

The Neolithic in the Middle Morava Valley



Editor: Slaviša PERIĆ



INSTITUTE OF ARCHAEOLOGY, Belgrade
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The Neolithic in the Middle Morava Valley:

Interdisciplinary contributions
to research and preservation
of archaeological heritage



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In memoriam Radovan Petrović





Geophysical Surveys at Drenovac in 2012 and 2013¹

Abstract:

The paper presents the results of the geophysical survey of the Neolithic site at Drenovac, near Paraćin (Central Serbia), conducted in 2012 and 2013, and subsequent archaeological excavations carried out after the survey to test the survey results. The survey results have shown a very complex organisation of the settlement. Zones with a distinctive regular organisation and others where a completely different spatial organisation was applied can be clearly distinguished. The results of the archaeological excavations have demonstrated the advantages that the method of archaeological prospection can bring, but have also indicated that the data obtained from a geophysical survey should be taken with reservations.

Key words: Drenovac, Neolithic, geophysical survey, settlement organization, houses

Introduction

Research into the Neolithic in the area of the Middle Morava Valley (*Central Pomoravlje*) has been ongoing for more than seven decades, with one of the most valuable results of this long process being an archaeological map of Neolithic settlements (Fig. 1 – Map of sites). The great number of Neolithic settlements in the Middle Morava Valley requires a multidisciplinary approach in all forms of archaeological research, including archaeological prospection. In this context, in 2008, as part of the project *Permanent Archaeological Workshop – Middle Morava Valley in Neolithisation of Southeast Europe*, a team of the Romano-Germanic Commission of the German Archaeological Institute carried out test geophysical surveys in the area of the Middle Morava Valley at the sites of Slatina – Turska česma at Drenovac, near Paraćin, Motel-Slatina in Paraćin and Dunjički šljivari at Međureč, near Jagodina. Following the positive results from these surveys, a detailed surface prospection and assessment of the endangerment of the sites were staged in 2010, which may be of interest for the continuation of the geophysical survey. In the same year, a joint project of the Romano-Germanic Commission of the German Archaeological Institute and the Archaeological Institute was initiated with respect to geophysical surveys in the territory of Serbia, and, *inter alia*, the survey of a number of the Neolithic sites in the Middle Morava Valley. This project was carried out between 2010 and 2012 and the results of these surveys were presented in a previous volume of a series of monographs *The Neolithic in the Middle*

¹ This paper has resulted from work on Project no. 177020 of the Ministry of Education, Science and Technological Development of the Republic of Serbia. The geophysical survey and archaeological excavations were financed by the Ministry of Culture and Information of the Republic of Serbia.

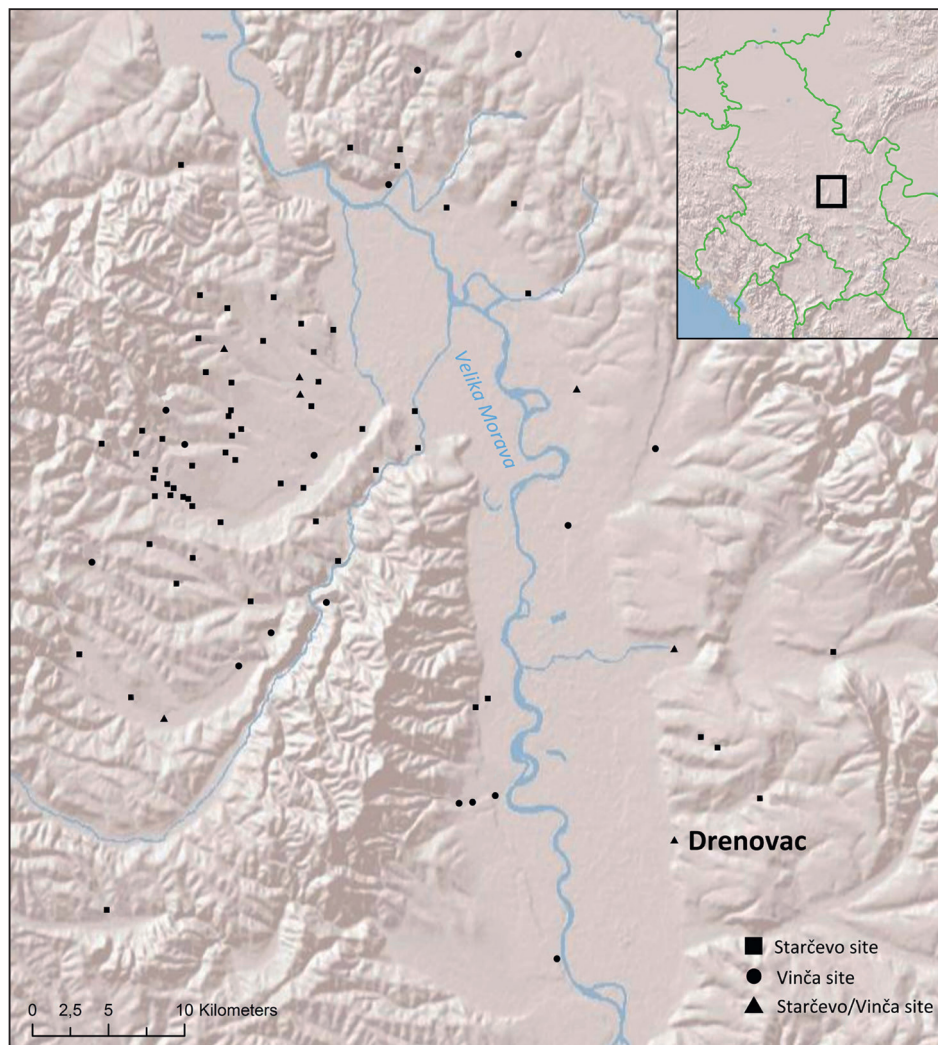


Figure 1. Map of Neolithic sites in the Central Pomoravlje

Morava Valley ²². With the positive results obtained and the favourable conditions for the continuation of the survey, in late autumn 2012 and in January 2013, the geophysical prospection was continued, but only at Drenovac, and this time organised by the *Centre for New Technologies Viminacium*. Until now, the geophysical surveys conducted at Drenovac have covered an area of 30 ha. The results of these surveys have exceeded all expectations in terms of the size of the settlement, the number of registered anomalies indicating structures of various purposes and the organisation of the latest phase of the Late Neolithic – Vinča settlement.

