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## ISSUES OF SPATIAL DISTRIBUTION OF THE MONUMENTAL CEMETERIES OF THE FUNNEL BEAKER CULTURE IN THE LOESS LANDSCAPE OF SOUTHEASTERN POLAND

### ABSTRACT

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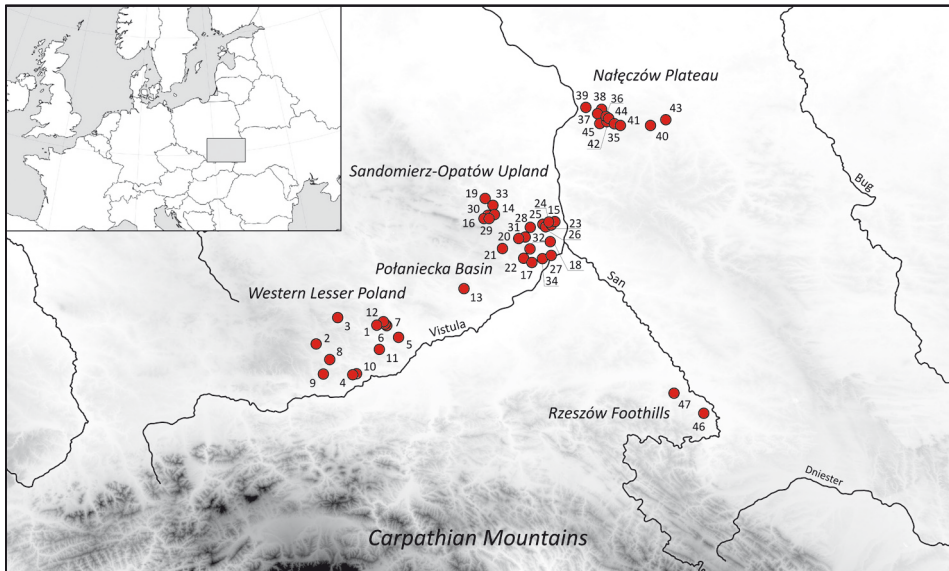
Varied monumental cemeteries were one of the most characteristic attributes of the Funnel Beaker culture communities in the 4<sup>th</sup> Millennium BC. These structures have been well recognized in Northern, Western and Central Europe. This article shows several patterns of the placement of Funnel Beaker culture monumental cemeteries related to the natural landscape in southeastern Poland. Based on GIS spatial and statistical testing, it is reasonable to indicate possible rules of their functioning in the loess areas.

Keywords: monumental cemeteries, Funnel Beaker culture, landscape, spatial analysis, statistics, GIS  
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### INTRODUCTION

Funnel Beaker culture (hereinafter: FBC) monumental cemeteries are among the most thought-provoking and still unsatisfactorily understood funeral remains of the Middle Neolithic period. During the 4<sup>th</sup> Millennium BC, they were widespread in Northern, Western and Central Europe (*e.g.* Chmielewski 1952; Madsen 1979; Midgley 1985; Kossian 2004; Rzepecki 2011). Apart from their obvious sepulchral function, it should be mentioned that

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**Fig. 1.** Distribution of FBC monumental cemeteries in southeastern Poland. Western Lesser Poland: 1 – Dębiany; 2 – Czaple Wielkie 14; 3 – Giebułtów 15; 4 – Karwin 43; 5 – Kolosy; 6 – Małżyce 30; 7 – Małżyce 31; 8 – Niedźwiedz 1; 9 – Pielgrzymowice 15; 10 – Rudno Górne 8; 11 – Słonowice 5; 12 – Zagaje Stradowskie 43. Połaniecka Basin: 13 – Grzybów 1. Sandomierz-Opatów Upland: 14 – Broniszowice 5; 15 – Czyżów Szlachecki 13; 16 – Garbacz-Skała 1; 17 – Gorzyczany 4; 18 – Kichary Nowe 2; 19 – Kunów 1; 20 – Malice Kościelne 1; 21 – Mydłów 58; 22 – Nasławice 50; 23 – Pawłów 3; 24 – Pawłów 10; 25 – Prusy 36; 26 – Prusy 44; 27 – Sandomierz 105; 28 – Stodoły-Kolonia 35; 29 – Stryczowice 1A; 30 – Stryczowice 7; 31 – Studzianki 7; 32 – Święcica 1; 33 – Świrna 1; 34 – Złota 6. Nałęczów Plateau: 35 – Antopol; 36 – Chruszczów-Kolonia 1; 37 – Karmanowice 35; 38 – Klementowice 6; 39 – Las Stocki 71; 40 – Lublin Sławinek 2; 41 – Miłocin-Kolonia 1; 42 – Nałęczów-Kolonia 1; 43 – Pliszczyn 9; 44 – Strzelce-Kolonia 1; 45 – Wąwołnica 7. Rzeszów Foothills: 46 – Skołoszów 7; 47 – Szczytna 6

