS-52297	5	I	3682 ± 23	2133–2029	2190–1977
MAMS-52298	6	III	3691 ± 23	2134–2034	2192–1981
MAMS-52299	181	II	3668 ± 21	2130–1981	2137–1961
MAMS-52300	252	II	3694 ± 23	2135–2035	2193–1982
MAMS-54235	19	III	3685 ± 22	2134–2031	2189–1978
MAMS-54236	178	II	3743 ± 23	2200–2061	2276–2038

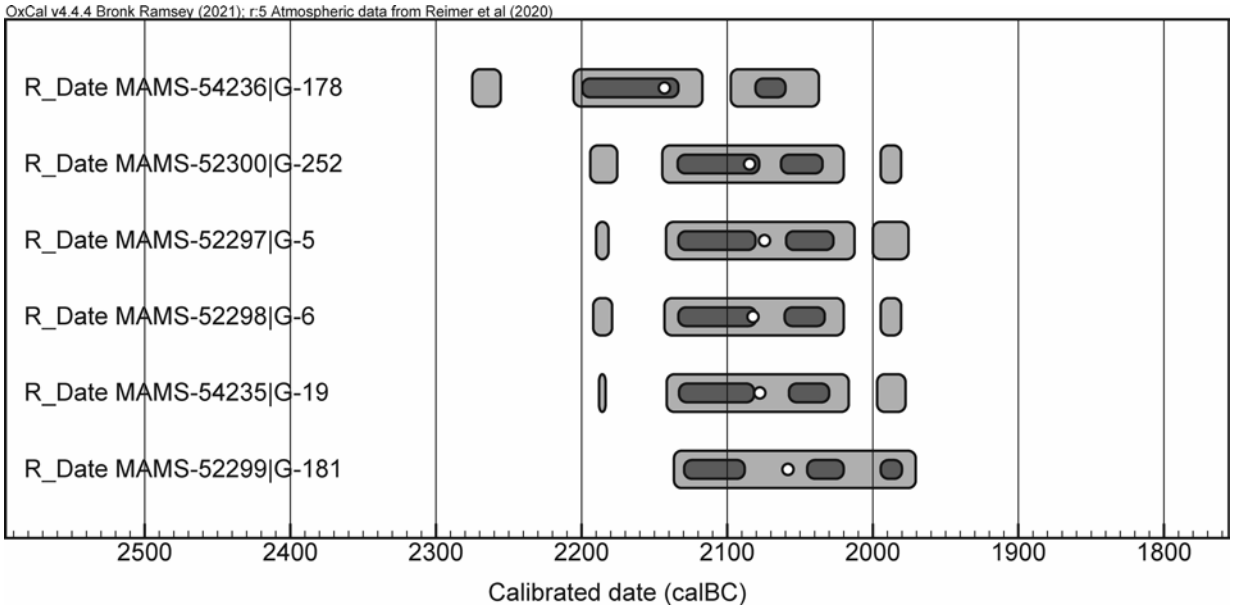

Fig. 3. Výčapy-Opatovce. Results of the sum-calibration of the six ^{14}C samples. Light grey –indicated the 2σ calibrated range; dark grey – indicated the 1σ calibrated range. Raw data in Tab. 1.

Ramsey 2009) with the IntCal20 (*Reimer et al. 2020*) calibration curve was used. In the first step the dates were put into a dating model based on the phases defined by Ch. Bernard. Additional sum and sequence models were used, to compare the model's agreements to the prior chronological assumptions. It should be noted here that no statistically binding statements can be made due to the small sample size (n = 6). For a consideration of the datings according to their geographical distribution on the cemetery (grave clusters), there is unfortunately too few data.

The results of the calibration with OxCal showed (Fig. 3; Tab. 1) that grave 178 (2σ: 2276–2038 cal. BC, 1σ: 2200–2061 cal. BC) is the oldest of the dated graves. Graves 5 (2σ: 2191–1976 cal. BC, 1σ: 2134–2028 cal. BC), 6 (2σ: 2193–1981 cal. BC, 1σ: 2134–2034 cal. BC), 19 (2σ: 2189–1978 cal. BC, 1σ: 2134–2031 cal. BC), and 252 (2σ: 2195–1981 cal. BC, 1σ: 2135–2035 cal. BC) date to the same period, and their calibrated radiocarbon dates are nearly coincident. The youngest of the graves examined is grave 181 (2σ: 2137–1971 cal. BC, 1σ: 2130–1981 cal. BC). The dates span a period from 2276 to 1971 cal. BC (2σ).

Assuming a sequence of graves according to the phases of Ch. Bernard (Fig. 4; in the following Model 1), based on the available dating, the duration of occupation of the cemetery ranges from 0 to 118 years (2σ), or 0 to 57 years (1σ). The use of the cemetery begins between 2201 and 2040 cal. BC (2σ) and ends in the period 2130 to 1973 cal. BC (2σ).[9] The sequence according to Ch. Bernard has a model

[9] Model 1: 2161–2086 to 2096–2019 cal. BC (1σ).