Position of site and research history

The archaeological site of Slatina – Turska česma at Drenovac, near Paraćin, lies on the right bank of the Morava River, about 5 km east of the river (Fig. 2. Satellite image). It is a multilayered site where surface finds of a predominantly Neolithic origin have been noted across an area of 50 to 60 ha. However, in a wider central zone of the site, some surface finds and cuts into the ground from the period of the transition from the Late Bronze Age to the Early Iron Age have also been noted. Furthermore, fragments of Roman brick, likely to be the remains of destroyed Roman



Figure 2. Position of Drenovac in relation to the Morava river

graves, have been found in the south-western section of the site, while thin layers holding shards of medieval pottery have been noted on the slope of the south-eastern section of the site.

In a wider geographical sense, Drenovac belongs to the Middle Morava Valley, the area where more than eighty Neolithic settlements have been noted. The site is located in the contact zone between the river valley and the uplands. The majority of it lies at the eastern periphery of the Morava valley, while a small part (the north-eastern and south-eastern periphery) stretches over the mild slopes on the left and right banks of the dried stream bed of the Drenovački potok (Drenovac Creek). The Belgrade – Niš Highway splits the site along its north-south axis³.

The remnants of a Neolithic settlement at Drenovac were discovered in 1966, during a systematic reconnaissance initiated by the Regional Museum in Jagodina. The first extensive investigations were made between 1968 and 1973 as part of a joint project of the Regional Museum in Jagodina and the National Museum in Belgrade⁴. The excavation was conducted in five campaigns. In the first two campaigns in 1968 and 1969, only the team of the Regional Museum conducted excavations. In the first campaign, trenches I, II and III were investigated and the excavation of trench IV began. In the second campaign, along with the completion of the excavation of trench IV, trench V was explored. In 1970, two teams were engaged: the team of the Regional Museum excavated trench VI and started the excavation of trench IX, while the team of the National Museum excavated trenches VII and VIII. In the fourth campaign in 1971, the team of the Regional Museum completed the excavation of trench IX, while the team of the National Museum excavated trenches X, XI and XII. In the following year in 1972, the work was suspended, to be renewed in 1973, when only the team of the National Museum participated in the fifth campaign and excavated trenches XIII and XIV. As can be seen, in the stated period, 14 trenches of different measurements with a total area of 290 m² were explored. The material from trenches I–VI and IX is

3 Perić 2004, 20, Map. No 2.

4 S. Vetnić of the Regional Museum in Jagodina and D. Krstić of the National Museum in Belgrade were leading the excavation.

stored in the Regional Museum in Jagodina and the material from trenches VII, VIII, and X–XIV in the National Museum in Belgrade.

On the basis of the results of those investigations, S. Vetnić concluded that the Neolithic settlement stretched across an area of approximately 10 ha, with the unequal thickness of the cultural layer varying between 2 m to 5.5 m, and that, within the noted cultural layers, two main cultural periods could be distinguished: the Starčevo period, which was confirmed across the whole excavated area by a layer 0.30 m to 0.60 m thick in sector II, and barely 0.30 m in sector I, and the Vinča period, to which the layers above those levels belonged⁵. In the same paper, he pointed to the layer of dark brown soil between the light brown Starčevo layer and the Vinča layer of the same kind, arguing that there was no continuity between the Starčevo settlement and the Vinča settlement⁶. In his later works, Vetnić developed a periodisation of the Starčevo settlement at Drenovac and distinguished six horizons through which the overall development of the Starčevo culture could be followed. However, in the vertical stratigraphy of trench V, he recognised a horizon with the material of the so-called Proto-Vinča phase, thus contradicting his earlier view that there was no continuity between the Starčevo culture and the Vinča culture⁷. As for this and other periodisations proposed by S. Vetnić, we have already expressed our views on this subject⁸.

In 2004, the team of the Archaeological Institute in Belgrade, in cooperation with the Regional Museum in Paraćin, began a revisory excavation and then a systematic excavation at the site of Drenovac, led by S. Perić⁹, within the framework of the project *Permanent Archaeological Workshop – Middle Morava Valley in Neolitisation of South-Eastern Europe*. The results of the excavations conducted from 2004 to 2018 have revealed that, in the posited central part of the site, the cultural layer is about 6.5 m thick, and that two cultural strata can be distinguished in the vertical stratigraphy.¹⁰ The earlier stratum, with one level of semi-subterranean dwelling structures, belongs to the Early Neolithic Starčevo settlement, while the later stratum belongs to the Late Neolithic Vinča settlement, with at least four levels of dwelling structures. At the sections of the Neolithic settlements that have been explored so far, these strata were separated by a distinctive layer of unequal thickness with sporadic finds, which justifies the conclusion that there may have been a chronological hiatus between the Starčevo settlement and the Vinča settlement¹¹.

In parallel with these excavations, the geophysical survey of a section of the site covering an area of 106.246 m² was conducted at Drenovac in 2008 and between 2010 and 2012, in cooperation with the Romano-Germanic Commission (RGC) of the German Archaeological Institute (DAI)¹². The results of the survey have shown that the eastern boundary of the Neolithic settlement lies 100 m east of the previously supposed boundary. In addition, the settlement has turned out to have a fairly regular pattern of organisation, with houses built in parallel rows with a uniform distance between them, a regular orientation and a uniform size. Based on the results of the geophysical surveys, the Neolithic site is assumed to have covered an area of about 30 ha¹³. With regard to these results and the fact that, due to the existing agricultural crops, many land plots were unavailable for geophysical survey, which rendered the defining of specific spatial units impossible, and given the need for defining the western boundaries of the settlement, the decision was made that the geophysical survey should be continued in 2012 and 2013.

5 Vetnić 1974, 123–168.

6 Vetnić 1974, 125.

7 Vetnić 1985; 1986; 1988, 75–96; 1990, 91–97.

8 Perić 2004; 2009.

9 Perić 2004; 2009; Perić et al. 2013.

10 Perić 2009.

11 Perić 2009.

12 Perić et al. 2016.

13 Perić et al. 2016, 14–18.

Geophysical Surveys in 2012 and 2013

Geophysical surveying continued in cooperation with the *Viminacium Centre for New Technologies*¹⁴. The team of this centre, led by V. Miletić, surveyed 20.1 ha of the site, applying the geomagnetic method¹⁵, which enabled an efficient and precise coverage of the terrain.