some of these structures can be also interpreted in alternative ways as a result of different social and/or economic interactions. It is worth mentioning the most important ones. Over the last fifty years, monumental cemeteries have been interpreted as territorial markers (*e.g.* Wierzbicki 1999; 2006; Gorczyca 2005), kinds of landmarks – stable components of communication networks (Hoika 1986; van Ginkel *et al.* 1999; Gorczyca 2005), or examples of rights to a particular area with its reservoirs (Randsborg 1975; Chapman 1981). They are also seen as a result of multifaceted confrontations between adjacent populations of the FBC, or rivalry between these farming communities and mesolithic hunters-gatherers (Czerniak 1994; Wierzbicki 1999; Müller *et al.* 2013). Finally, it is believed that one of the main functions of monumental cemeteries was the integration and stabilization of societies. Their space might be a specific area of bilateral interactions between the “worlds” of the living and the dead (Andersen 2000; Sjögren 2003; Furholt and Müller 2011; Furholt *et al.* 2012; Schülke 2014).

More than 40 FBC monumental cemeteries have been recognized in southeastern Poland so far (Fig. 1). These constructions occurred in several areas: western Lesser Poland (*e.g.* Burchard 1998; 2006; Tunia 2006; Tunia and Włodarczak 2011; Przybyła and Tunia 2013; Jarosz *et al.* 2009; 2013; Przybyła – personal communication), the Sandomierz-Opatów Upland (*e.g.* Bąbel 2006; Matraszek and Sałaciński 2006; Bargiel and Florek 2006ab; Florek 2008), the Nałęczów Plateau (*e.g.* Jastrzębski and Ślusarska 1982; Nogaj-Chachaj 1991; Chmielewski 2015), the Połaniecka Basin (Garbacz 2006) and the Rzeszów Foothills (Król *et al.* 2012; 2014). This is an important dataset (*cf.* Król 2011; 2016). Therefore, we ought to formulate the question as to what kind of content is encoded in these cemeteries. Can spatial analyses of the dispersion of these cemeteries prove their alternative functions? Let us try to understand their meanings by analysing some of the territories.

## GENERAL DISTRIBUTION PATTERNS

Based on GIS methods such as Kernel Density Estimation – KDE (*e.g.* Baxter *et al.* 1997) and Delaunay triangulation – DT (*e.g.* Zimmermann 1992), many interesting examples of the distribution pattern of FBC monumental cemeteries are well-visible in two nearby areas: the Sandomierz-Opatów Upland and the Nałęczów Plateau (Fig. 1). In the first case, there are two slightly isolated clusters of cemeteries: A – in the Kamionka basin on the Świętokrzyskie Mountain foreland, and B – about 30 km away to the east in the Czyżowianka Basin (Fig. 2). Both areas differed slightly from each other. For instance, some cemeteries cluster B were placed on the rolling loess foothills. The most representative cemetery of this cluster is the non-exposed site 3 in Pawłów (Bargiel and Florek 2006b). It is very important to note that three different types of monumental barrows (with stone and/or kerb remains) have been discovered there, while only one type of barrow with stone kerb was found in cluster A. In contrast to cluster B, each of the barrows in cluster A were situated in a highly varied landscape, with significant differences in altitude between the highest elevations and the floor of the valley (*cf.* Kowalski 1997). Many cemeteries were situated very high in cluster A, even more than 50 m above the floor of the valley of the Kamionka River. When compared with the two described clusters, others cemeteries were a bit scattered – however in a fairly regular way (Fig. 2).