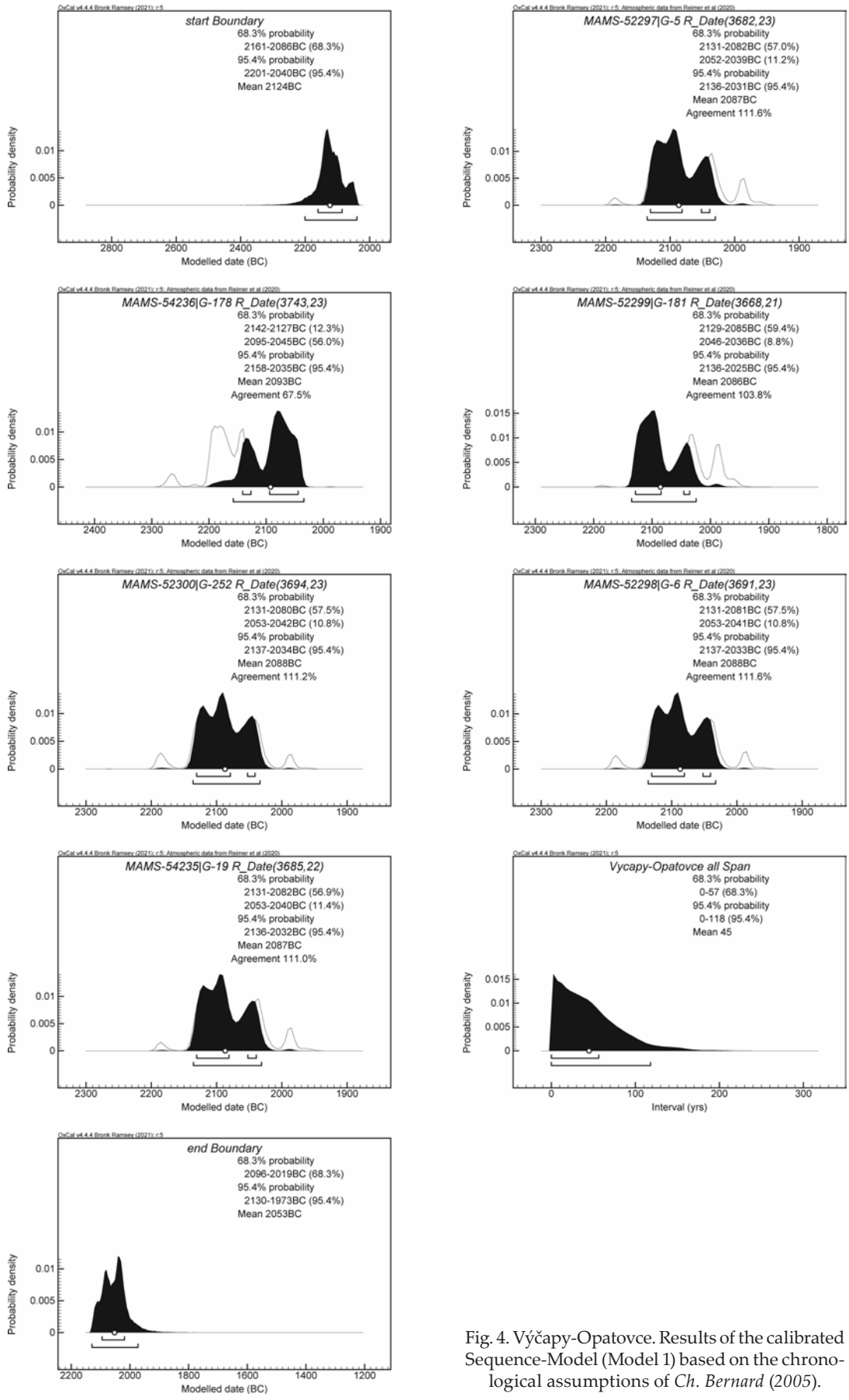

Fig. 4. Výčapy-Opatovce. Results of the calibrated Sequence-Model (Model 1) based on the chronological assumptions of *Ch. Bernard* (*2005*).

