

## TRACING TAPHONOMIC PROCESSES

Multiple Layer Analysis of Ceramic Distribution from Surface Collection and Excavation at the Early Bronze Age Settlement of Vrábľe-Fidvár<sup>1</sup>

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Surface find distribution analysis is a standard tool within the archaeological prospection arsenal. Nevertheless, the results are often met with a certain degree of scepticism and disapproval. The most common objection revolves around the idea that recent agricultural impact causes too much 'noise'. The Early Bronze Age (EBA) settlement of Vrábľe has been subjugated to intensive agricultural use over the past decades meaning that thousands of archaeological finds are scattered over the surface of the site. The richness of these finds and the availability of multi-layered information offers exceptional preconditions with which to evaluate the potential of surface distributions. In order to investigate the possibilities and limitations of this phenomena, we focussed on making a detailed analysis of the spatial pattern of ceramic finds within different scales and layers. The excavation data from two key areas were used to analyse the correlation of archaeological features with the occurrence of sherds in different layers in order to understand and reconstruct the taphonomic processes involved. Our starting point took the form of a large-scale surface collection which covered the settlement and delivered detailed information regarding its internal structure. Subsequent steps analysed higher resolution data from collections in a 2 x 2 m grid as well as from topsoil sampling from 1 x 1 m squares. This data was juxtaposed with that from excavations which took place in the very same area at a later date. What was crucial here was the question of the transformation of the upper settlement layer to the recent arable topsoil and the traceability of EBA houses, paths or pits in terms of sherd distribution. The sum of these results have enabled us to evaluate both the possibilities and limitations of the spatial analysis of ceramic finds. Specifically, this example illustrates the potential of revealing more general structures in a given settlement through analysis of ceramic distributions.

Key words: Slovakia, Early Bronze Age, ceramic distribution, sampling, taphonomy, field survey, statistics, surface collections, excavation.

## INTRODUCTION

Observations of surface finds at archaeological sites are regularly noted upon discovery and during subsequent field work. What would at first glance seem to be a phenomenon both straightforward and interpretable becomes more complex when the data is analyzed in more detail. The deposition, accumulation and preservation of finds as well as their dislocation are the result of various formation processes that have been most extensively studied by behavioural archaeologists such as Schiffer and colleagues (e. g. *LaMotta/Schiffer 2001*; see also *Ernée 2008*; *Kuna 2012*). However, at least in Continental Europe, many archaeologists still seem to both implicitly act (and argue) on the basis of the aptly-

dubbed 'Pompeii premise' or 'Dornröschen-Prinzip' (see, however, e. g. *Kadrow 1998*; *Sommer 1991*). These aspects as well as the methodical background, potential and constraints are well analysed and explained in Orton's standard text *Sampling Archaeology (Orton 2000)* and by Doneus' resumé of his extensive experience in landscape archaeology (*Doneus 2013*, 138 ff.).

Based on prospection and excavation data we can outline the rise and decline of the Early Bronze Age settlement of Fidvár near Vrábľe (2100–1600 BC). Founded at the end of the third millennium BC, over the course of its development during the EBA, a small settlement of less than 0.3–0.5 ha expanded to fill an area which measured approximately 12 ha in size (it is the largest found to date in the Pannonian

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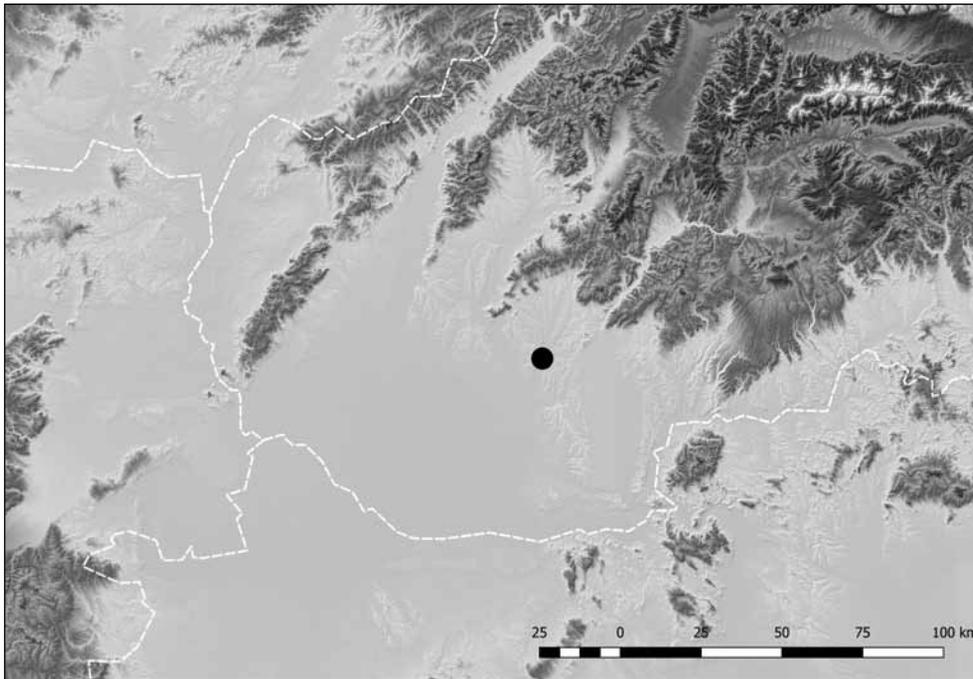


Fig. 1. Fidvár near Vrábce. The location of the Early Bronze Age site in the northwest Pannonian Basin.

Basin; Fig. 1). After approximately three to four generations, Fidvár was abandoned by the majority of its inhabitants. In its final stage, the settlement extended over only 1.2 ha.

The first appreciable excavation on the EBA settlement at Fidvár was commissioned by A. Točík in 1967. A trench of 55 m length cut the area between ditches A and B close to the slope (Fig. 2), partially sectioning both ditches. That excavation provided information on the depth of the ditches, the thickness of settlement layers and yielded some indications of their date (Točík 1986). By contrast, the geomagnetic data alone revealed the presence of c. 180 houses on site. When combined with aerial photography, a further 2500 pits of different sizes could be determined over an area of 12 ha. Some of the houses are clearly visible in the geomagnetic map (especially in area 1). This data is invaluable to the analysis of ceramic distributions at different depths as well as to the discussion of which archaeological features contributed to the distribution of ceramics in the topsoil and on the surface.

The richness of the archaeological data and the combination of the various methods opens the way to analyze the distribution of surface finds in detail. The geomagnetic map (with its clear indications of burnt houses, pits and postholes) and the three fortification systems (consisting of rampart and ditch) provided the first clues. The distribution of sherds on the surface of the settlement reveals a clear pattern which corresponds to

the geomagnetic data. The correspondence of these pictures was a promising indication of the benefits to be had by analyzing these phenomena in greater detail. Our analyses of the surface finds included different scales of surface collection in raster cells and along lines. The excavations were preceded by the sampling of the topsoil in every square metre. Apart from geomagnetics and surface finds, other valuable data were brought forward by the examination of aerial photographs (Kuzma 2005), resistivity (Nowaczinski *et al.* 2012), soil chemistry (Gauß *et al.* 2013) and other excavation information (Bátora *et al.* 2011). A PostgreSQL-database with PostGIS-extension serves as the backbone of our project; it contains the different data layers and enables us to take on a holistic perspective over the totality of our data space.

The cross-comparison of data from different scales provided insights in the processes by which artefacts were deposited. Based on these results, we are able to design an effective workflow of prospection techniques which renders representative data at the optimal resolution.