In comparison with an adjacent (east group) FBC territory, many flat graves in the context of barrows, as well as in theoretically autonomous flat cemeteries, have been recognized in the Sandomierz-Opatów Upland (Florek 2006; 2008). Nevertheless, it is debatable whether the cemeteries identified as flat were originally monumental cemeteries – perhaps all of them? There are several problematic sites in the Sandomierz Opatów Upland, such as Wojciechowice 1, that do not seem to be unambiguously flat (Bąbel 2000; *cf.* Florek 2006). So let us assume that many of the flat cemeteries (or even all of them) were origi-

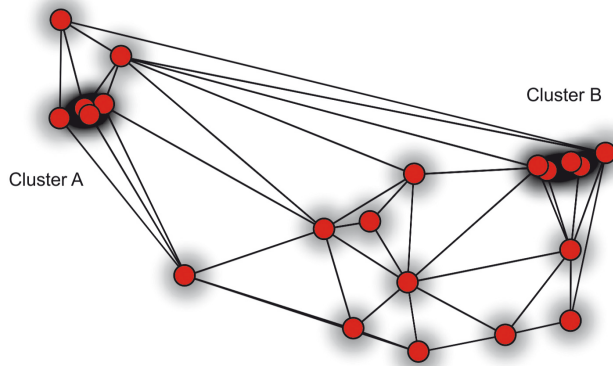


Fig. 2. KDE and DT visualizations of the distribution of FBC monumental cemeteries in the Sandomierz-Opatów Upland

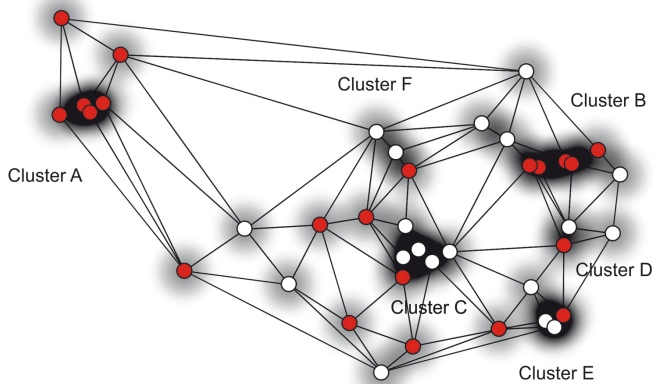


Fig. 3. KDE and DT visualizations of the distribution of FBC monumental and flat cemeteries in the Sandomierz-Opatów Upland. Red dot – FBC monumental cemeteries; white dot – FBC flat cemeteries

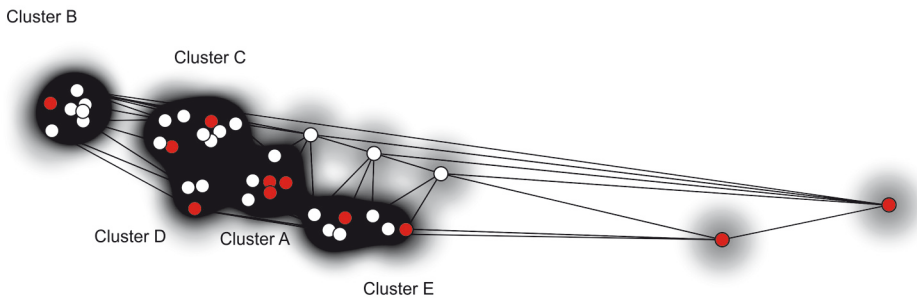


Fig. 4. KDE and DT visualizations of the distribution of FBC monumental and flat cemeteries in the Nałęczów Plateau. Red dot – FBC monumental cemeteries; white dot – FBC flat cemeteries

nally monumental cemeteries and test them in the context of all confirmed monumental cemeteries.

As a result of GIS analysis, an interesting model has been obtained. In the case of the two well-known clusters of monumental cemeteries A and B, “new” cemeteries have appeared in the area of the Czyżowianka Basin within cluster B, which leads to an increase in the cemetery density coefficient (Fig. 3). A similar situation can be observed in other regions, *e.g.* in the area of Święcica 1 (cluster C), neighbouring the cemetery in Dacharzów 1 (Florek 2006). Another new cluster (E) is visible in the area of Sandomierz 105 when the cemetery in Kamień Łukawski 1 and others (Florek 2008) are taken into consideration. In spite of the fact that new clusters appeared here, the previously observed, fairly regular model is still “active” (Fig. 3).