The new geophysical survey at the site at Drenovac was carried out in two phases. Two different manometers-gradiometers were used for the prospection. The results of the prospection are shown in the same map as the anomalies of the vertical gradient of the magnetic field. The geophysical equipment used for the survey included:

- magnetometer-gradiometer GSM19gw (Canadian made)
- magnetometer-gradiometer FGM650B (German made)

With the previous archaeological research and the available data (the type of archaeological structures to be expected at these locations) in mind, an advantage in the geophysical prospection was seen with the geomagnetic method, mostly due to the expected contrast in the magnetic features of the presumably present structures and their surroundings. The earlier archaeological excavations, as well as the reconnaissance, have confirmed the existence of a Neolithic settlement. It is well known that such remains, due to the presence of remnant magnetism, may be the source of relatively strong magnetic anomalies, which can be easily recognised in the results of geomagnetic prospection.

The methodology of the geophysical survey at the site of Drenovac, carried out in 2012 and 2013 by means of the magnetometre-gradiometre GSM19gw, employed a geomagnetic prospection along the profiles at a distance of 1 m from each other. The profiles were grouped in square survey grids generally measuring 20 m by 20 m, which were geodetically positioned at specific locations, so to ensure that the obtained results could be precisely located. Data sampling along the profiles was done in walking mode, with the sample density set at every 0.5 sec.

The results of the geomagnetic surveys are shown in the map of the anomalies of the vertical gradient of the magnetic field and combined with the results of the earlier conducted magnetic prospection (Fig. 3). Shades of grey between white and black are used for the display. Each shade in the specific palette matches the value of the magnetic field gradient. In this way, the zones with anomalous gradient values, i.e. the locations with the potential presence of archaeological remains of material culture, can be clearly observed. In such a display, white represents the lowest values of the vertical gradient of the magnetic field, black reflects the highest values, while the various shades of grey correspond to the medium values (homogenous environment). In terms of the requirements relating to the archaeological interpretations of the surveyed area, the extreme values or the anomalies of the geomagnetic field gradient are of paramount interest.

A range of gradients limited to +/- 8 nT was used to display the results in order to emphasise the registered anomalies. Normally, these anomalies occur in the field within a range from -30 nT to +52 nT. These values can be considered relatively high, thus indicating with certainty the possible presence of archaeological remains. Previous experience from similar archaeological sites directs attention to all those values higher than +/- 3 nT. Since these values go beyond +/- 20 nT, archaeological features or material remains associated with prolonged human occupation of the area must be expected.

Results of geophysical surveys

The registered and processed data from 30 ha of the total surveyed area of the archaeological site at Drenovac suggests that the intensity and distribution of the obtained magnetic anomalies may indicate the existence of a Neolithic settlement with a relatively regular pattern of distribution of

14 The geophysical survey was financed by the Ministry of Culture and Information of the Republic of Serbia.

15 In this paper, we will discuss the results of the survey carried out in 2012 and 2013, while taking into account the results obtained in the period between 2008 and 2011.



Figure 3. Results of geomagnetic prospection – Archaeological site of Drenovac

houses and other structures. High values of the vertical gradient of the magnetic field at specific locations indicate that the houses/structures were, at a certain period of time, exposed to fire. Doubtless, such conditions favour the application of the geomagnetic method as the difference in the magnetic features of the structure and the surrounding soil increases and the possibility to detect an underground structure rises. It is also the case of hearths or ovens for different purposes, which are to be expected at the locations with the extreme values of the magnetic field gradient.

Based on the analysis of the geomagnetic prospection conducted in 2012 and 2013, some 415 anomalous zones were registered, with the gradient values most probably corresponding to the remains of Neolithic material culture. The anomalies measuring from 8 m x 5 m and 12 m x 5 m up to 12 m x 8 m are distinguishable by their shape, and their layouts and positions correspond to houses (Fig. 4). At least three structures with base dimensions of 16 m x 5.5 m have been registered so far.

Although the survey did not cover the whole area of the site, it is apparent that there is no uniform pattern of distribution, dimension or shape of the anomalies. In some sections of the site, the regularity in shape, dimension, orientation and distance between the anomalies is clearly pronounced, while in other zones the distribution of anomalies is uneven, so that the zones with a remarkably regular organisation can be distinguished from the zones where a completely different organisation of space is applied. In the north-western central section of the site, where the terrain is relatively flat, the houses are aligned in rows and with a general southwest-northeast orientation. In other sections of the site, the orientation of houses largely depends on the terrain features.

In the zones with a regular organisation, the regularity is reflected in the dense parallel rows of houses. The distance between the adjacent houses is small – from two to six metres. On the other hand, in some places the space between the rows extends from five to ten metres, being organised in such a way as to allow normal communication and, perhaps, some other activities. Such a disposition of structures raises issues of the settlement's internal organisation, the way the

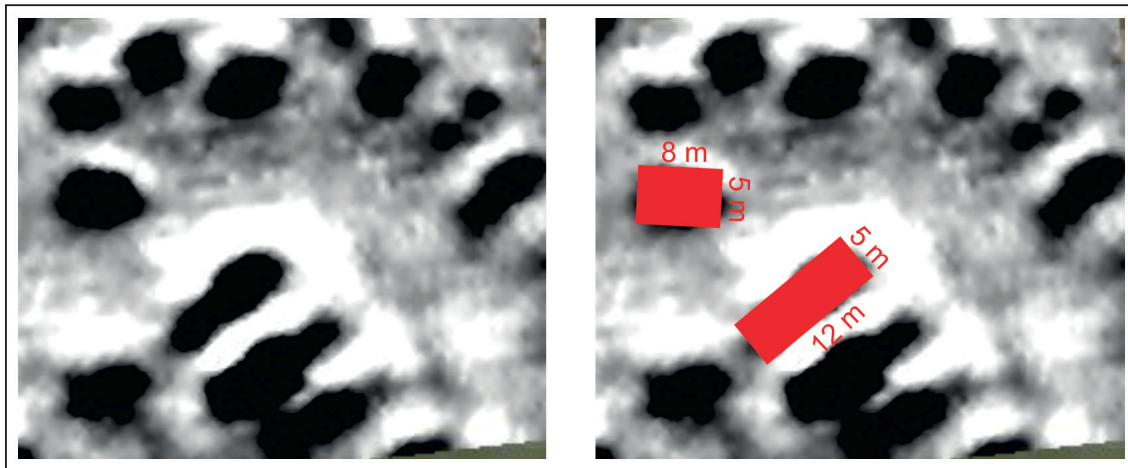


Figure 4. Shape and dimension of anomalies

basic economic activities were organised, the social structure and the organisation of households and family relationships.