## MATERIAL AND METHODS

### Raster quadrants versus lines

On the basis of the geophysical prospections, soil chemistry and surface sampling were carried out at

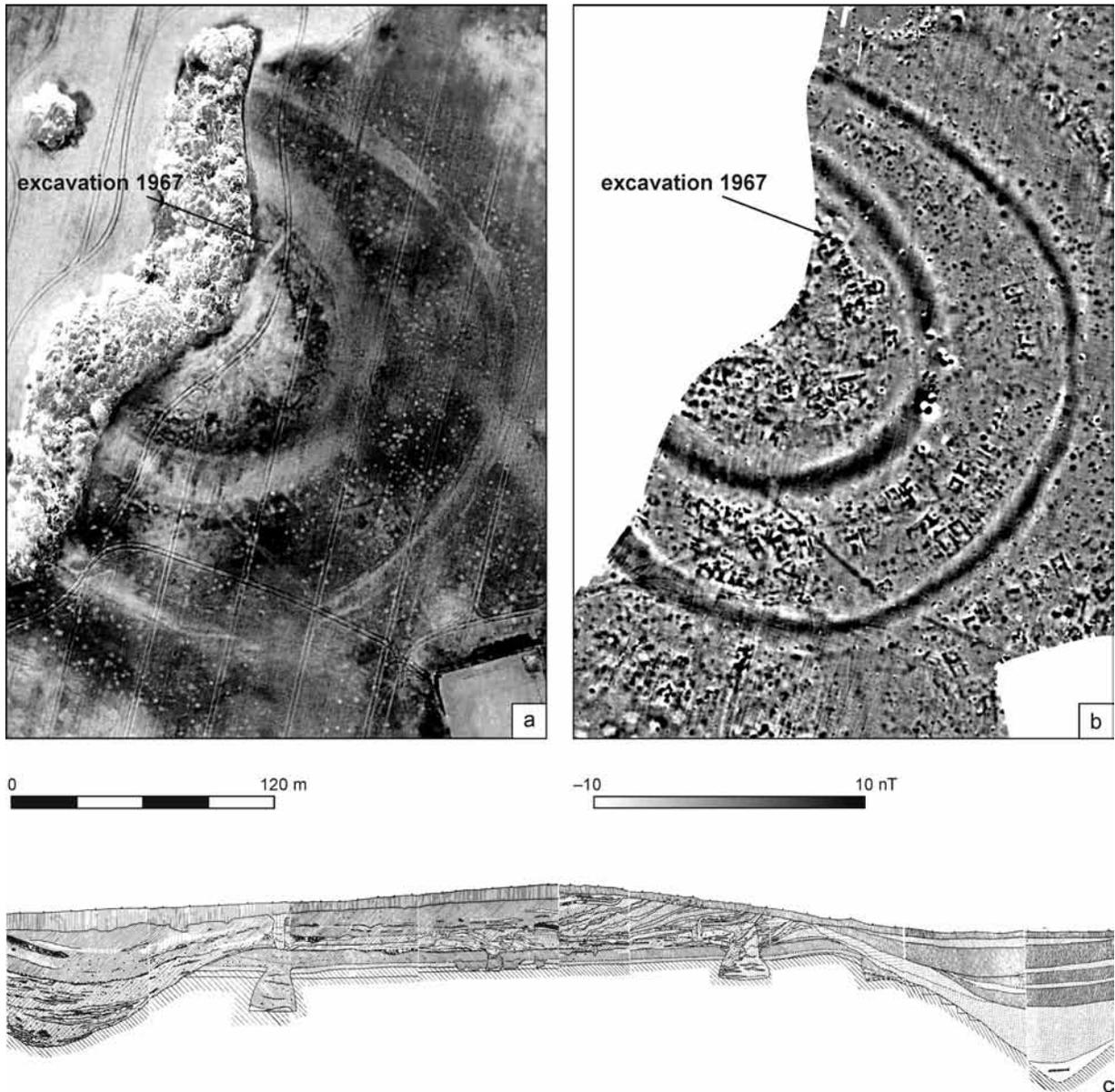


Fig. 2. Fidvár near Vrábce. a – aerial photography; b – geomagnetic map; c – profile section through the inner fortification system according to the excavation in 1967 (cf. *Točík 1986, 467, fig. 3*).

different scales in preparation for later excavation. The general workflow was as follows: fieldwork began with large-scale surface collections which covered the settlement. Higher resolution collection in  $2 \times 2$  m grids and the sampling of the topsoil by  $1 \times 1$  m squares completed this investigative program before the start of excavation.

### Sampling in quadrants

The 2007 campaign saw the start of a new field research program which began with surface col-

lection in raster cells of  $5 \times 5$  m,  $5 \times 10$  m and  $20 \times 20$  m. A total of around 2 t of sherds and other finds were collected. The interpolation of the ceramic weight revealed a spatial pattern which correlated with the geomagnetic data and clearly indicated a settlement area of at least 12 ha (*Falkenstein et al. 2008, 45, fig. 6; 7*). Without a doubt, the quality of this raster collection was excellent. However, there are some disadvantages inherent to this approach.

The first of these involves differences in the size of the raster cells. The decision for larger raster cells ( $20 \times 20$  m) in the periphery was imposed by time

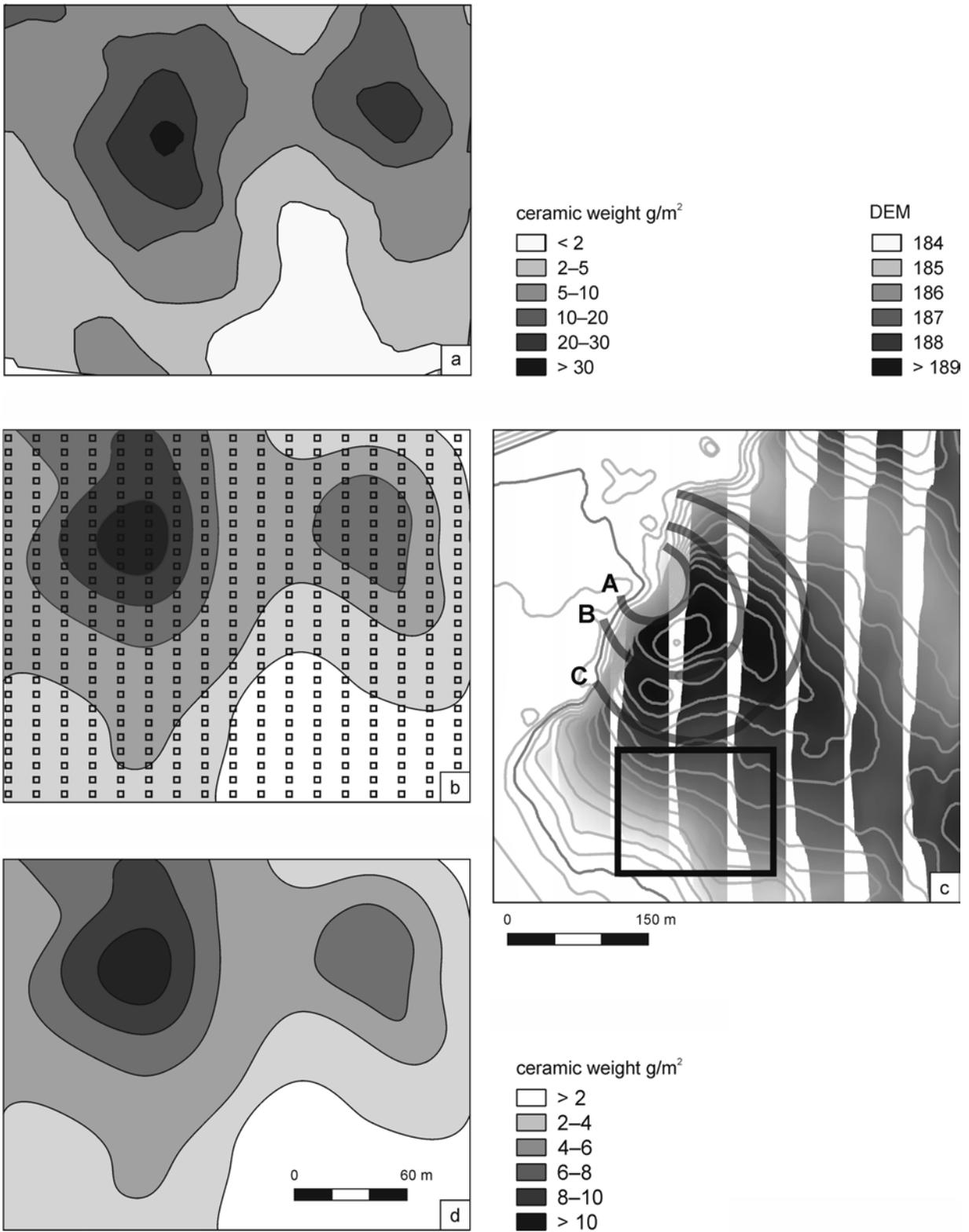


Fig. 3. Fidvár near Vrábce. Comparison of raster and line prospecting. a – result of line-oriented prospecting; b – pattern of line-oriented prospecting; c – overview (the black rectangle marks the position of figures a, b, d); d – re-digitized contour map of raster prospecting (cf. Falkenstein et al. 2008, 45, fig. 6).

constraints and was supported by the assumption that lower data precision was permissible along the periphery of the site. However, it is now obvious that it would have been more desirable to have the same level of accuracy across the whole site.