These results are confirmed by the analysis of the distance between nearest cemeteries (in the sense of neighbourhoods). Accordingly, the following ranges and values were obtained: 0-1000 m – 25.9%; 1001-2000 m – 22.2%; 3001-4000 m – 7.4% and 5001-6000 m – 14.8%. The first of these indicators refers to clusters, while the others refer to “autonomous cemeteries”.

Now let us move on to the Nałęczów Plateau. In this territory, there is only one confirmed cluster (A) of FBC monumental cemeteries, consisting of three such sites: Chruszczów-Kolonia 1; Nałęczów-Kolonia 1 and Strzelce-Kolonia 1 (Fig. 4). Other monumental cemeteries seem to be somewhat autonomous (Fig. 4). Apart from that, there are several dozen theoretically flat cemeteries in this region (Gajewski 1952; Nogaj-Chachaj 2004). Therefore, the same questions arise as in the case of the Sandomierz-Opatów Upland. How many of those defined as flat cemeteries could originally belong to the category of monumental cemeteries? Is it possible that all of them are monumental? The most serious problem of the FBC cemeteries on the Nałęczów Plateau is their extremely poor state of preservation, which is a result of intensified erosion processes (Maruszczak 1973; Nogaj-Chachaj 2004; Janicki *et al.* 2010). For this reason, we will once again test the assumption that so-called flat cemeteries were originally monumental cemeteries.

Each spatial study confirms the existence of several distinct clusters of FBC cemeteries, although one of them, in the western part of the Nałęczów Plateau (B) in the area of Las Stocki 71, seems to be isolated (Fig. 4). Other interesting clusters occurred to the east of the aforementioned cluster, although the boundaries between them are often blurred, especially between A, C and D (Fig. 4). Undoubtedly, this was not the only spatial pattern that could exist there. It is interesting to note that many cemeteries were not in clusters (Fig. 4). These autonomous cemeteries were sometimes found in intriguing spatial configurations such as linear systems. Cemeteries in Bronice 1, Gutanów 1 and Ługów 1 in the northern part of Nałęczów Plateau were situated in such an arrangement (Fig. 4). The distances between each of them are almost equal (about 3.5 km).

The general results of the distance measurements between the cemeteries are worth considering. The nearest neighbour indicator in the range 0-1000 m is 53.6%. The other

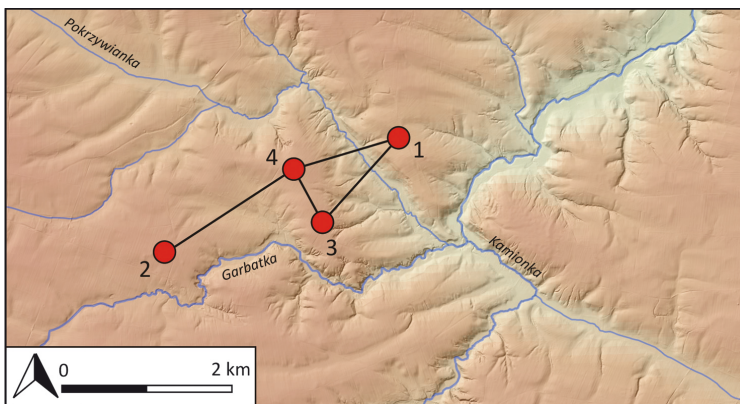
values are: 1001-2000 m – 21.4%, 2001-3000 – less than 10%, 3001-4000 m – 14.3%. The last one is related to the aforementioned linear pattern of the FBC cemeteries' distribution.