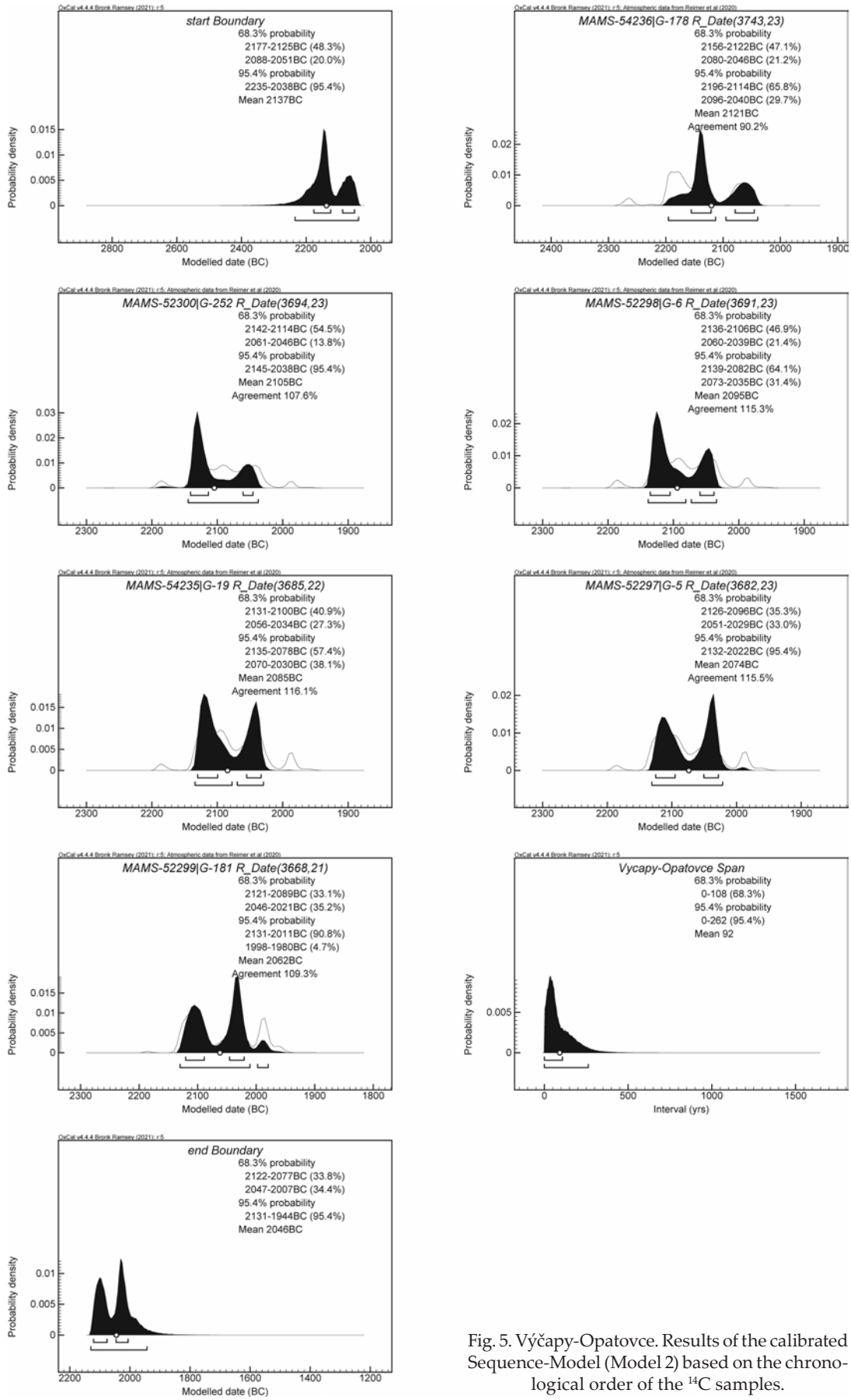

Fig. 5. Výčapy-Opatovce. Results of the calibrated Sequence-Model (Model 2) based on the chronological order of the ^{14}C samples.

agreement of 102%. Grave 178 in Phase II has the lowest value with an agreement of 68%.

If the graves were considered in a sequence from the oldest to the youngest dated grave (Fig. 5; in the following Model 2; agreement 125%), a possible Time Range of 0 to 262 years (2σ), or 0 to 108 years (1σ) is obtained. In this case, the occupation of the burial ground begins between 2235 and 2038 cal. BC (2σ) and ends in the period 2131 to 1944 cal. BC (2σ).[10]

The results show that a division of the cemetery into three phases – as outlined by *Ch. Bernard* (*2005*) – must be rejected. The ^{14}C dates are mostly contemporaneous and only grave 178 stands out with an older date. For this reason, the cemetery can be regarded as single-phase, but at most as two-phase.

Burial index

The results of the radiocarbon dating show that the chronological relevance of the costume groups postulated by *Ch. Bernard* (*2005*) may not be given. Therefore, the question arose to what extent possible segmentation according to social groups existed on the cemetery and how this could be determined.

Instead of a typological approach, a quantitative methodology was chosen. At the centre of this approach is the question of the extent to which individual social groups can be separated from each other by their wealth and location in the cemetery – similar to *A. Točík's* family groups (*1963*; *1979*). To compare the wealth of the graves as objectively as possible, a burial index was determined.

Since the value of an object from prehistoric contexts is unknown, this study uses with a grave or burial index. Generally, various burial index approaches were previously developed (*Beyer 2020*; *Bösel 2008*; *Endrigkeit 2014*; *Hedeager 1980*; *1990*; *Holten 1989*; *Izquierdo-Egea 2013*; *Müller 1994*; *Rebay-Salisbury 2006*; *Windler/Thiele/Müller 2013*), with most building a set of sub-indices (grave volume, rarity of objects, number of objects) and combining them to a cumulative index. A common critique on most of these indices is, that they are often seen to be subjective and building on a set of sub-indices which are not statistically independent from each other. In most cases, it is unnecessary to use a set of sub-indices, since it is discussed, that there might be a positive correlation between sub-indices regardless (*Bösel 2008*, 51 f.; *Sprenger 1999*, 117).

This study uses the statistical method of standardization (Z-transformation) that was established as a burial index by *M. Bösel* (*2008*, 52 f.) and further used by *J. Laabs* (*2010–2011*). The method standardizes every observation within a sample, or in our case: of every object from a burial site, giving it the sample mean of 0 and the sample standard deviation of 1. The presence and absence of an object is considered. For this method, grave goods were assigned to individual object groups (e.g. object groups: small jewellery, tools, small ceramics).

To calculate Z-values, the average number of objects of a particular object type (e.g., willow leaf rings) within the cemetery is subtracted from the number of willow leaf rings in a single burial and the result is divided by the standard deviation of the object type.[11] The Z-values of each object type within each burial are summed and the value of an empty burial is subtracted from the summed values, yielding the burial index or burial value for each burial.

This calculation of the Z-values considers burial inventories of disturbed burials, since despite their disturbance they comprise a considerable part of the material quantity belonging to the society examined. However, in the later consideration on social groups, the disturbed burials were removed because their specific burial value can no longer be reconstructed due to the disturbance or robbery. The burial indices determined, are used below as a measure of the burial wealth.

Due to the rejected chronological model of Ch. Bernard, we decided to treat all undisturbed graves as a single phase (Fig. 2). Based on the burial indices, a normalized Gini index (*Marzian 2021*) was also calculated to provide an indication of the distribution of wealth within the graveyard.

A total of 272 graves were undisturbed. The burial indices range from 0 to 28.4, with a mean of 2.9. Wealth is relatively unequal distributed, or concentrated at the cemetery (Normalized Gini index 0.72, 2σ-confidence interval 0.69–0.78). There are no grave goods in 115 graves, so their burial index is 0. A burial index of 0.1 to 10 is present in 130 graves, and 27 graves have a value of 10 to 28.4.

The collected information on ^{14}C dating, burial indices and costume groups according to Ch. Bernard were compiled in a GIS (QGIS v.3.12). For this purpose, in a first step, the cemetery plan of A. Točík was digitized. While the calibrated ^{14}C data and the groups according to Bernard in the GIS only serve for a more precise visualization, it is possible to determine regions in the cemetery in which a con-

[10] Model 2: 2177–2051 to 2122–2007 cal. BC (1σ).

[11] $Z = \frac{x - \mu}{\sigma}$; x: number of objects of a specific object type in a single burial, μ: mean of the specific object type on the cemetery, σ: standard deviation of the specific object type.