A second problem area comes from the amount of labour required for these analyses. The collection of 2 t of ceramic was time consuming; the task lasted four weeks. One must also take into account the resources needed for the packing and storing of the finds, a point which is often overlooked (c. *Doneus 2013*, 143). Furthermore, it is necessary to consider the complete prospection of the settlement, meaning a nearly complete sampling frame, to use *Orton's (2000, 85 ff.)* terminology. The question which arises is whether such an intensive and time consuming strategy is truly necessary. As was just mentioned, the cost of prospecting the whole site involved the allocation of varying sizes of raster cells (between 5 x 5 m in the centre to 20 x 20 m in the periphery).

### Transect point sampling

In his introduction *Orton (2000, 19)* emphasizes the necessity of a well-balanced sample design. Two crucial points include the choice of specific sample unit (i. e. collection in squares or in transects) and adequate sample frame. *Orton's* textbook details a methodological discussion of the potentials and constraints of the different sampling techniques (*Orton 2000, 19*). Besides sampling in quadrants – as was done in 2007 (*Falkenstein et al. 2008, 45 f.*) – another option is to prospect in transects or in 'points'. To us, it seemed worthwhile to use the site of Fídvár to evaluate both methods in order to find the most effective technique.

After thorough discussion, we made the decision to combine transect sampling with regular point sampling. The first data published by *Falkenstein et al. (2008, 45, fig. 6; 7)* was useful as a means of gauging the labour efforts and the quality of prospection data. In 2014, we organised a one-week campaign during which an area of 14 ha was prospected. Transects were placed at 10 m intervals along which every 5 m a 4 m<sup>2</sup> window was opened at 5 m intervals and searched for exactly one minute (for more details see *Müller-Scheeßel et al. 2016, 89 ff.*). In contrast to the study completed in 2007, only the number of sherds were counted with the help of a mechanical handheld counter; no sherds were collected (Fig. 3: d).

In this way, one hectare was divided into ten 100m-long transects. This means that along a single transect 20 areas of 4 m<sup>2</sup> were examined, covering

an area of 80 m<sup>2</sup>. All in all, the ten transects within a single hectare yielded a total overall coverage of 800 m<sup>2</sup>, or 8 % of the total area. Apart from the fact that we only counted sherds, this comparison brings to the fore the possibility of a serious reduction in the required workload. The quality of the prospection results is compared below.

### High resolution sampling in quadrants

Because of the coarse resolutions obtained by the 2007 and 2014 sampling windows (the two campaigns were necessarily both concerned with the larger picture surrounding the structuring of the settlement), the question remained as to whether other (more detailed) structures could be revealed by surface finds. Two areas were selected, one in the center of the settlement between ditch A and B and a second close to ditch C which belonged to the site's youngest phase. The screening of the whole site by large scale surface sampling was helpful in making optimal selections in this regard. The size of both areas measured 20 x 20 m, and each was divided into 100 2 x 2 m raster cells. Surface collection in these 200 raster cells was precisely timed at four minutes per cell. All finds were recorded and weighed.

### Topsoil raster

Common archaeological practice for the preparation of an excavation in ploughed areas calls for the removal of topsoil by machine. This saves time and is generally thought to remove only data that would be of low information value (but see *Ernée 2008*). Archaeological features are not visible and the archaeological finds are regarded as strongly dislocated, suggesting that precise and time-consuming locational information is not appropriate. As mentioned above, the distribution of surface finds revealed valuable settlement patterns. Particularly the distribution as counted in the 2 x 2 m resolution demonstrated the same trends picked up by the raster or transect prospection, albeit with greater detail. However, in order for this to be evaluated, it was necessary to produce control data by means of excavation. It is obvious that the recording of the distribution of finds in the topsoil is the link from surface patterns to the archaeological structures in the ground in which they were primarily contained. Based on these considerations, the topsoil from excavation areas 1 and 2 was sampled before this layer was removed by heavy machinery. To that end, in each square

meter a volume of approximately 8 l of soil was sieved with a mesh size of 0.5 x 0.5 cm (yielding a total of 182 samples). All finds found during sieving were recorded and weighed.

### Excavation

Having assessed the earlier excavations which took place in 1967, we started with two trenches on the western slope of the settlement and small target excavations in the settlement and its periphery. Based on the evaluation of all data obtained, three house areas were selected for more extensive excavation (Fig. 6). Our taphonomic study focused on Area 1's clearly visible house remains and pits. Our excavation strategy followed natural layers and was documented based on 2D and 3D photogrammetry in combination with feature recording by total station. All excavation soil was sieved through a 0.5 x 0.5 cm mesh. The sum of this information was then entered into a documentation system based on a PostgreSQL-database with a PostGIS-extension which enabled us to locate the finds and all sherds to their exact contexts within an archaeological feature. Characteristic finds made from stone, or bone tools, metal objects and ornamented sherds were recorded with an accuracy of  $\pm 2$  cm. The resultant mesh of information is both dense and precise enough to support the analysis of find distribution.

### Statistical methods

The distribution of sherds checked by sampling and excavation were analyzed by a set of different explorative and inferential statistical methods: spatial and non-spatial, parametric as well as non-parametric. In most cases, we opted to stay as simple as possible, so as to rely on proven and reliable methods. In terms of software, we mostly worked with free and open source software like QGIS (vers. 2.6) and GRASS (vers. 6). Some of the diagrams were prepared with Aabel (vers. 3).

The 2007 paper map was digitized and the resulting polygons transformed into a raster map with a resolution of 1 metre per raster cell (Fig. 3: d). The 2014 point count (Fig. 3: b) was recalculated to number per square metre (i. e. divided by 4) and the result interpolated (GRASS modul *v.surf.bspline* with the following options: east-west length: 20; north-south length: 10; Type of interpolation: Bicubic; Tykhonov regularization parameter: 1.0; Resolution: 1 metre per raster cell; Fig. 3: a). For Fig. 11, both surveys were combi-

ned by first resampling the one from 2007 with a resolution of 5 m, extracting the centroids of each raster cell with the respective value, then merging both vector layers after having adjusted the one from 2007 to match the values of that of 2014 (assuming that, according to Fig. 4, one sherd roughly equaled 4 g) and by finally interpolating the resulting layer again with the GRASS module *v.surf.bspline* (see above).

Because we had only categories of sherd weight for the 2007 field-survey, the 2007 and 2014 results could not reasonably be compared by way of regression analysis. Instead, we generated box plots for each weight category (Fig. 4).

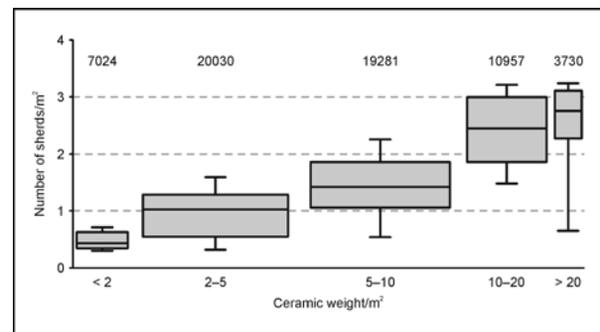


Fig. 4. Fidvár near Vrábce. Comparison of ceramic quantity of the raster prospection (weight) and transect prospection (number) by boxplots. The boxes contain 50 % of the respective values, the whiskers 80 %. The median is marked by the line. The width of the boxes are proportional to the number of observations (= raster cells), which is also given as integer above each box.