## TOPOGRAPHY, HYDROLOGY AND VISIBILITY

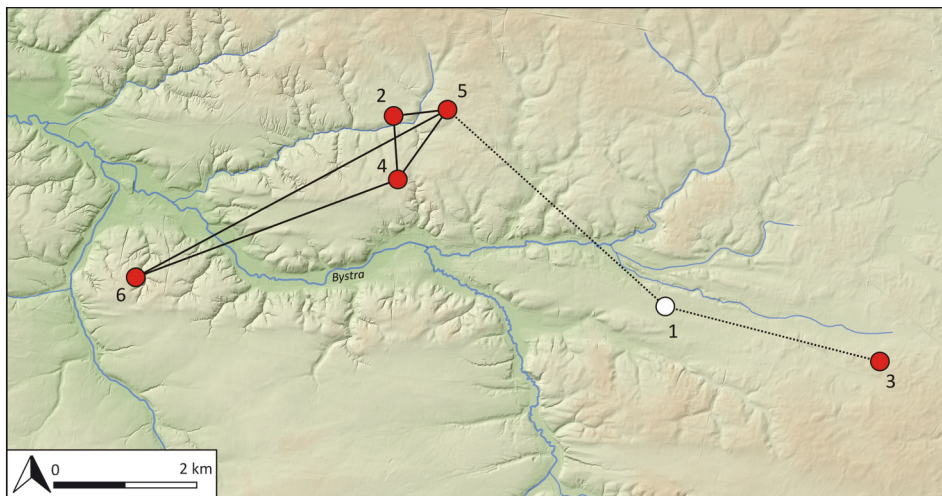
After having presented the general patterns of distribution of the FBC monumental cemeteries in two selected regions, it is necessary to more closely analyze the topographical and hydrological contexts of their occurrence. Regarding the whole territory of the southeastern group of the FBC, most of the monumental cemeteries were located in the valley areas, especially at the valley edges (*ca.* 70%). They were also located on various parts of the slopes, and even near the floor of the valley, as in Słonowice 5 (Przybyła and Tunia 2013). This is probably an exception, which is contrary to “the high and dry” principle in the FBC landscape (Kruk 1980), *i.e.* many cemeteries were located at higher elevations (*e.g.* Jarosz *et al.* 2013).

Many similarities can be seen in the spatial orientation of the FBC monumental cemeteries. Most of them were located on the southern part of the terrain rather than on southeastern or southwestern terrains. Other variants are incidental (*e.g.* Król *et al.* 2012). What might be indicated by the presented topographical tendencies? What was the meaning of such placement?

To find answers to these questions, a viewshed analysis was conducted. These studies consisted of two stages. In the first stage, only cemeteries with confirmed barrows were analyzed, while in the second stage all cemeteries were analyzed together. This is an obvious



**Fig. 5.** Visibility scheme of FBC monumental cemeteries in the Broniszowice 5 – Garbacz-Skała 1 sector in the Sandomierz-Opatów Upland. Red dot – monumental cemeteries; black line – visibility confirmed. 1 – Broniszowice 5; 2 – Garbacz-Skała 1; 3 – Stryczowice 1A; 4 – Stryczowice 7



**Fig. 6.** Visibility scheme of FBC monumental cemeteries in the Wąwolnica 7 – Miłocin-Kolonia 1 sector in the Nałęczów Plateau. Red dot – FBC monumental cemeteries; white dot – hypothetical location of FBC monumental cemeteries; black line – visibility confirmed; black dotted line – hypothetical visibility. 1 – Antopol; 2 – Chruszczów-Kolonia 1; 3 – Miłocin-Kolonia 1; 4 – Nałęczów-Kolonia 1; 5 – Strzelce-Kolonia 1; 6 – Wąwolnica 7

continuation of the approach that assumes that theoretically flat cemeteries originally had a different morphological and spatial configuration. In order to carry out an analysis of visibility, two regions were chosen: the well-known Sandomierz-Opatów Upland and the Nałęczów Plateau. With regard to the first one, the Broniszowice 1 – Garbacz-Skała 1 sector seems to be very intriguing, since almost all of the local cemeteries were connected by visibility in this sector (Fig. 5; *cf.* Iwaniszewski 2006). These cemeteries were located at the confluence of the Garbatka and Pokrzywianka Rivers (left tributaries of the Kamionka River), and formed a specific and hermetic spatial module (Fig. 5).

The visibility relationships in the Nałęczów Plateau are more complex and challenging to assess. The most characteristic examples are spatial relationships occurring in the sector of Wąwolnica 7 – Miłocin-Kolonia 1. This model is largely theoretical and cannot be treated literally. It is not difficult to diagnose the type of relationship between the cemetery in Wąwolnica 7 to the other cemeteries in cluster A, such as Nałęczów-Kolonia 1, nor between the cemeteries within this particular cluster, itself. Only the “eastern expansion” of this model is unclear. The problem is the ambiguous location of the cemetery in Antopol. Nevertheless, the theoretical location of this cemetery was marked out.