In a few peripheral zones of the settlement, there is no regularity in the disposition, shape or size of the structures. This irregularity may have resulted from the different purpose of the specific sections of the settlement and the structures or their chronological position, or even from the accommodation of the terrain features.

In addition, a number of zones assumed to have been open spaces were registered. In some of them, no anomalies were recorded during the geomagnetic surveys, while anomalies with a weak signal were noted in some others, allowing for the assumption that they represented the reflection of deeper structures. Without a targeted survey of such areas within the site, we can only assume what their function might have been and speculate as to whether these sections were reserved for common activities or the activities of specific individuals, or were allocated to individuals with special status.

In addition to the detection of the position of the archaeological features, the survey at Drenovac helped to define the western boundary of the settlement, which is clearly visible on the map of the magnetic field gradient (Fig. 5). In the western part of the archaeological site an area with a great number of houses and other structures can be distinguished from the area which is void of these features. Between these two areas, a linear anomaly can be seen, its values reaching about $\pm 6\text{ nT}$, which is likely to have been caused by the existence of a ditch or some other barriers marking the boundaries of the settlement.

Two more anomalies indicating the existence of ditches have been noted in the geomagnetic picture. The geomagnetic picture shows two anomalies inside the settlement that presumably represent the ends of another arc-shaped ditch extending in parallel with the external western ditch, but with a significantly smaller diameter. The existence of a smaller ditch enclosing a small section of the settlement is hypothesised (Fig. 5) on the basis of the arc-shaped anomaly in the northeastern part of the settlement.

As the area inside the settlement has not been fully covered by geomagnetic prospection, and without archaeological excavations, it is difficult to talk about possible communications, their disposition or significance.

Testing geophysical survey by archaeological excavation

With the geomagnetic prospection completed, the results were tested by archaeological excavations. Three micro-locations were selected for excavation. The first location was in the central part of the site, where wide excavation was planned for the investigation of a number of the anomalies

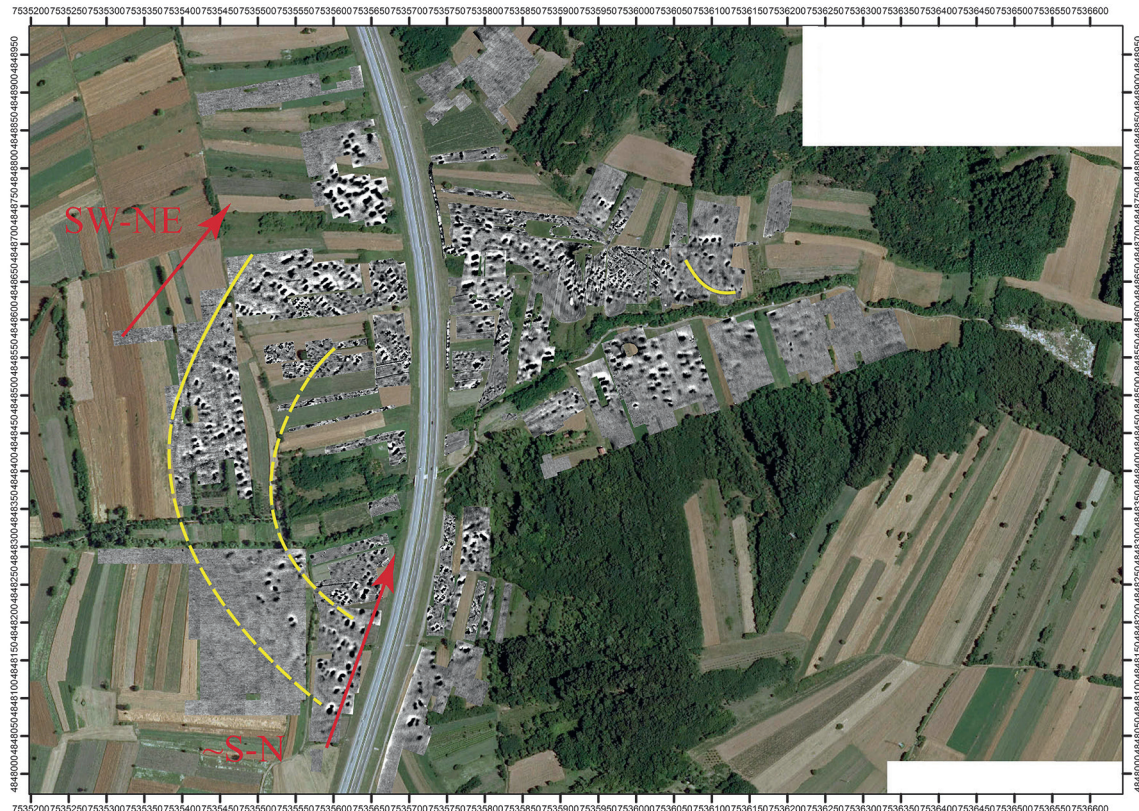


Figure 5. Lines of anomalies of potential boundary ditch and ditches inside the settlement

with very high values of the geomagnetic gradient, which we assumed represent Vinča houses. At the other two locations, along the western edge and the eastern periphery of the site, a trench excavation was planned for the investigation of the two arc-shaped anomalies, which we assumed to reflect the existence of ditches.

The aim of the excavation at the first micro-location was to investigate a number of Vinča houses as a whole and to gain an insight into the space between them. This micro-location had been selected as a potential unit for the *in situ* presentation of the remains of the Neolithic settlement. For the purpose of the presentation, a protective construction measuring 40 m by 30 m was planned to be erected above three features/houses. However, the location of the protective construction was determined by the conditions set by the *Public Enterprise "Roads of Serbia" regarding* the minimum distance of the construction from the highway. The first draft proposal offered a protective construction which would comprise two bigger anomalies of a relatively regular rectangular shape and one smaller anomaly of the same rectangular shape. In that case, the foundation of the protective construction would have cut across two features of a rectangular shape with very high values of the anomalies (Fig. 6). With this in mind, two trenches, XIX and XX, were opened in 2013 (Fig. 7) to facilitate the examination of the two features assumed to be the remains of houses.