For the 2 x 2 m survey the categorized raw numbers were plotted as choropleth map (Fig. 5). Its comparison with the topsoil sampling was underpinned by a regression analysis and the computation of Pearson's Product Moment Correlation Coefficient (Fig. 6). For that the values of the four 1 x 1 m-squares corresponding to one of the 2 x 2 m squares were averaged by taking the median.

For the smoothed distribution patterns in Fig. 7 a moving window of 3 x 3 raster cells was used, and the values were averaged by computing the median. The distribution of sherds and features like pits alone could be quantified by very different algorithms. However, in this case it seemed most appropriate to use Kernel Density Estimation (the current state of research was recently summarized by Herzog 2012). We opted for the implementation via QGIS' 'Heat map' tool (Fig. 11). We set the search radius to 30 metres and left the rest at the default values (kernel: biweight; no further values for radius, weighting or fall-off).

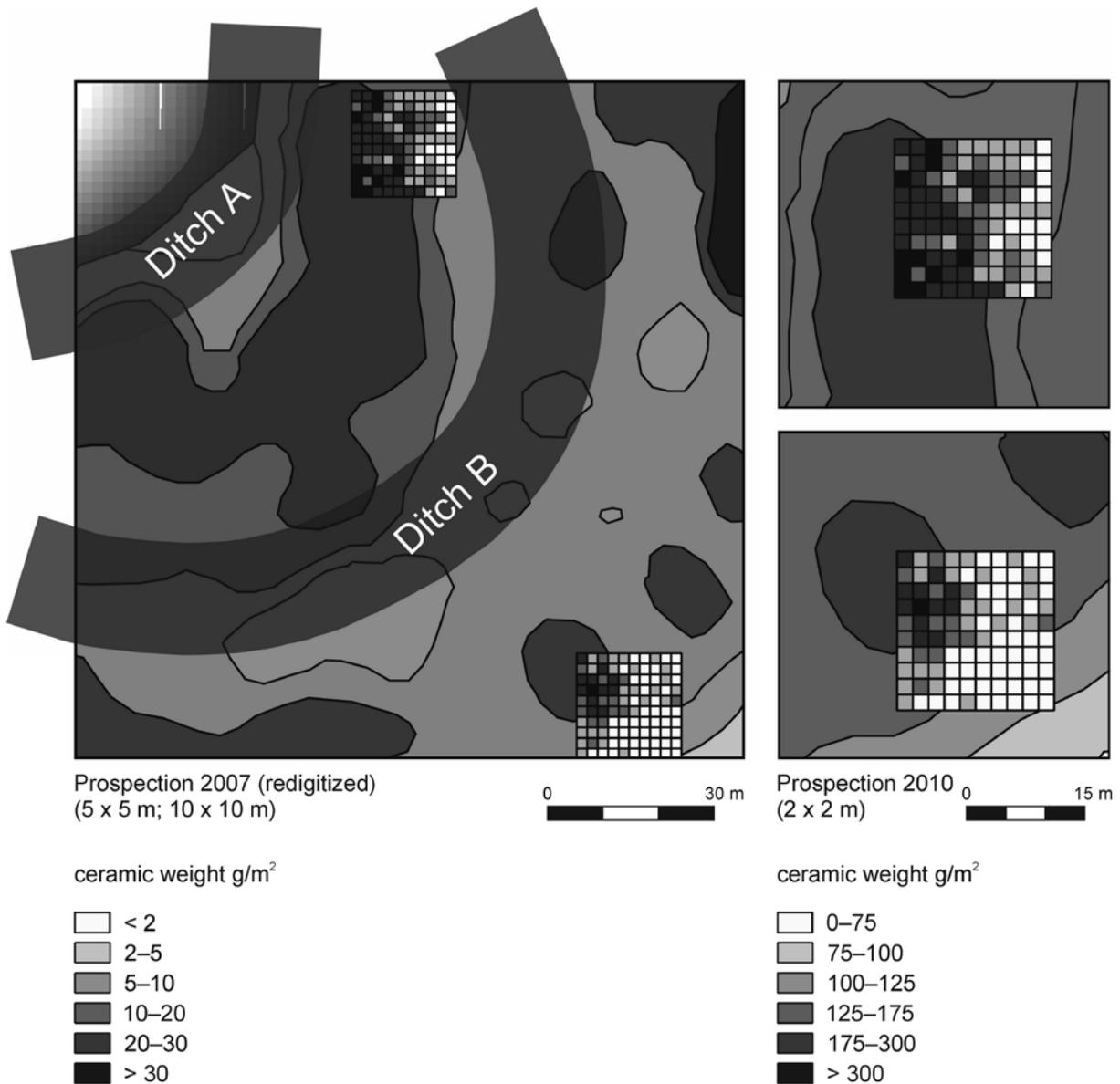


Fig. 5. Fidvár near Vráble. Comparison of the raster prospection at 5 x 5 m to 10 x 10 m with 2 x 2 m observation windows. The 2 x 2 m prospection shows categorized raw counts.

## RESULTS

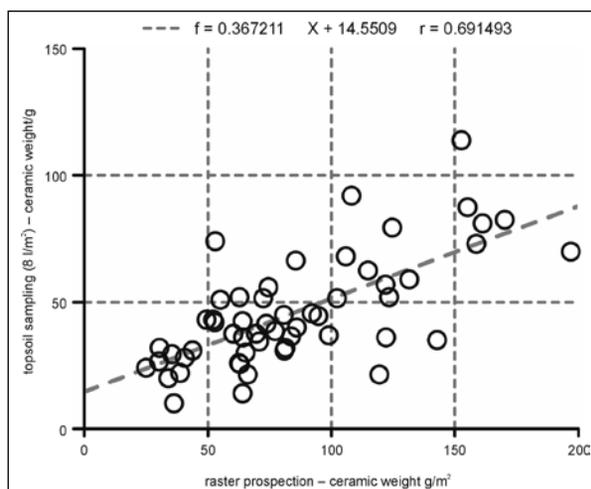
### Transect sampling

In contrast to the 2007 survey (which was based on weight), the transect sampling was modelled on number of sherds. The boxplot illustrates a significant correlation between ceramic weight (from the quadrant sampling in 2007) and sherd number (from the transect sampling in 2014; Fig. 4). Both prospection methods revealed concentrations of sherds in exact the same positions (Fig. 3). Areas with higher densities of ceramic finds correlate precisely with the house clusters outside of ditch C.

Therefore, both counting methods generated virtually the same picture.

### High resolution sampling in quadrants

The collected amount of ceramic topped out at over 150 g per square; this number was roughly five times higher than that of the large-scale collection in quadrants. A comparison with the more general pattern (Fig. 5) principally shows that both sample strategies had similar tendencies. Only those areas with the highest sherd density had raster cells displaying weights greater than 125 g.



Pearson Product-Moment Correlation Coefficient	
Independent var.	topsoil-sample – median in g
Dependent var.	raster prospection in g
r:	0.691493
Fisher's 'z'	0.850812
df:	53
r (two-tailed) 0.05:	0.266
r (two-tailed) 0.01:	0.345
r (one-tailed) 0.05:	0.225
r (one-tailed) 0.01:	0.314
t:	6.96881
df:	53
p (two-tailed):	< 0.001
p (one-tailed):	< 0.001

Fig. 6. Fidvár near Vrábce. Regression analysis between topsoil sampling and high resolution surface collection per square metre. The value for topsoil sampling is based on the median of the squares falling within the 2 x 2 m of the high resolution surface collection (usually four).