It was possible to address this problem through an analysis of archival maps, and by determining hypothetical locations of this burial site based on the possibility of its synchronization (in the sense of visibility) with the nearest cemeteries (Miłocin-Kolonia 1 and Strzelce-Kolonia 1). The resulting model is an illustration of the potential meanings of the

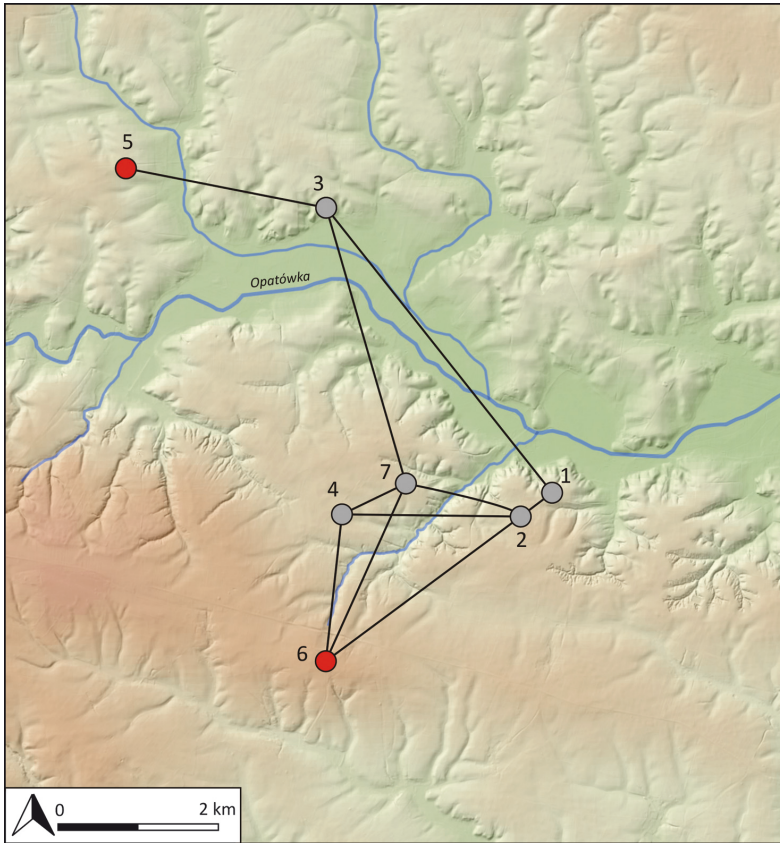


Fig. 7. Visibility scheme of all FBC cemeteries in the Świącica 1 – Studzianki 7 sector in the Sandomierz-Opatów Upland. Red dot – FBC monumental cemeteries; grey dot – FBC flat cemeteries; 1 – Dacharzów 1; 2 – Dacharzów 23; 3 – Daromin 5; 4 – Komorna 22; 5 – Studzianki 7; 6 – Świącica 1; 7 – Zagrody 13

visibility relationship on the east-west axis. It is possible that these relations were based on a hydrographic network, mainly the Bystra River (Fig. 6)

Each of these theoretical models is modified by adding flat cemeteries. Sometimes these flat cemeteries become sensible links between places where barrows are confirmed. The classic example of this is the Świącica 1 – Studzianki 7 sector within cluster C in the Sandomierz-Opatów Upland. There are numerous and complex visibility relationships within the sector that are likely to be related to the hydrographic network of the Opatówka Basin (Fig. 7).