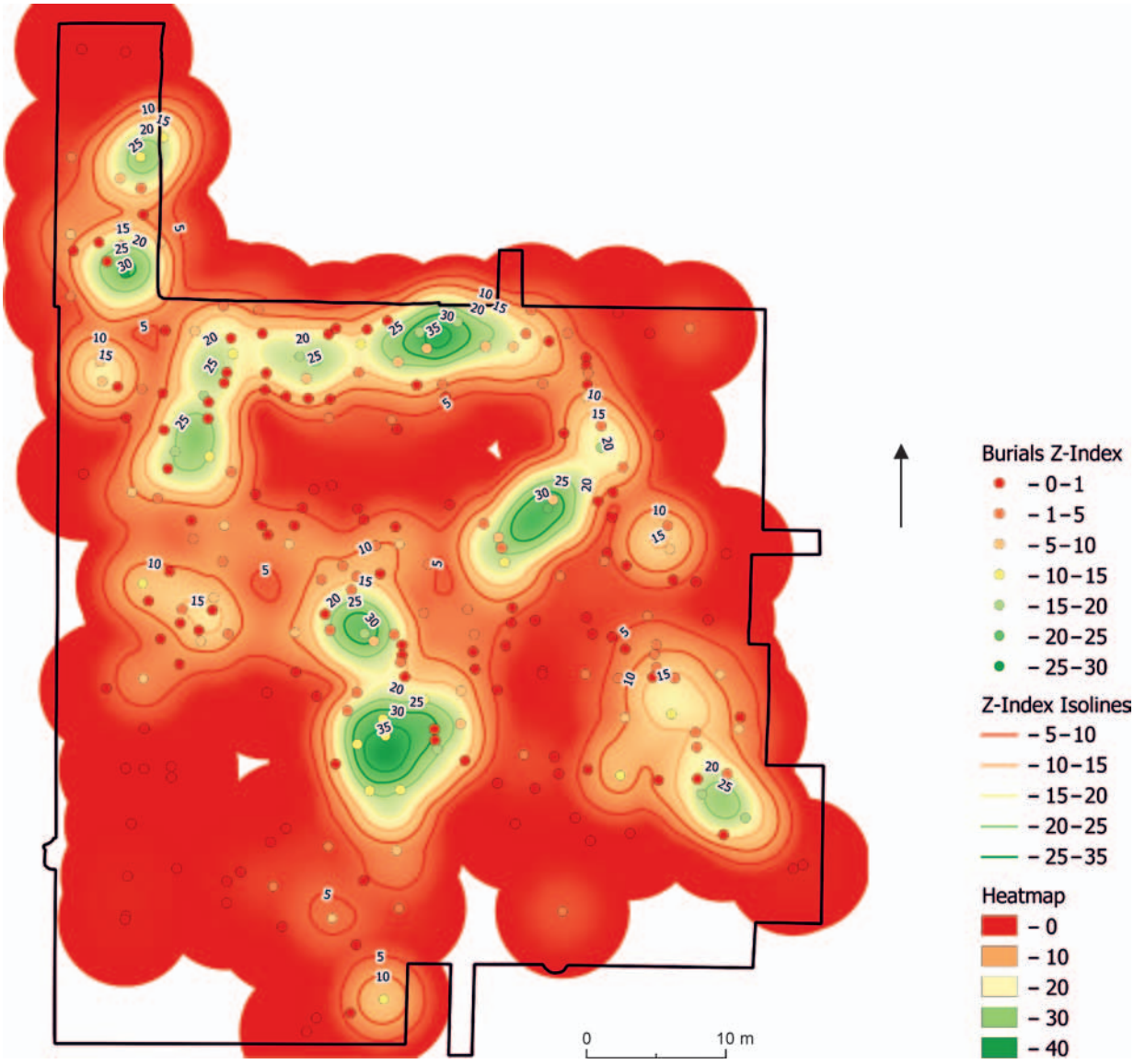

Fig. 6. Výčapy-Opatovce. Results of the Burial Index Analysis (Z-transformation) of undisturbed burials (dots). Heatmap weighted after Burial Index with a radius of 5 m.

centration of material or wealth occurs with the help of the grave goods indices.

First, a weighted kernel density estimation was performed, with a radius of 5 m around each grave and the burial indices as weight. Contour lines with an increment of 5 were determined from the resulting heatmap. In the resulting map, areas were coloured mapped based on the burial indices (Fig. 6–8).

The distribution of wealth in the burial ground demonstrated a clustering of wealthier graves (index 10–28) in five areas (Fig. 6; 7; Clusters A–E). The clusters are each separated by graves with a low burial index (index 0–5). Cluster borders are formed by the 10 Z-value line of the heatmap. Cluster E needs to be excluded from further discussions, given its position on a narrow part of the excavation trench.

DISCUSSION

The chronological position of Výčapy-Opatovce

Consulting both previous and new research on the Výčapy-Opatovce cemetery in conjunction with these new ^{14}C dates, aspects of the site need re-evaluation. Furthermore, the dating and the analysis of the grave inventories allow an alternative interpretation of the chronology and social structure of the cemetery.

Regarding the classification of the finds belonging to the Early Bronze Age, there is no doubt in view of the ^{14}C dating. Both the typological spectrum of the find material and the dated period of