### Topsoil sampling

In the next step the ceramic distribution from the topsoil was compared with the high-resolution sampling and the settlement layers as revealed at greater depth. A regression analysis of topsoil sampling and high resolution surface collection shows a highly significant concordance (Fig. 6). The same holds true for the first level which was removed by hand (spit 2). By sampling the topsoil (= spit 1), a grand total of 7807 g of ceramics were found. This contrasts with the 110 064 g of ceramics recovered from spit 2. Therefore, the quotient of the weight of the ceramics from spits 2 and 1 is 14.1. Spit 2 measured 10–12 cm and ranged over an excavation area of 143 m<sup>2</sup>. This in turn roughly equals 15 cubic metres or 15 000 litres of excavated soil. For the sampling, 182 buckets of approximately 8 litres of soil apiece were collected and sieved, a total mass which roughly equates to 1200 litres. In this case the quotient of spits 2 and 1 in relation to the amount of soil moved is 12.5. So, both quotients are clearly in the same ballpark, suggesting in turn that the sampling method allows reasonable estimates of the amount of finds to be expected (at least below the immediate topsoil).

This leads us to wonder whether there is any correlation with architectural remains in underlying layers. There are indications that house areas are characterized by lower ceramic densities. However, there is no correlation between higher ceramic densities and the locations of the alleyways between buildings (Fig. 7; 8). This was unexpected at first because concentrations of rubbish (including

ceramics) in such areas is a general phenomenon known from many settlement excavations, e. g. a well-observed and -analysed study concerns the Vinča settlement at Okolište (Hofmann *et al.* 2006, 132). A clear pattern of correlation between the location of ceramic concentrations and alleys is visible only in spit 6 at a depth of around 70 cm (Fig. 7; 8). It seems reasonable to conclude, therefore, that ceramic concentrations in the upper layers and on the surface do not correlate with the locations of houses or alleys.

### Discussion

Before entering into discussion, it seems necessary to restate that the 2007 team collected *all* finds. At least in those areas which were covered by both 2007 and 2014 investigations, therefore, the finds recorded in 2014 must have surfaced in the period between 2007 and 2014. The same is true for the high resolution sampling which took place in 2010. Therefore, it seems quite certain that the archaeological content from the surface as well as from the first decimetres of soil correlate with each other and therefore reflect the same underlying archaeological phenomena.

There can be no question of whether or not surface material yields important information about hidden archaeological structures. However, what needs to be addressed is *what kind* of structures are revealed by this information. As was noted above, it seems that the concentrations that have been observed cannot be assigned to houses and alleys.

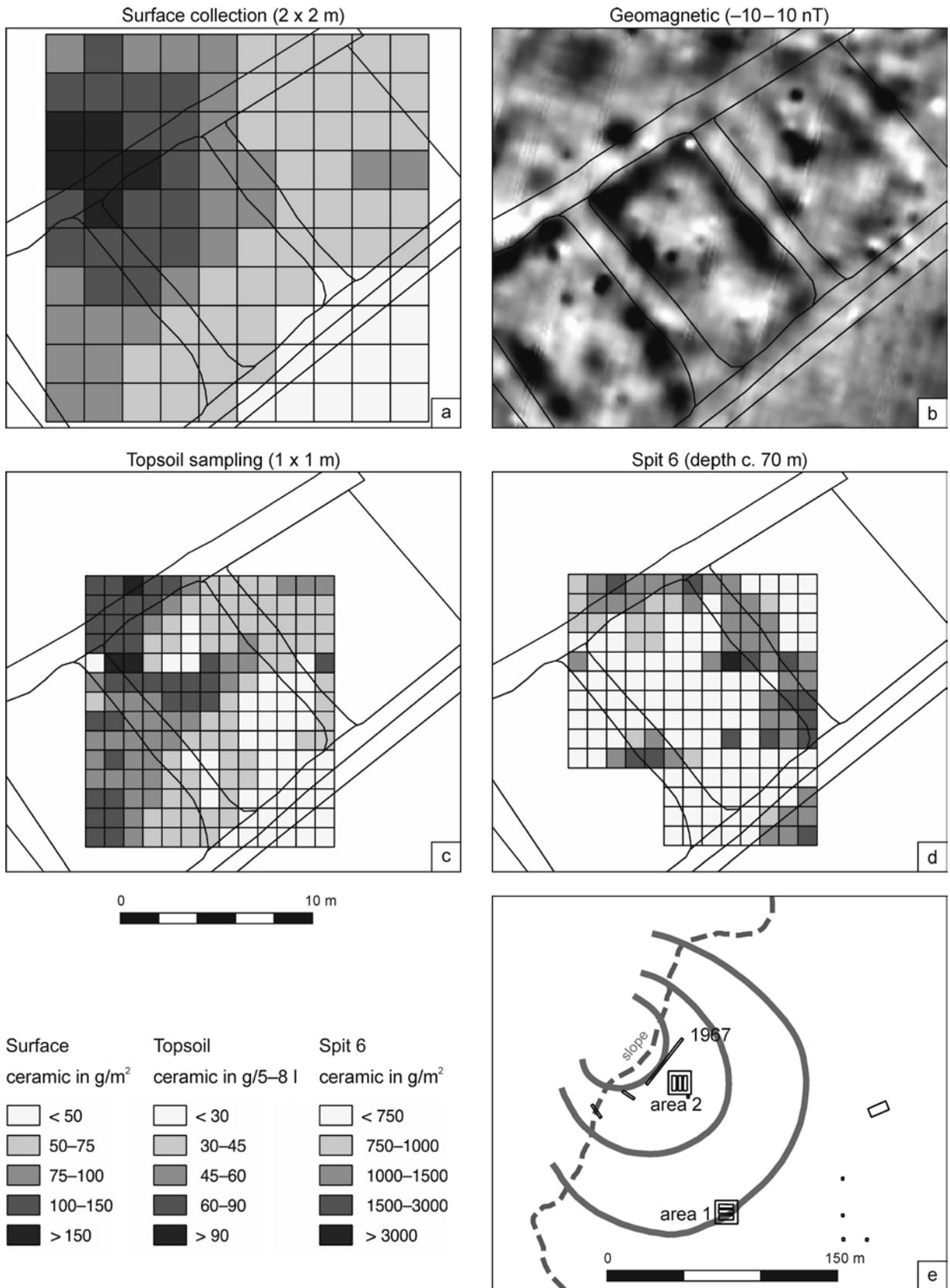


Fig. 7. Fidvár near Vrable. Area 1. Comparison of ceramic weight with archaeological features. a – raster prospection (2 x 2 m; with moving window of 3 x 3 raster cells); b – geomagnetic prospection and generalized archaeological interpretation; c – topsoil sampling in 1 x 1 m squares (with moving window of 3 x 3 raster cells); d – weight of excavated ceramics, spit 6 (with moving window of 3 x 3 raster cells); e – overview on the excavation trenches and prospection areas 1 and 2.