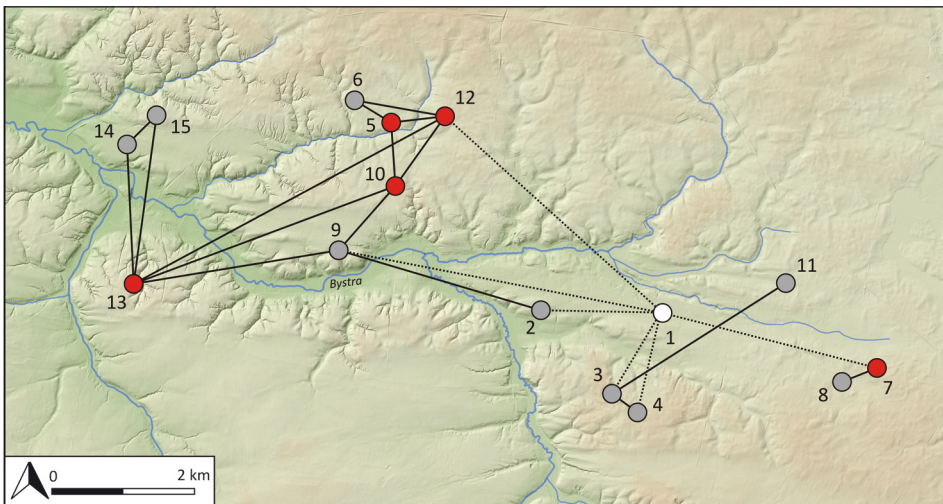
Another significant example of complicated cemetery arrangements has been observed in the Wąwolnica 7 – Miłocin-Kolonia 1 sector in the Nałęczów Plateau (Fig. 8). In this updated scheme, the hypothetical location of the cemetery in Antopol is still unchanged. This sepulchral place can be synchronized with others, such as Bochothnica 4, as well as



Bochotnica-Kolonia 1 and 2. Still, the main axis of this system seems to be the Bystra River with its tributaries (Fig. 8).

An aquatic context seems to be quite significant in regard to the location of FBC monumental cemeteries (*cf.* Chmielewski 1952; Midgley 1985; 2005). There are two “aquatic” tendencies in the location of such burial sites in the Sandomierz Opatów-Upland and the Nałęczów Plateau. An analysis of the distance of the cemeteries from the water provided the following values: 201-400 m – 25.8%; 401-600 m – 25.8% and 0-200 m – 19.4%. Only one site was situated less than 100 m from water. Furthermore, it is interesting that in the range 1001-1500 m, another 22.6% of cemeteries were identified. The latter group is typical of the cemeteries of cluster B in the Sandomierz Upland. Furthest from the water were the cemeteries in Prusy 44 (almost 1500 m) and Pawłów 3 (1030 m). Nevertheless, there were generally similarities between the Sandomierz Opatów-Upland and the Nałęczów Plateau, especially manifested in the 201-400 m and 401-600 m distance preferences.

Another important characteristic relates to a special kind of aquatic context: springs. The issue of springs can be approached in two ways – either by focusing on each spring separately or by considering in their entirety the more complex hydrological areas, characterized by more strongly developed spring networks on an arbitrary, relatively small area.



**Fig. 8.** Visibility scheme of all FBC cemeteries in the Wąwolnica 7 – Miłocin-Kolonia 1 sector in the Nałęczów Plateau. Red dot – FBC monumental cemeteries; white dot – hypothetical location of FBC monumental cemeteries; grey dot – FBC flat cemeteries; black line – visibility confirmed; black dotted line – hypothetical visibility. 1 – Antopol; 2 – Bochotnica 4; 3 – Bochotnica-Kolonia 1; 4 – Bochotnica-Kolonia 4; 5 – Chruszczów-Kolonia 1; 6 – Drzewce-Kolonia 1; 7 – Miłocin-Kolonia 1; 8 – Miłocin 11; 9 – Nałęczów 2; 10 – Nałęczów-Kolonia 1; 11 – Sandurki 2; 12 – Strzelce-Kolonia 1; 13 – Wąwolnica 7; 14 – Zgórzyńskie 1; 15 – Zgórzyńskie 7

In this case, careful research should be maintained. This also concerns the presence of dried-out springs as well as places of groundwater discharge (*cf.* Rasmussen and Skousen 2012).

To estimate the relationship between FBC monumental cemeteries and the developed spring network, only relevant data has been selected. Each of sites was analyzed in terms of its distance to the nearest three sources. The arbitrary reference point was set at 500 m. If the distance to a spring was less than or equal to this value, and a distance difference between the cemetery and particular springs was relatively close, then the spring context of the cemetery would be considered to be quite probable. In the matter of the Sandomierz-Opatów Upland and the Naęczów Plateau, the distance of the first of the three springs was less than 500 m in only 7 cases (*i.e.* 22.6%; Fig. 9). In this range, the shortest distance was 373 m. On the other end of the spectrum are the monumental cemeteries, located even over 1000 m from the nearest source. For instance, the cemetery in Pawłów 3 was located 1405 m from the nearest spring, 1925 m from the second closest, and 3322 m from the third (Fig. 9). The case of Pawłów is a bit extreme, although not unique. What does it all mean?