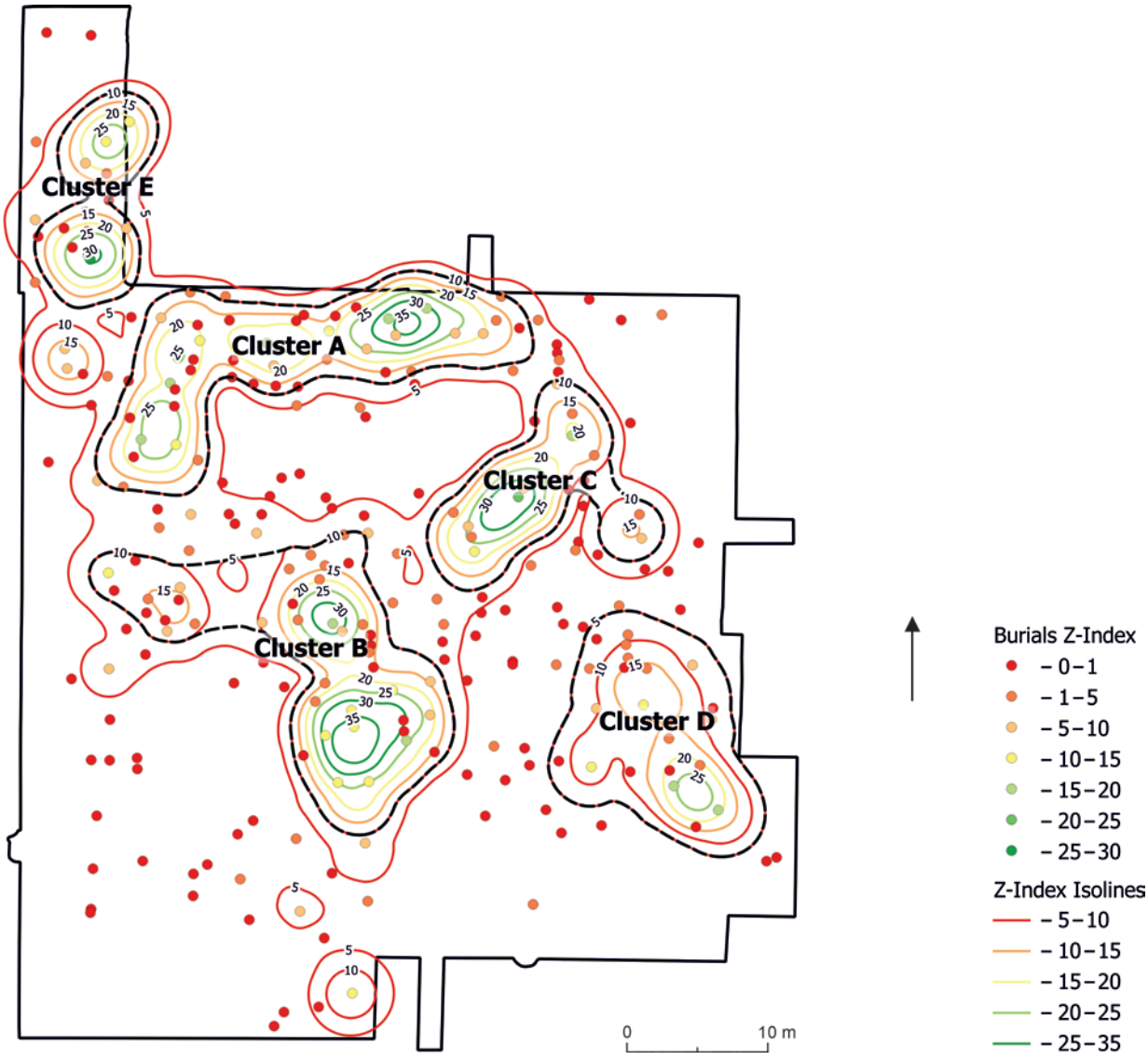

Fig. 7. Výčapy-Opatovce. Burial Clusters based on the concentration of burials with a high Burial Index as described in the text.

occupation (Model 2: 2235–2038 cal. BC), place the cemetery at the beginning of the Early Bronze Age. Based on the ^{14}C dates from Branč[12] and Jelšovce[13] it appears that Výčapy-Opatovce is overlapping with the burials in Branč (2151–1961 cal. BC), but burial activity is starting slightly earlier (Fig. 9).

Based on the dating of grave 5, the assignment of eight to eleven graves to the Eneolithic Ludanice group is to be doubted (*Lichardus/Vladár 1964*; *Porubský 1955*; *Točík 1979*, 65). The calibrated date (2σ 2191–1976 cal. BC) for grave 5 clearly show its Bronze Age origin. An Eneolithic occupation of the cemetery cannot be ruled out. However, we like to suggest that the assignment of individual graves to the Ludanice group have to be critically questioned and subjected to a new analysis.

Evaluation of Ch. Bernards chronological and social model

With regard to the chronological structure or the costume groups of the Early Bronze Age graves of Ch. Bernard, the ^{14}C dating allows several conclusions. Although Ch. Bernard does not specify a time frame for the development of the three occupation

[12] Branč GrN 12816-19 (*Gerloff 1993*).

[13] Jelšovce Bln 4374, 4378, 4421, 4491 (*Görsdorf 2000*).