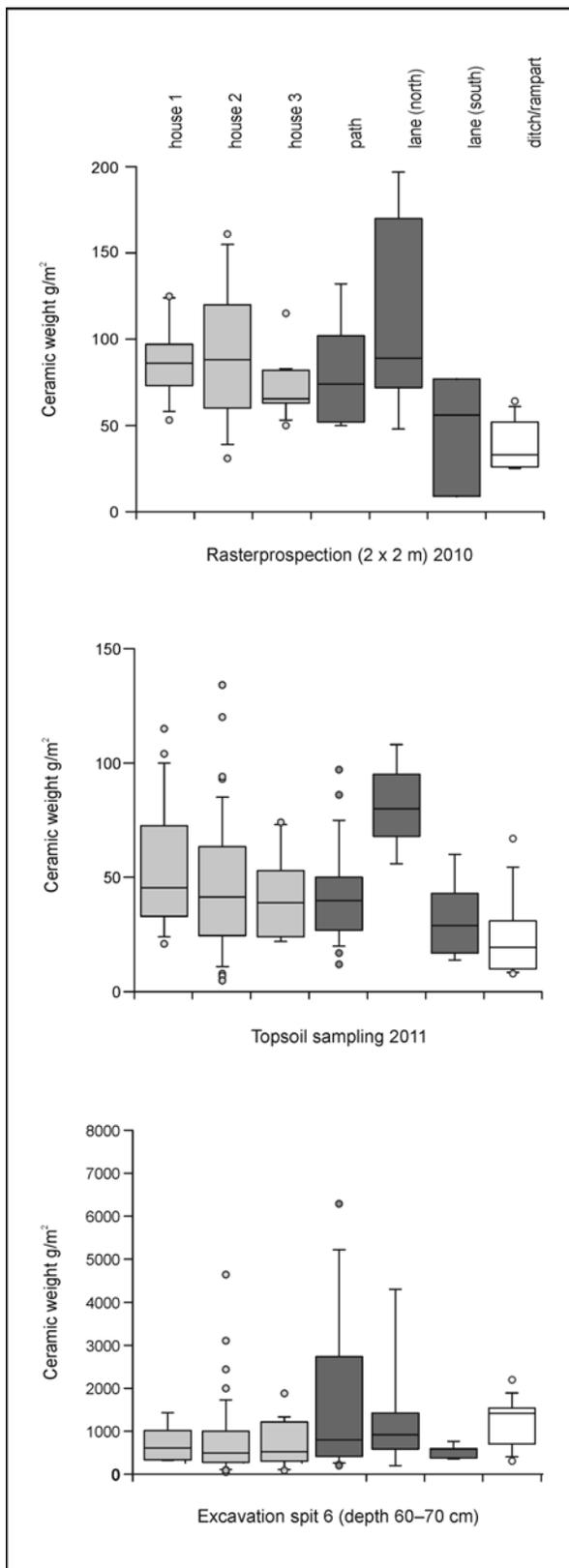


Fig. 8. Fidvár near Vrábě. Comparison of the ceramic quantity of raster prospection, topsoil sampling and excavation by boxplots. The boxes contain 50 % of the respective values, the whiskers 80 %, outliers are also shown. The median is marked by the line.

Area 1 shows a remarkable concentration in the northwest, at least in terms of the data from surface prospection and topsoil sampling. Excavation in this area revealed a large pit which was filled with rich ceramic layers (Fig. 9; 10). The conclusion which seems most likely is that the concentrations in the upper layers were produced by this exact pit. In that case, a dislocation of the finds of 2–3 m can be taken into account.

As mentioned above, over 2500 pits were identified at the site by means of aerial photography and geomagnetic data. Despite the fact that numerous pits are also visible in the centre of the settlement inside ditch B, the highest density occurs in the area between ditches B and C as well as in the periphery (Fig. 11). This spatial pattern mirrors that of the ceramic distribution. One can conclude, therefore, that the locations of pits and areas with higher densities of ceramics can be correlated. In turn, this implies that the correlation between house clusters and ceramic distribution as deduced by *Falkenstein et al. (2008, 45 ff., fig. 7; 10)* is only indirect; while there is a certain correlation between these factors – houses are near pits which contain ceramics which in turn can be collected from the surface – it is unlikely that houses formed the basis for the distribution of ceramics.

### Sampling design

Based on our experience it is clear that a combination of different sampling strategies (which should guide later excavation) represent the optimal choice in sampling design. Taking methods such as geomagnetics and aerial photography as given, we suggest a prospection design as follows (Fig. 12). First, if possible, the entirety of a site should be covered by a large-scale surface prospection. With regards to the collecting vs. counting dilemma, we clearly argue for the efficiency of transect prospection. In our case, similar structures were revealed with less labour and effort. The crucial point is the choice of the distance between the lines (as already discussed by *Orton 2000, 47, fig. 2.8*). In some cases, 10 m may be too large a distance to reveal very small concentrations of finds. However, 10 m is precise enough for obtaining an idea of the general patterns within a site. It might be worth returning to the controversy regarding the quantification of ceramics by number versus by weight (cf. *Orton 2000, 52, fig. 3.6*). According to the example from Fídvár, both methods were fungible, as they yielded comparable results.

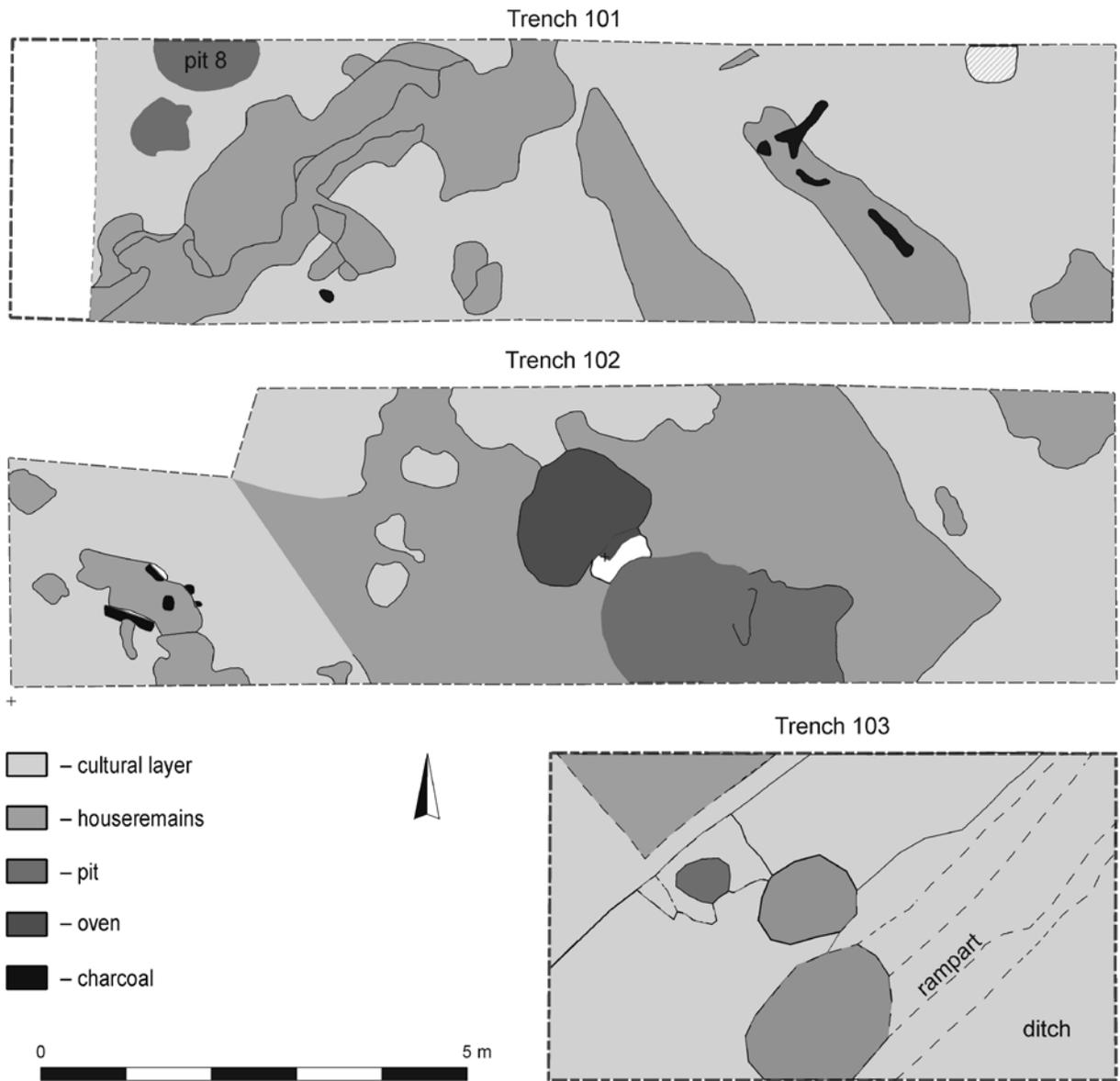


Fig. 9. Fidvár near Vráble. Remains of a house in planum 5. Pit 8 in the northwest corner is marked.



Fig. 10. Fidvár near Vráble. Fotogrammetry of pit 8 in the northern section of trench 101 (cf. Fig. 9).