Based on these analyses, it can be seen that the importance of springs in the selection of the optimal location for a monumental cemetery could be minimal or even negligible. Compared to watercourses that could have pragmatic transportation and communication functions (see viewshed issues), other water areas (especially wetlands and sources) are often attributed to the symbolic dimension (Midgley 1985; 2005). Interestingly, this is particularly emphasized in discussions on the symbolic meaning of barrows in the Polish

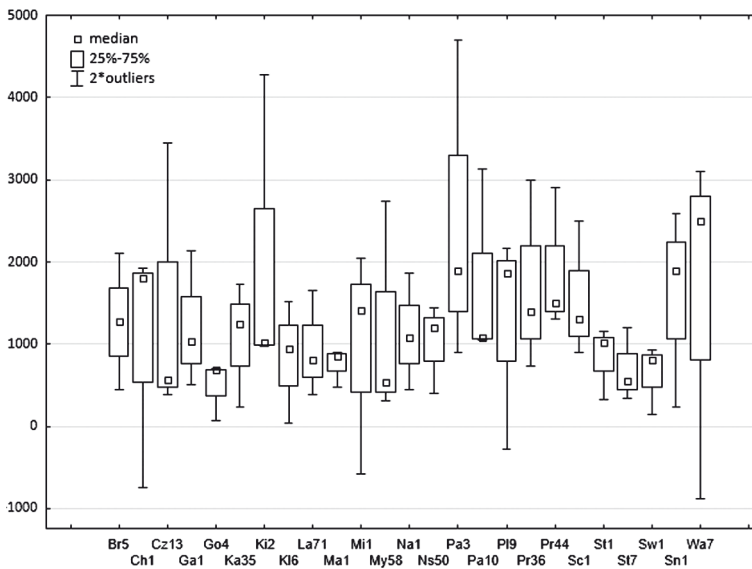


Fig. 9. Box-plot of the distance between FBC monumental cemeteries and the three nearest springs in the Sandomierz-Opatów-Upland and the Naęczów Plateau

Lowland (e.g. Woźny 1996). In fact, there are examples of cemeteries located very close to springs in the Kuyavia region, even at a distance of less than 100 m (i.e. Buszkowo 1; Gorczyca 2005). On the other hand, there is Central Pomerania (Łupawa Basin), where the spring context (or rather the lack thereof) is similar to southeastern Poland.

## SUMMARY AND CONCLUSIONS

What can we conclude from the presented studies? Do we have arguments that FBC monumental cemeteries were built in spaces specially selected for their alternative functions and meanings? It is definitely clear that analyses of the basic patterns of monumental cemetery distribution (especially if we include in this category the many debatable flat cemeteries) may indicate the existence of two basic approaches to spatial organization: clustered and scattered (Fig. 3-4). Could it be a characteristic of their varied functions? This question is difficult to answer due to insufficient data on the absolute chronology of FBC monumental cemeteries. This fact has very serious consequences, because it does allow for the creation of a dynamic model of the functioning of these cemeteries. The analysis of static points shows certain trends, but these trends can only be interpreted as various possibilities. We do not know whether the monumental cemeteries within the clusters (e.g. A and B in the Sandomierz-Opatów Upland) existed at the same time or not. It is currently not possible to exclude any of these scenarios.

The chronological uncertainties of the FBC settlement network are also particularly noticeable during viewshed analysis. Generated visibility relationships (Fig. 6-9) make sense only when they are composed of units of the same chronology. Viewshed analyses are potentially important in identifying the communication meanings (as territorial markers) of cemeteries. However, in order to validate these models, it is also necessary to gather data on landscape deforestation (cf. Demnick *et al.* 2008; Diers *et al.* 2014). Forest-free spaces are a *sine qua non* for the functioning of such a system. Especially important in this context is one issue. The traditional – or rather the most basic – role of cemeteries, barrows and graves is to provide space for the deposition of the deceased. In this sense, cemeteries are active as long as the dead are being buried within them. If we assume that they also have alternative roles, it follows that they might also be important after the end of the funeral process – until the appearance of the forest. This fact leads to a very important conclusion. The progress of research on the absolute chronology of FBC monumental cemeteries can provide optimal results only in the context of conjunction with parallel research on the environmental context of such sites.

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