The excavation in trench XIX uncovered extremely well-preserved burned clay rubble of a house measuring 12 m by 5 m, which had consisted of three rooms. Trench XX encompassed a complete large dwelling structure, constructed in an almost identical manner to the one in trench XIX, but poorly preserved. Inside trench XX, the western half of another feature, appearing in the geomagnetic picture as a regular circular anomaly, was also investigated. At present, we cannot assert its function with any certainty. We can only assume, on the basis of the inventory, that it may have been a small size auxiliary structure.

The degree of preservation of the feature from trench XIX was a sufficient argument to concur with the *PE "Roads of Serbia"* regarding the correction of the location for the protective construction so that it should now cover a group of three clearly distinguishable anomalies of the gradient of the magnetic field which were correctly assumed to correspond with Neolithic houses. The values of these anomalies ranged from -42 to +73 nT.

During the 2014 campaign, trenches XXI and XXII, encompassing the central and northern anomalies, were excavated in the area stretching immediately adjacent to the northern profile of trench XIX. However, the archaeological excavations from 2014 to 2017 showed that there was another house in the area between the southern anomaly and the central anomaly, i.e. between houses 1 and 3 (Fig. 8).¹⁶ As can be seen, four Neolithic houses were detected at this location, three of them matching, to a great extent, the distinguishable anomalies of the gradient of the magnetic

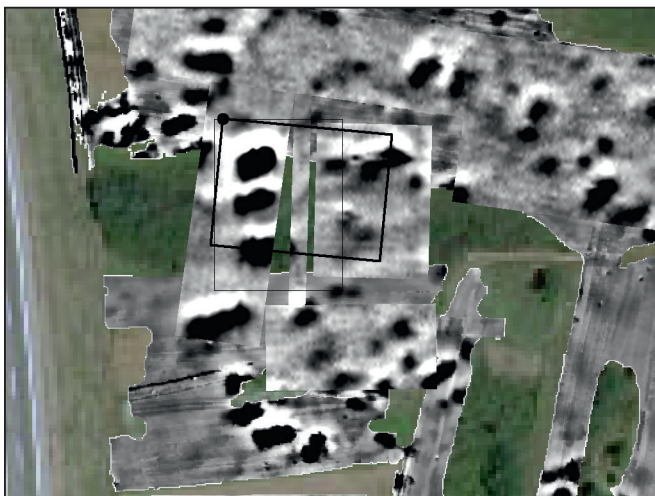


Figure 6.
*The first proposal for the position
of the protective construction*



Figure 7. Position of trenches

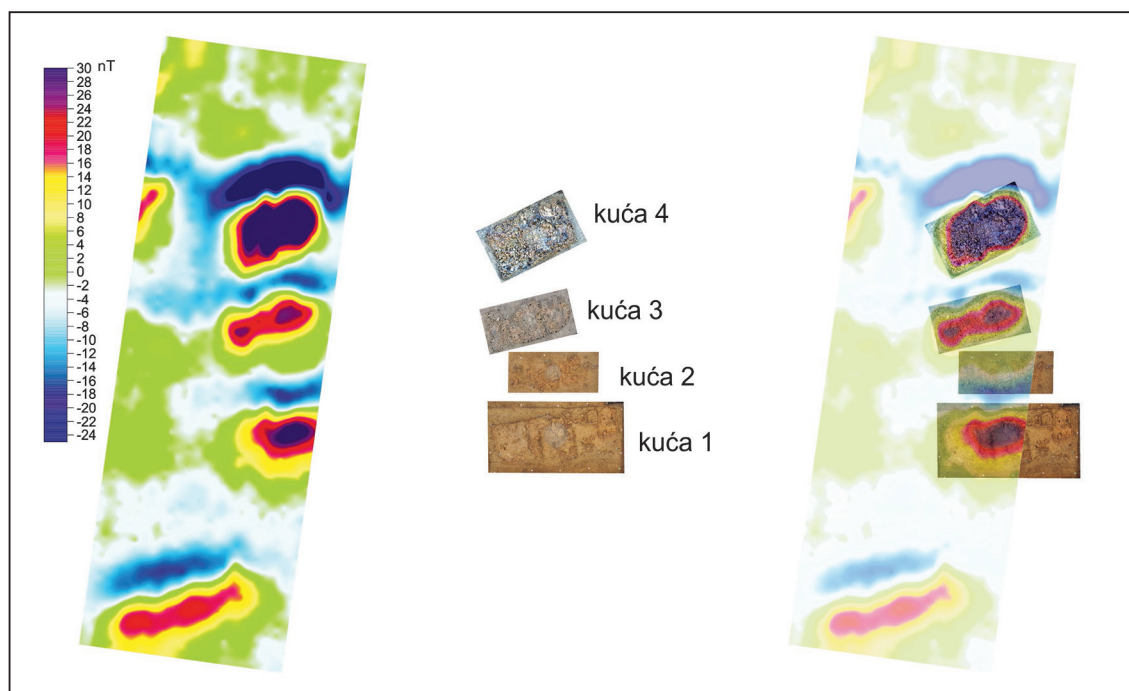


Figure 8. Comparing results of geomagnetic prospection and archaeological excavations. Relationship between the excavated houses and the recorded anomalies

field (houses 1, 3 and 4 in Figs. 8 and 9). Large quantities of daub and other materials causing high values of the magnetic field were noted in these three houses. The fourth detected house (house no. 2 in Figs. 8 and 9) lay in close proximity to house no. 3 (with very high values of the gradient) and contained much less daub compared to the other houses. Thus, due to the vicinity of house 3 and the significantly lower values of the magnetic field gradient, house no. 2 was difficult to detect and the anomaly caused by this house was, to a large extent, covered by the considerably stronger anomalies of the adjacent houses. This example shows that the number of registered anomalies does not automatically match the exact number of the archaeological structures and it is only by conducting archaeological excavation that we can determine the accurate number of immovable structures at specific parts of the settlement.

At the second micro-location, trench XXIII was excavated to test the anomaly in the eastern part of the site, the shape of which indicated the existence of a short arc-shaped ditch. The trench, with dimensions of 12 m x 2 m, was oriented to cut across the registered anomaly at a right angle (Fig. 10). Even under the humus layer at the depth of 30 cm to 40 cm, the hypothesis that the above mentioned anomaly reflected a ditch proved to be correct. The width of the ditch at the level of digging was about 6 m, while the bottom of the ditch was at about 1.80 m below the surface. Taking into account that the level from which the ditch had been dug was immediately below the humus layer, at a depth of 30 cm, and considering the characteristics of the finds at that level, the ditch must have been created during the latest phase of the Vinča settlement and its purpose was to set the boundaries for an area holding a few small structures. What is unusual about this ditch is that it opened to the periphery of the settlement (Figs. 3 and 5).