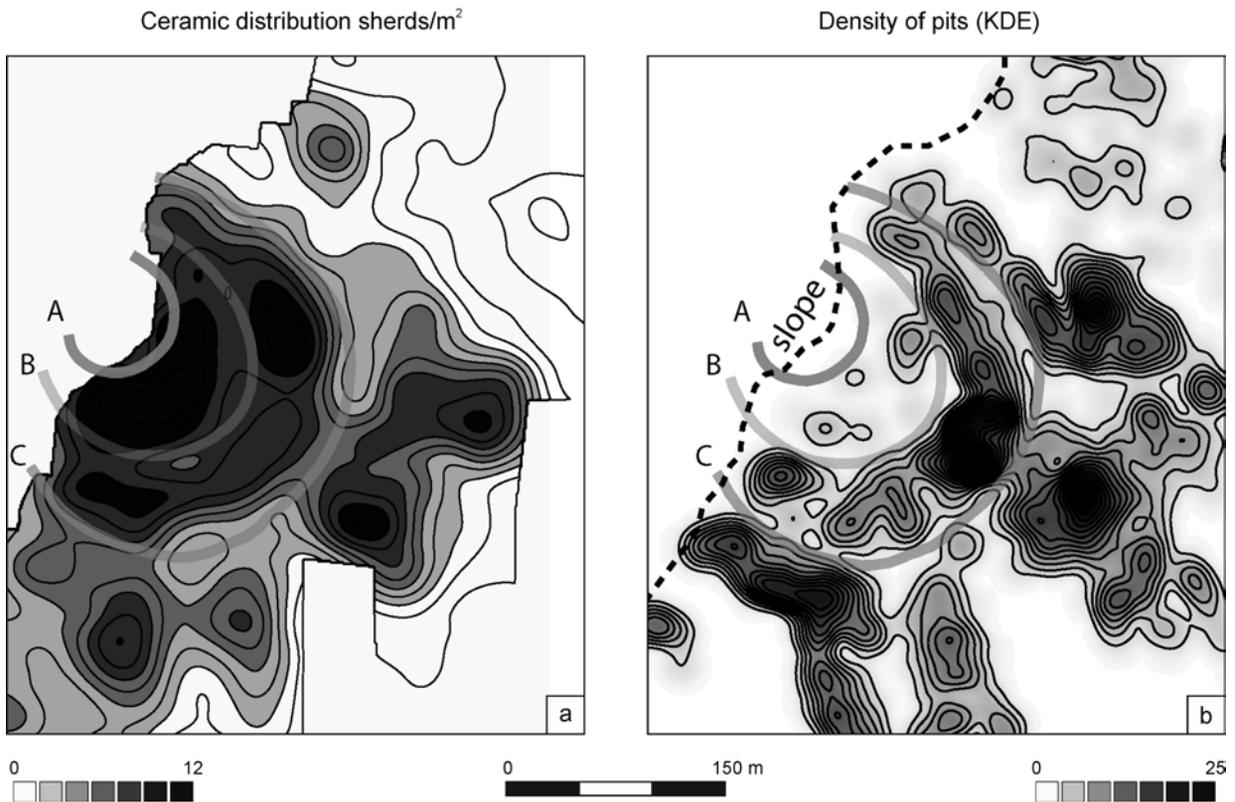


Fig. 11. Fidvár near Vrable. a – interpolation of ceramic quantity (combination of survey 2007 and 2014); b – density of pits as recognized via geomagnetics and aerial photography.

A secondary measure should select specific areas with higher concentrations for raster prospection in higher resolution (e. g. with  $2 \times 2$  m cells). This step enables more detailed insight into the spatial structures and will be more likely to provide datable ceramics or other finds. In the third analytical step, these results should be combined with e. g. geophysical data, remote sensing and/or drilling profiles in order to facilitate the selection of the most promising areas for excavation.

### Conclusion

Contrary to other sites where the relationship between surface find scatters and subsurface find patterns were studied (e. g. *Greenfield 2000; Johnson 2014*) the site of Fidvár was subjected to a great deal of human activity (especially agricultural ploughing, some of which was very deep). However, our results imply that despite these activities the surface collections at Fidvár not only generate a kind of 'site signature' (*Schofield 1991; see also Steinberg 1996*), but that they also allow for inferences about the internal structure

of the settlement. This would certainly also be true for other densely populated sites with substantial cultural layers.

At first sight, our conclusion seems to be at odds with simulation studies of ploughing effects, which have shown that surface patterns degenerate over time (*Boismier 1997; see also Reynolds 1988*). However, what is not taken into account by simulation studies is the fact that the finds from the surface are 'renewed' as long as there are archaeological features in the ground containing finds and to be distributed by continual ploughing (cf. *Pieler 2012*). This is certainly the case with the site at Fidvár, as is demonstrated by the fact that the find distributions between different survey campaigns of collecting remained the same. In our view, this makes empirical studies like ours so important in contrast to simulation studies which might allow more control over variables but, in the end, bear little resemblance to archaeological find situations. The distribution of the topsoil finds is not random and is not representative only of agricultural activities. While we noted that finds were not always recovered exactly in the same location as deeper archaeological features, there is a clear correlation

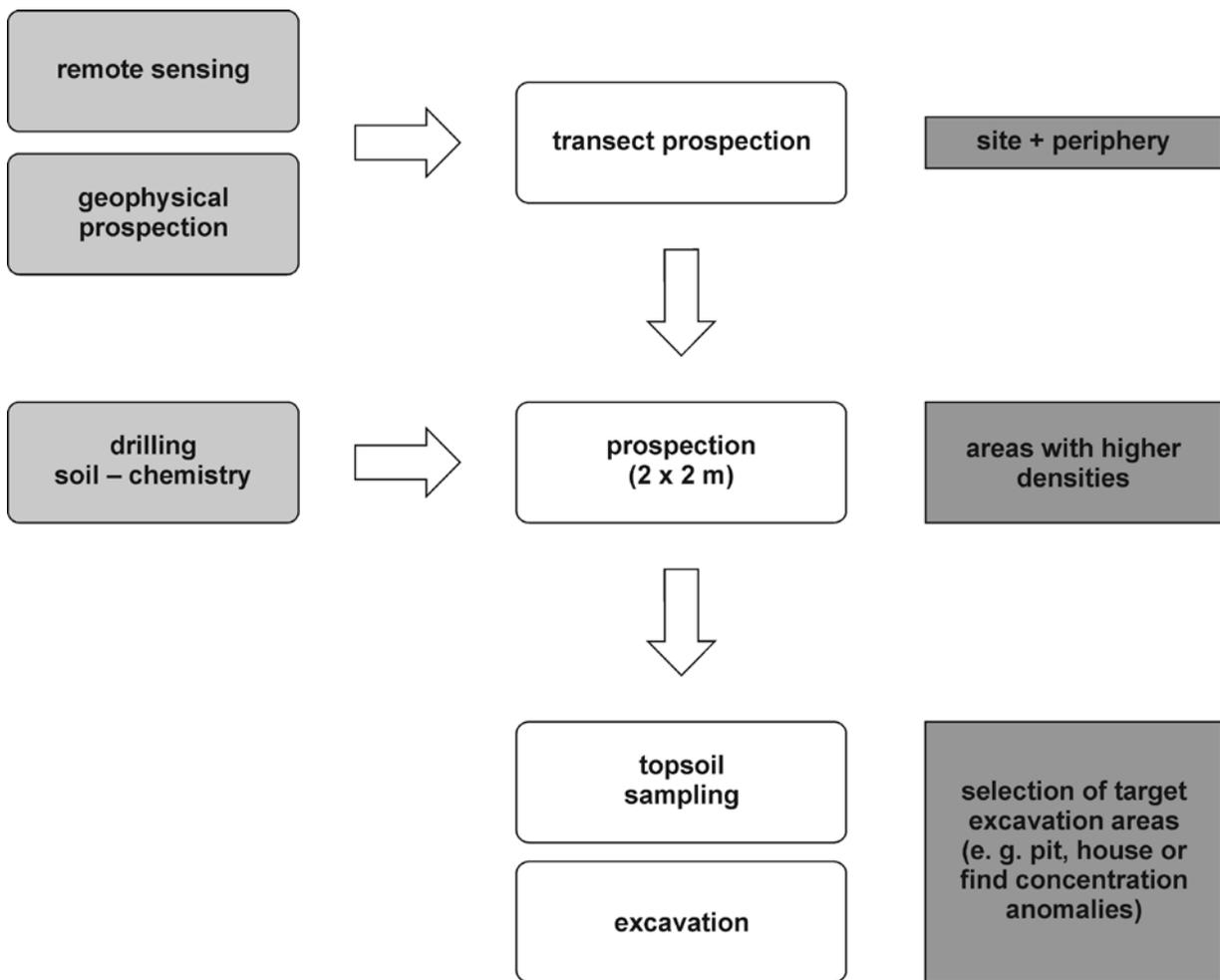


Fig. 12. Fidvár near Vrábce. Workflow for surface prospection in preparation of excavation.

between the two phenomena. Based on our data, we can estimate the dislocation of the finds at the site within a range of 1–2 m. Only a small part (20–30 % as a rough estimate) were more dispersed. This point is crucial when dealing with features in close proximity to the topsoil, e. g. on heavily-eroded sites. For functional chronological analysis we must be certain to account for the majority of the finds from the site in question. Time constraints often lead to the intensive use of machines for the

removal of all topsoil. Presumably, this common practice leads to the dramatic loss of finds that could otherwise have been centrally important to crafting an understanding of highly eroded features close to the topsoil. It seems indispensable, therefore, to have a representative sample from the first few decimetres of soil, be it from transect counting, high resolution sampling or topsoil sampling (although in ideal conditions all three methods would of course be employed).