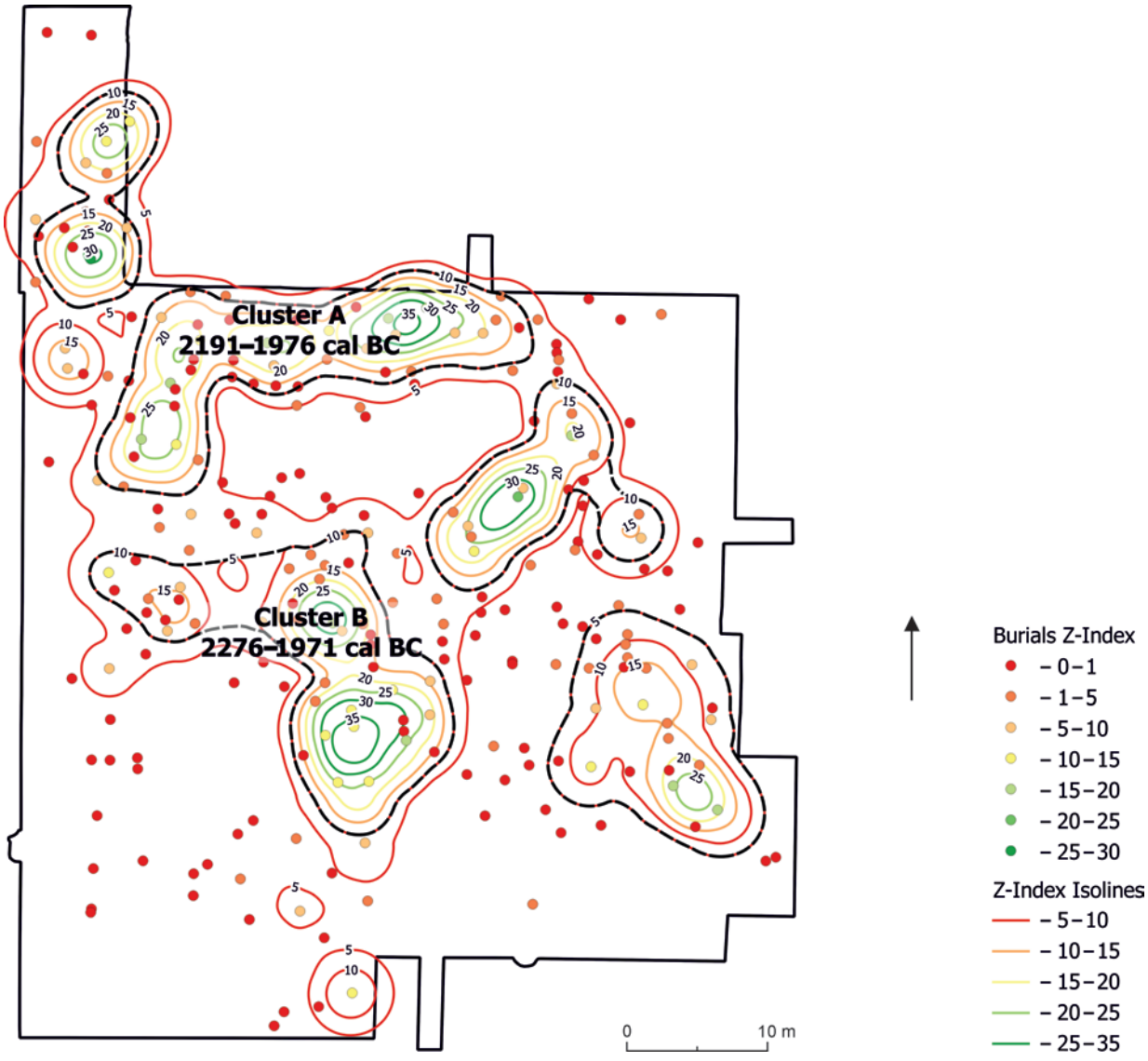

Fig. 8. Výčapy-Opatovce. Burial Clusters A and B and their possible time of use according to the ^{14}C samples presented in this study.

phases of the cemetery, a temporal separation (20–50 years) between the individual phases can be assumed. Overall, the three phases cannot be completely rejected based on the ^{14}C analysis, since at least theoretically a sequence as outlined by Bernard could exist (Fig. 4; Model 1; agreement 102%). This is primarily due to the strong temporal overlap of the ^{14}C data.

Considering the size of the cemetery, an occupation period of 0 to 58, or 118 years (2 to 4 generations) according to this model by Ch. Bernhard (Fig. 4) seems to be very short and unrealistic. The typological forms that Bernard places in phase II of the cemetery were found in a grave with the oldest calibrated ^{14}C-date. Phase II also includes the oldest (grave 178) and the youngest dated grave (grave 181). Altogether, of the six dated graves, four show an almost identical dating result, which in turn fall into all three phases according to Ch. Bernard.

Taking the size of the cemetery and the chronological sequence of the ^{14}C data into consideration, an occupation period of 0 to 108, or 262 years, seems more likely (Fig. 5; Model 2; 4–10 generations). This would mean that all typological forms, which *Ch. Bernard* (*2005*) assigns to her individual phases (I–III), were in use over the entire duration of the cemetery and that only a limited chronological but possibly a social division can be deduced from the material. The existing analyses of the find material (*Lichardus/Vladár 1997*; *Točík 1960*; *1979*) from Výčapy-Opatovce shows that a typo-chronological division within the cemetery is certainly present,