16 It should be noted that the house from trench XX and three out of the four houses from trenches XIX, XXI and XXII were two-storey buildings, Perić 2017; Perić et al. 2014; Perić, S., Bajčev, O., *Interiors of Neolithic Houses at Drenovac*, in press.

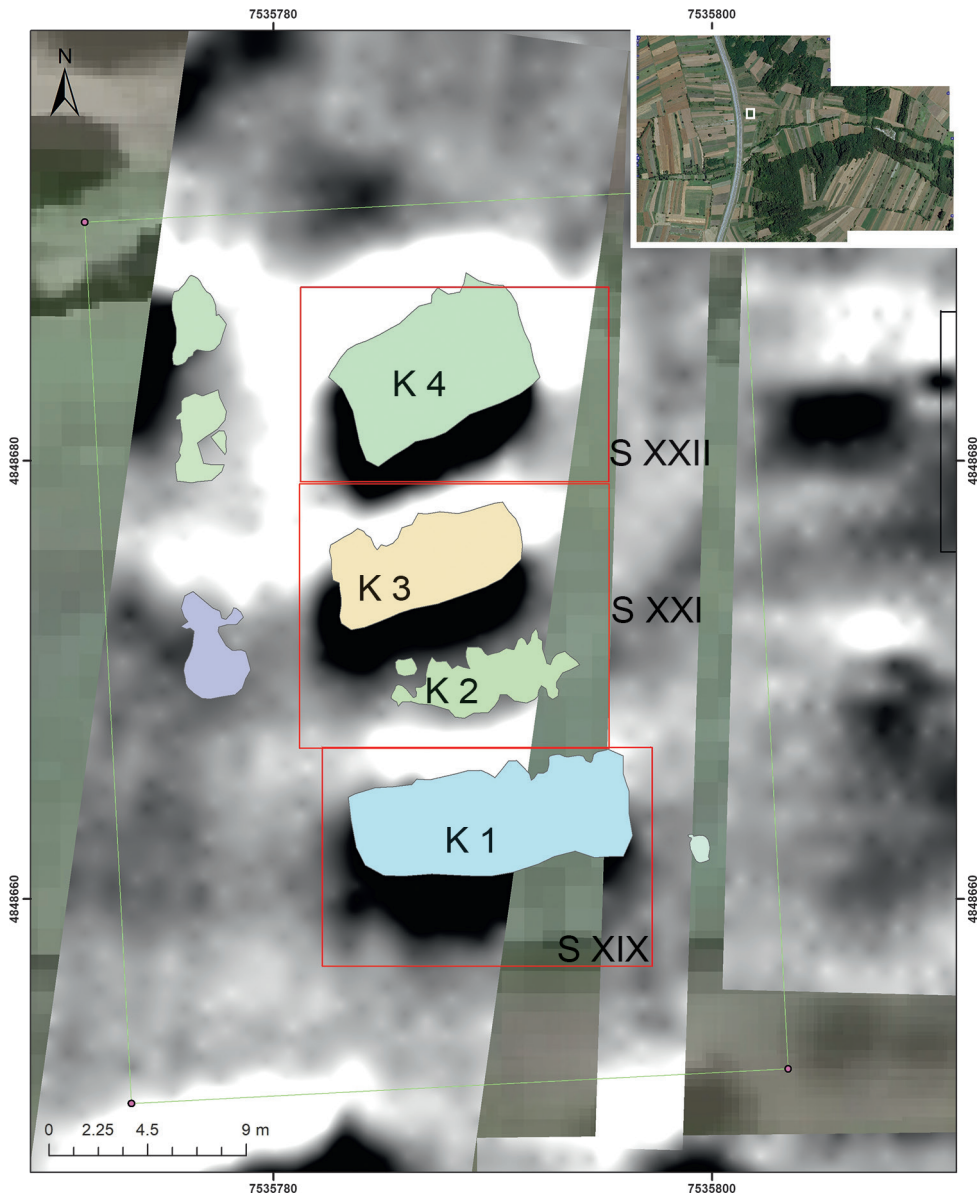


Figure 9. Position of excavated houses in relation to the anomalies

The ditch was filled with a compact layer of dark soil with rare finds of late Vinča pottery, which could prompt the conclusion that the ditch was deliberately backfilled over a short period of time when the Vinča settlement was in existence. However, the results of more recent geological analyses have shown that the backfill of the ditch consisted of a layer created by the erosion of deposits from the surrounding terrain¹⁷.

At the third micro-location, at the western periphery of the settlement, trench XXIV was excavated. This trench was used to test a linear anomaly, assumed to have been caused by the existence of the ditch or some other barrier enclosing the settlement from the west side (Figs. 3 and 5). Although the registered anomaly was, in some spots, very distinct, we could not check its character at those locations, but we excavated the trench on a previously purchased plot of land