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## Sledovanie tafonomických procesov

### Viacvrstvová analýza distribúcie keramiky získanej z povrchových zberov a sondážneho výskumu na lokalite zo staršej doby bronzovej – Vrábľa, poloha Fidvár

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## SÚHRN

Analýza rozmiestnenia huteľných archeologických artefaktov získaných z povrchových zberov je dnes už zaužívaným štandardom pri systematických archeologických výskumoch. Tento typ dát sa však pomerne často kritizuje z pohľadu ich nízkej výpovednej hodnoty, zapríčinennej prípadnou rozsiahlou poľnohospodárskou činnosťou na ploche, z ktorej boli získané. To by mohol byť aj prípad lokality Vrábľa, poloha Fidvár, kde sa nachádzalo rozsiahle opevnené sídlisko zo staršej doby bronzovej. Na rozlohu približne 12 ha bolo pomocou geofyzikálneho

prieskumu a leteckého snímkovania identifikovaných asi 180 obydľí a vyše 2300 sídliskových jám. V dôsledku intenzívneho poľnohospodárskeho obrábania pôdy sa preto aj v súčasnosti na ploche nachádzajú stovky roztrúsených huteľných archeologických nálezov. Prvýkrát bol vykonaný na lokalite sondážny výskum A. Točíkom v roku 1967, v rámci ktorého boli získané informácie o stratigrafii kultúrnych vrstiev. Tie bolo zároveň takto možné kultúrno-historicky interpretovať. Údaje z tohto výskumu, vrátane údajov získaných z geofyzikálnej a leteckej prospekcie,

pomohli vytvoriť dostatočne verný obraz o charaktere lokality. To bolo zohľadnené pri povrchovom prieskume sektorovou metódou (5 x 5 m, 5 x 10 m a 20 x 20 m), ktorý sa realizoval v roku 2007 a svojím rozsahom pokryl takmer celú maximálnu predpokladanú plochu sídliska zo staršej doby bronzovej. Slabinou tohto prieskumu, aj napriek jeho nespornému prínosu, bola predovšetkým rozličná veľkosť skúmaných sektorov, ako aj neúmerne vysoké množstvo vynaloženého času a úsilia, potrebného na jeho realizáciu a samotné vyhodnotenie. Z toho dôvodu bola v roku 2014 zvolená druhá metóda povrchového prieskumu, ktorá zahŕňala vzorkovanie na vybraných bodoch v tzv. transektoch. Tie boli umiestnené v 10 m intervaloch, pričom každých 5 m bola preskúmaná plocha o veľkosti 4 m<sup>2</sup>. Podobne ako pomocou prvej metódy bola preskúmaná plocha o rozlohe takmer 14 ha. Posledná použitá metóda povrchového prieskumu, ktorá sa uskutočnila v roku 2010, zahŕňala aj podrobné vzorkovanie vo vysokom rozlíšení vo dvoch vopred vybraných sektoroch.

Pri sondážnom výskume boli brané do úvahy všetky predchádzajúce zistenia a sondy situované do priestoru, kde sa s najväčšou pravdepodobnosťou mali vyskytovať pozostatky obydľí zo staršej doby bronzovej. Ešte pred skryvkou ornice prebehlo vzorkovanie taktiež vo vysokom rozlíšení a získané artefakty boli podrobne zdokumentované. Následný archeologický výskum postupoval metódou manuálneho odkryvu prirodzených vrstiev, pričom odkryvaná zemina bola preosievaná cez sito, kvôli zachyteniu čo najväčšieho množstva artefaktov.

Všetky vyššie uvedené dáta boli následne štatisticky vyhodnotené pomocou širokej škály štatistických metód prostredníctvom voľne licencovaných GIS softvérov QGIS (verzia 2.6) a GRASS (verzia 6) ako aj štatistického softvéru Aabel (verzia 3). Prezentovaný krabicový graf ukazuje výraznú koreláciu medzi keramikou hmotnosťou (údaj získaný pomocou prvej metódy povrchového zberu) a množstvom črepov (údaj získaný pomocou druhej metódy povrchového zberu). Oba povrchové prieskumy odhalili koncentráciu črepov v tých istých miestach. Ukazuje sa teda, že obe metódy priniesli v podstate rovnaké zistenia. Štatistické porovnanie hmotností keramikových črepov z ornice a z kultúrnej vrstvy 2 (pod ornice) zo

sondážneho výskumu naznačuje, že z množstva črepov nájdených v ornici je možné usudzovať, aké množstvo črepov je možno očakávať v nižších vrstvách.

Pri porovnaní použitých metód vzorkovania sa ukazuje, že najlepšie výsledky prináša ich kombinácia. Povrchový prieskum by, podobne ako iné nedeštruktívne metódy, mal predchádzať sondážnemu výskumu. Ideálne je začať rozsiahlym povrchovým prieskumom, pričom vzorkovanie v bodoch na tzv. transektoch sa javí ako najefektívnejšia metóda z hľadiska vynaloženého času a úsilia. Prináša podobné zistenia ako sektorová metóda, avšak pri výrazne nižšom množstve vyššie uvedených investícií. Ako druhý krok by mal nasledovať detailný povrchový prieskum vo vysokom rozlíšení (bunky o veľkosti napr. 2 x 2 m) vo vybraných sektoroch, ktorý s veľkou pravdepodobnosťou prinesie dáta s vyššou výpovednou hodnotou. Tretí krok zahŕňa analýzu všetkých získaných dát pre určenie najperspektívnejších plôch pre sondážny výskum.

Na rozdiel od mnohých iných lokalít, kde bol skúmaný vzťah medzi distribúciou nálezov na povrchu a pod povrchom, bol Fidvár vystavený intenzívnejším poľnohospodárskym aktivitám. Aj napriek tomu je však na základe tu uvedeného zberu dát možné postulovať úvahy o vnútornej zástavbe sídliska. Zaujímavým zistením je to, že aj po sedemročnom časovom odstupe boli zistenia o distribúcii v podstate rovnaké, aj napriek naďalej prebiehajúcej intenzívnej poľnohospodárskej obrábanej pôdy. Distribúcia nálezov v ornici teda nebola náhodná, naopak, je tu zrejma korelácia medzi zahĺbenými objektmi, ktoré obsahujú väčšie množstvo nálezov (napr. odpadové jamy, teda sekundárne využité zásobné jamy) a ich vyššou koncentráciou v ornici. Dislokácia nálezov od týchto zahĺbených objektov je zhruba v polomere 1–2 m a len menšia časť (20–30 %) je distribuovaná vo väčšej vzdialenosti. Naopak, zistené koncentrácie evidentne nekorelujú s inými potenciálnymi štruktúrami, ako sú napríklad obydľia, nakoľko ich relevantné vrstvy neobsahovali dostatočne hustú koncentráciu nálezov. Z tohto dôvodu má systematické vzorkovanie a základná analýza artefaktov pochádzajúcich z ornice svoje opodstatnenie ešte pred jej samotnou skryvkou.