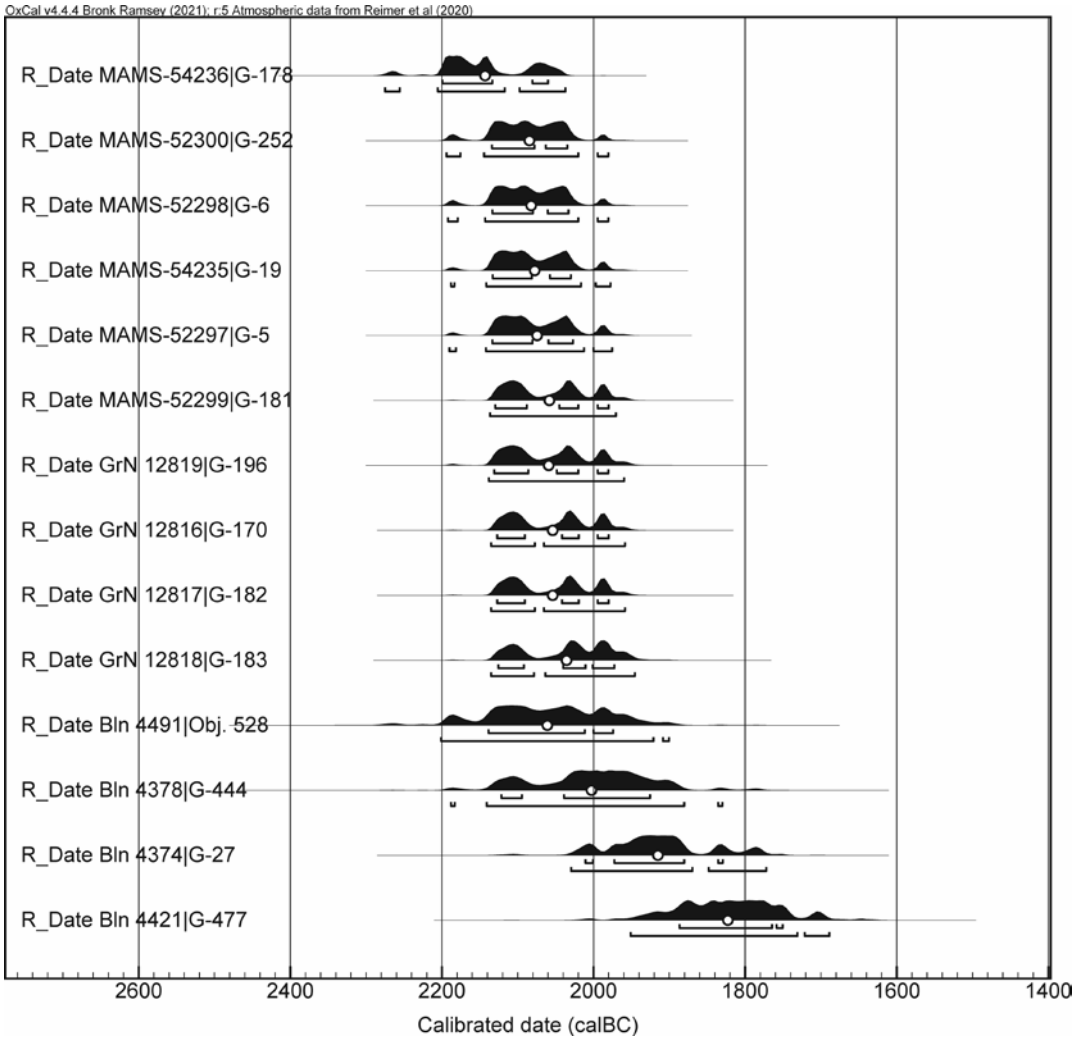

Fig. 9. All published ^{14}C samples of Nitra culture contexts from south-western Slovakia. Codes: MAMS – Výčapy-Opatovce; GrN – Branč; Bln – Jelšovce.

but this does not seem to be represented by Bernard's costume groups.

If Ch. Bernard's costume groups do not form chronological phases, there is still the possibility, also discussed by her, that they could be social groups (*Bernard 2005*, 158 ff.). Her final assumption – that they are not forming social groups – is based on the relatively high richness in individual graves of each of the three costume groups. She assumes that for social groups to exist, there must be a hierarchical structure between the groups, i.e. one group is rather poor and another rich. In doing so, she ignores the possibility that her costume groups could also be a different non-hierarchical type of social structure or that the groups could not even have been directly related to each other. Therefore, it is possible that the costume groups represent three different entities with their own, independent internal structure like occupational groups, groups from different settlements or family units.

The spatial distribution of the costume groups shows that graves of the individual groups cannot be clearly spatially differentiated and also occur in direct proximity (Fig. 2). It would be expected that burials of social groups are concentrated in spatial proximity to each other, so that grave clusters with similar equipment or a similar dress group can be separated from each other. For this reason, the interpretation of the costume groups as closed social groups is unlikely.

To conclude our thoughts on Ch. Bernard's model: What statements can be made up to this point?

1. No clear chronological groups can be identified at the burial ground on the basis of the costume groups.
2. A social division according to typological groups is unlikely.

A new (old) social model of Výčapy-Opatovce burial site

Since both the chronological and the social model of *Ch. Bernard* (*2005*) have to be rejected, the question arises to what extent a social division is existing in the burial ground. If we look at the distribution of rich and poor graves on the cemetery (Fig. 6–8), we see a concentration of rich graves in clusters. In the centre of these clusters are graves with high Z-values, i.e. graves with relatively rich furnishings, which are spatially separated from poor graves.

From this it can be concluded that there is no horizontal (chrono-)stratigraphy between the clusters, but as already assumed by *A. Točík* (*1963*; *1979*), there are different social units using the cemetery at about the same time. These social units each occupy a separate demarcated area, in the centre of which the members with the most extensive grave furnishings are buried and around which the burials of the other members of the community are grouped. The extent to which these groups are families, households or settlement groups will be left aside at this point, as further analysis is required.

An arrangement of graves according to social groups can also be found in other prehistoric cemeteries and only a few examples are listed in the following. One example is the Neolithic cemetery of Vedrovice (Moravia, Czech Republic), where grave clusters are also arranged around the graves of rich individuals (*Zvelebil/Pettitt 2008*, 201 ff.). In the Bronze Age cemetery of Neumarkt an der Ybbs (Lower Austria), the author speaks of economic associations (*Reiter 2020*, 225 ff.) which are arranged in clusters. In the case of the Early Bronze Age Nagycenk cemetery (north-western Hungary), a spatial proximity in connection with status groups is interpreted as a spatial differentiation of two households on the cemetery (*Gömöri/Melis/Kiss 2018*, 74). Burial grounds of the Bronze Age Vatya culture also show clusters (10–20 graves), which are interpreted as family groups (*Sørensen/Rebay-Salisbury 2009*, 57 f.). Our observations for Výčapy-Opatovce thus fit into a broader framework of contemporary models.

CONCLUSION

The six ^{14}C dates represent the first radiocarbon dating of Výčapy-Opatovce, and confirm that a typo-chronological order of costume groups, which were presented by Ch. Bernard in 2005, are likely not viable. Based on a quantitative approach to the burial inventories we propose a model of grave groups or clusters which represent contemporary social units instead and that the burial ground was in use for only the short duration of few generations.

While we think that a chronological depth is identifiable within the archaeological material, but the set of ^{14}C dates alone are not enough to establish a chronology within our defined grave clusters. Due to restrictions to our sampling strategies as well as the not published statistical analysis from *A. Točík* (*1960*) and the poor quality of the published inventory from Výčapy-Opatovce (*Lichardus/Vladár 1997*, 282) a more refined analysis was not possible.

An announced analysis from *J. Peška* and *J. Králík* (*2020*) about transition between Eneolithic and Bronze Age in Moravia and southwestern Slovakia which will hopefully include Výčapy-Opatovce can maybe shed more light onto the chronology within our defined clusters. Advisable would be further radiocarbon dating using graves with burial inventories which include chronological relevant ceramics like vessels with corded impression or vessels where Únětice culture influence is visible. Further ^{14}C-dates from parts of the burial ground we were not able to cover could also close the gaps in south-eastern and north-western part of the burial ground.