17 See the paper by French et al. in this publication.

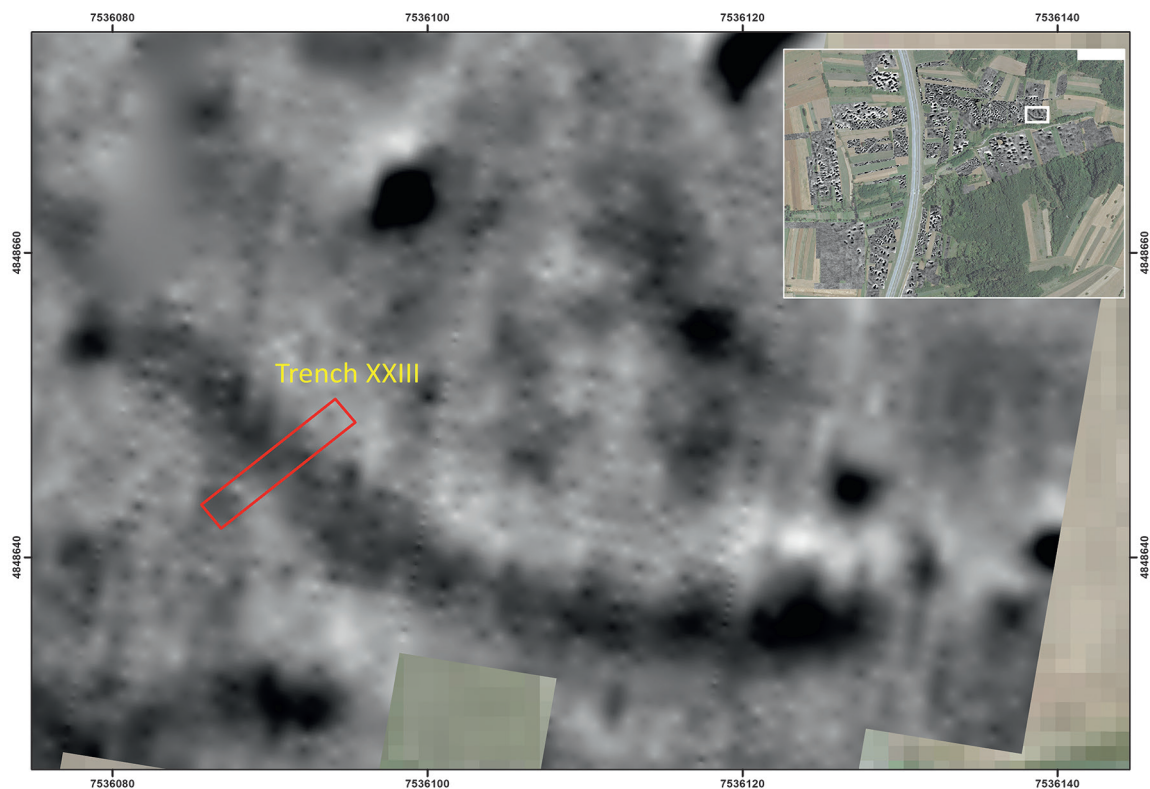


Figure 10. Trench XXIII

instead. The anomaly was the least distinct there, but its direction and contour were, nevertheless, discernible (Fig. 11). Trench XXIV was excavated at this location in 2017. The trench measured 15 m x 2 m and was oriented vertically in the direction of the anomaly.

The results of the excavations showed that the humus layer reached down from 60 cm to 85 cm and was much thicker in this section than at the eastern periphery of the settlement. Under the humus layer, at the south-eastern and north-western section of the trench, a 60 cm thick Neolithic cultural layer was noted, offering architectural remains in the form of a high concentration of daub, while in the central part of the trench, where the boundary ditch was expected, a uniform cultural layer holding finds from the late Vinča phase was noted instead. It is important to point out that at the assumed level of digging of the ditch the remnants of Neolithic architecture were noted on both sides of the anomaly, i.e. the assumed line along which the boundary ditch extended. This fact, *per se*, leads to the assumption that it was the level from where the ditch may have been dug and that remains of the Vinča house had been cut by the digging of the ditch. At the same time, as both surfaces with daub and pottery entered the profile of the trench, and the line separating it from the compact layer inside the trench was not even, we cannot be sure as to whether the surfaces with daub and pottery represent burned clay rubble debris of one or two structures, and whether the Vinča house was cut by the digging of the ditch or the central part of the trench was the space between two houses. If we accept the first variant, it would mean that the house was longer than 15 m and that by digging the ditch the western boundary of the settlement was moved to the east.

However, neither on the base nor in the profile under the layer with rubble, could any traces of digging or ditch contour be observed. In both parts of the trench, a compact cultural layer, 70 cm to 80 cm thick, with sporadic finds of Neolithic pottery, was noted below the layer with rubble. The lower level of this cultural layer gradually merged with the yellow clay subsoil.