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Úsvit staršej doby bronzovej na juhozápadnom Slovensku

Prehodnotenie sociálnej štruktúry a chronológie pohrebiska Výčapy-Opatovce

Fynn Wilkes – Henry Skorna

SÚHRN

V predloženom príspevku autori prezentujú šesť C^{14} meraní vykonaných na súbore nálezov z pohrebiska zo staršej doby bronzovej vo Výčapoch-Opatovciach, pričom z lokality neboli doposiaľ rádiouhlíkovou metódou skúmané žiadne vzorky. Po predstavení predchádzajúcich modelov pochovávania a chronológie pohrebiska, prezentovaných v minulosti *A. Točíkom* (*1956*; *1960*; *1963*; *1979*), *J. Lichardusom* a *J. Vladárom* (*1964*; *1997*), sa práca zameriava predovšetkým na výsledky obsiahnuté v diplomovej práci *Ch. Bernardovej* (*2005*). V príspevku autori preukázali, že chronológia založená na vyčlenení skupín hrobov na základe ich výbavy podľa Ch. Bernardovej pravdepodobne nie je správna.

V centre sociálnej analýzy bola otázka, do akej miery je možné navzájom oddeliť jednotlivé sociálne skupiny na základe bohatstva hrobu a jeho lokalizácie v rámci pohrebiska – podobne ako rodinné skupiny vyčlenené *A. Točíkom* (*1963*; *1979*). Aby bolo možné čo najobjektívnejšie určiť bohatstvo hrobov, bol definovaný hrobový index. V príspevku je použitá štatistická metóda štandardizácie (Z-transformácia), ktorú stanovil ako hrobový index *M. Bösel* (*2008*, 52 f.) a ďalej ju používal *J. Laabs* (*2010–2011*). Pri tejto metóde sa zohľadňuje prítomnosť a neprítomnosť predmetu v hrobe, rovnako ako aj celkový výskyt rovnakého typu predmetu na pohrebisku. Výsledný hrobový index, ako aj informácie o datovaní metódou C^{14} a príslušnosť k skupinám podľa Ch. Bernardovej, boli vizualizované v GIS-e (QGIS 3.12).

Vďaka GIS-u je možné determinovať oblasti na pohrebisku, v ktorých sa vyskytuje koncentrácia predmetov alebo bohatstva, ktoré sú indikované vysokými indexmi hrobového inventára. Pri pohľade na ich rozloženie na pohrebisku môžeme vidieť zoskupenie bohatších hrobov (index 10–28) v piatich oblastiach (obr. 6; 7; zhluky A–E), ktoré sú oddelené hrobmi s nízkymi hrobovými indexmi (0–5).

Na základe tohto kvantitatívneho prístupu k hrobovému inventáru autori príspevku navrhujú model hrobových skupín alebo zhlukov (obr. 7; 8), ktoré predstavujú súčasné sociálne jednotky, a predpokladajú pomerne krátke trvanie pohrebiska – len niekoľko generácií (4–10 generácií).

Na rádiouhlíkové merania sa použili dostupné fragmenty korálikov z parožia. Šesť vzoriek bolo vybraných na základe ich priradenia do chronologických fáz Ch. Bernardovej a na základe sprievodného inventára. Vzorky boli poslané na analýzu do Curt-Engelhornovho centra archeometrie GmbH.

Na kalibráciu a analýzu výsledkov datovania bol použitý softvér OxCal v4.4.4 (*Bronk Ramsey 2009*) s kalibračnou krivkou IntCal 20 (*Reimer et al. 2020*).

Výsledky kalibrácie so softvérom OxCal (obr. 3; tabela 1) ukázali, že hrob 178 (2σ: 2276–2038 cal. BC, 1σ: 2200–2061 cal. BC) je najstarší z datovaných hrobov. Hrob 5 (2σ: 2191–1976 cal. BC, 1σ: 2134–2028 cal. BC), 6 (2σ: 2193–1981 cal. BC, 1σ: 2134–2034 cal. BC), 19 (2σ: 2189–1978 cal. BC, 1σ: 2134–2031 cal. BC) a 252 (2σ: 2195–1981 cal. BC, 1σ: 2135–2035 cal. BC) sú datované do rovnakého obdobia a ich kalibrované rádiouhlíkové dáta sú takmer súčasné. Najmladší zo skúmaných celkov je hrob 181 (2σ: 2137–1971 cal. BC, 1σ: 2130–1981 cal. BC). Dátumy zahŕňajú obdobie od roku 2276 do 1971 cal. BC (2σ).

Na základe zoradenia výsledkov podľa chronologického modelu Ch. Bernardovej (model 1; obr. 4) a zoradením hrobov od najstaršieho po najmladší (model 2; obr. 5) sú diskutované dve možné obdobia využitia pohrebiska.

V prípade modelu 1 sa začiatok pochovávania na pohrebisku datuje medzi roky 2201 a 2040 cal. BC (2σ) a koniec pochovávania do obdobia medzi 2130–1973 cal BC (2σ). V prípade modelu 2 sa začiatok pochovávania na pohrebisku datuje medzi roky 2235 a 2038 cal. BC (2σ) a koniec pochovávania do obdobia medzi 2131–1944 cal. BC (2σ). Keďže oba modely majú vysokú štatistickú zhodu, ani jeden nemôže byť vylúčený ako možný scenár pre Výčapy-Opatovce. Avšak model 2 (zhoda 125 %) ukazuje vyššiu zhodu ako model 1 (zhoda 102 %).

Napriek tomu že chronologický rozsah je možné identifikovať v archeologickom materiáli, súbor šiestich C^{14} meraní, prezentovaný v predkladanom článku nestačí na definovanie jemnejšej chronológie v rámci definovaných skupín hrobov. Vytvoriť prepracovanejšiu analýzu nebolo možné vzhľadom na obmedzenia pri procese vzorkovania, ako aj z dôvodu nepublikovanej štatistickej analýzy *A. Točíka* (*1960*) a vzhľadom na nízku kvalitu publikovaného inventára z Výčap-Opatoviec (*Lichardus/Vladár 1997*, 282).