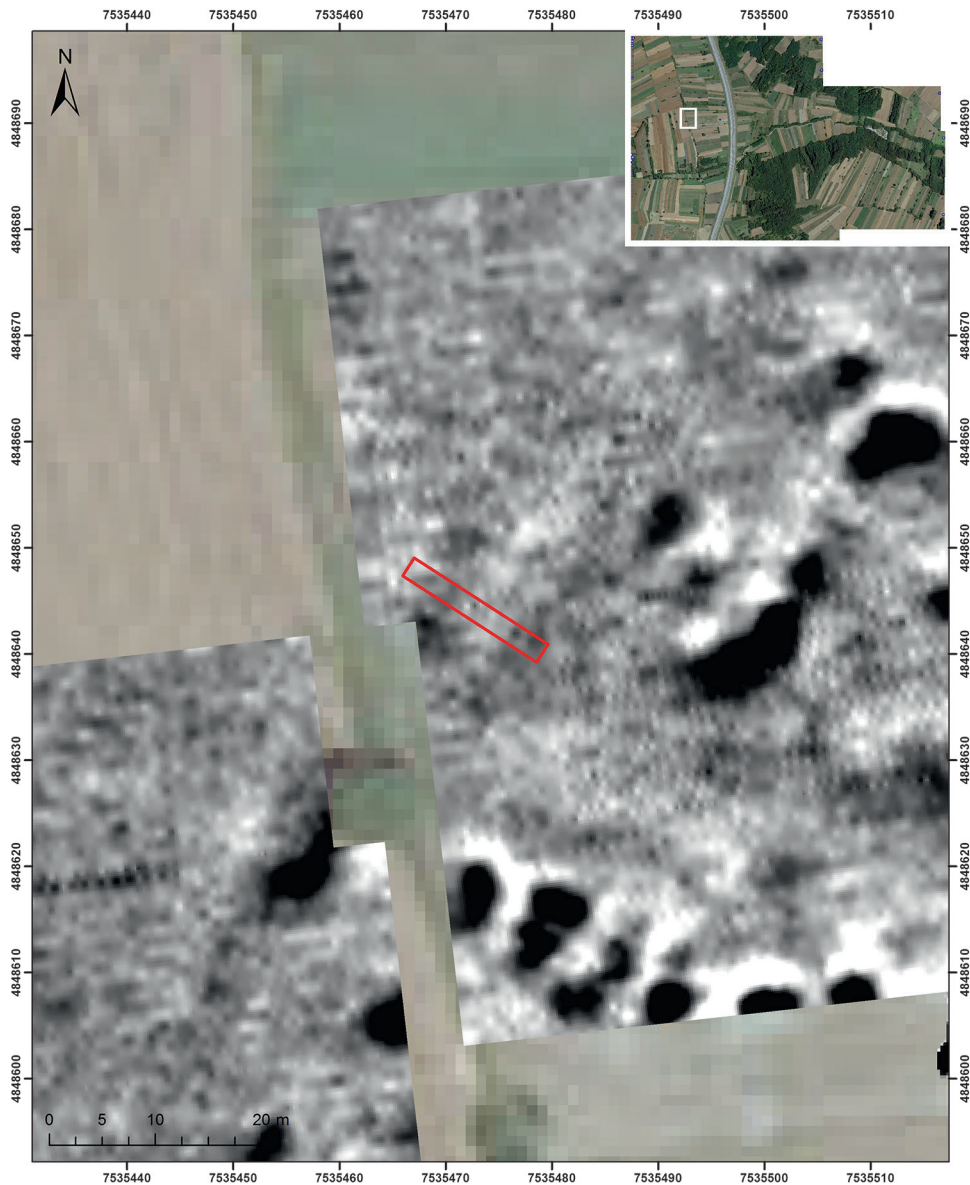


Figure 11. Trench XXIV

However, in the central part of the trench, a surface with pebbles and pottery fragments was noted. To a great extent, it coincided with the section where there were no architectural remains in the preceding layer and with the width and direction of the anomaly. It is very likely that this surface may have been registered during the geophysical surveys but, due to the depth at which it lay, the registered anomaly was less distinct. As this was a thin layer of pebbles and pottery fragments forming a sort of pavement, its function in the settlement remains unclear. Nevertheless, the situation at the longitudinal profiles under the surface, where a certain difference in the layer composition is discernible from the rest of the profile, leaves open the possibility that this layer actually covered the upper level of the ditch. If this is the case, and it is associated with the ditch, then its function must have halted before the construction of the latest level of the Vinča houses at Drenovac. Otherwise, there is the possibility that, in a specific phase of the Vinča settlement, this layer was used as a kind of a communication route across the settlement. What it really was of all the possibilities we have proposed will be revealed through new excavations in the areas where



Figure 12. The position of trench XV in relation to the registered anomaly

the anomaly was more distinct. In any case, this situation provides us with yet another example of the organisational complexity of the settlement, affirming once again that the results of prospection and the interpretations that follow them should, in the end, be verified by archaeological excavations.

Finally, we should also mention the situation in trench XV, which was excavated between 2004 and 2006, i.e. before the geophysical survey. In the south-eastern half of this trench, remains of the house, consisting of a concentration of daub and secondarily burnt pottery, were identified. During the geophysical survey, the lot where trench XV had been located was also surveyed. The geomagnetic picture clearly displays the contours of the trench as a white square (the negative value of the gradient of the magnetic field) encompassing part of a highly distinguishable black rectangular anomaly (Fig. 12). This confirms that the excavations covered a smaller section of a rectangular structure extending in a northeast–southwest direction.

Conclusion

As demonstrated in the preceding text, the results of the geophysical survey, especially the concentration and shape of the anomalies, provide the basis for a realistic determination of the shape and boundaries of the latest occupation level of the Vinča settlement. The settlement appears to have covered an area of approximately 40 ha. However, the archaeological excavations have shown that some features were not detected by the geomagnetic survey, so that the number of the registered anomalies does not reflect the actual number of structures in the settlement.

Besides, at specific sections of the site, where no anomalies were noted by the geophysical surveys, surface finds of Vinča pottery and flint artefacts were noted during the reconnaissance. Given the terrain configuration in those zones of the site, the surface finds could not have been moved there by erosion. When the results of the geophysical surveys and the reconnaissance are combined, a conclusion can be reached that the archaeological site at Drenovac covers a total area of between 50 and 60 hectares.

As the geophysical surveys covered 2/3 of the latest occupation horizon of the Vinča settlement and in the covered section resulted in more than 400 registered anomalies that can be assumed to reflect the contours of structures of varying purposes, it is justified to expect that, in the section of the site that was not covered by the geophysical surveys, especially in the area below the highway alignment that crossed the central part of the site and encompassed 4 ha, there could be at least 200 structures. This means that at this level of the Vinča settlement there may have been between 600 and 700 structures, most of which served a dwelling function. With so many dwelling structures, the question inevitably arises as to size of the population occupying the settlement during the latest phase of the Neolithic settlement. The subsequent archaeological excavations of five houses confirmed that four of them were two-storey buildings, and that one house may have accommodated two or three nuclear families. Thus, although the issues of the household size, the size of population and the population dynamics are very complex, it seems realistic to estimate that the Neolithic settlement at Drenovac, at a certain period, may have comprised more than 2,000 inhabitants.

Finally, we should point out that the geophysical survey has proved yet again to be a vital method in archaeological investigation. It is a method that not only makes the planning of systematic excavations easier but also enables and facilitates the viewing of an archaeological site/settlement as one unit, at least at a specific period of its existence. It also helps to direct our attention to some sections that may have had specific functions or to elements of economic and social life, and to provide data for which, without the geophysical survey, we could otherwise be waiting for decades.

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Резиме

Геофизичка истраживања у Дреновцу 2012. и 2013. године

Након геофизичких снимања неолитског налазишта у Дреновцу, која су у периоду од 2008. до 2012. године реализована у сарадњи са Римско-германском комисијом Немачког археолошког института, геофизичка проспекција је настављена у јесен 2012. године у сарадњи са *Центром за нове технологије Виминацијум*, а под руководством В. Милетића. На основу регистрованих и обрађених података са 30 ha снимљене површине археолошког налазишта у Дреновцу, добијене магнетске аномалије по свом интензитету и распореду указују на неолитско насеље са релативно правилно распоређеним кућама и другим објектима. С обзиром да се на неким локацијама ради о високим вредностима вертикалног градијента магнетског поља, то указује на закључак да су објекти у насељу у неком периоду били изложени термичкој промени, односно спаљивању.

Анализом резултата геомагнетске проспекције издвојено је око 415 аномалијских зона, које на основу вредности градијента највероватније одговарају остацима неолитских објеката. По облику се издвајају аномалије димензија од 8 x 5 m, 12 x 5 до 12 x 8 m, за које се на основу распореда и положаја може тврдити да одговарају основама кућа (Сл. 4). За сада су регистроване најмање три структуре чије су димензије у основи износиле 16 x 5,5 m. На неким деловима налазишта јасно су изражене правилности у облику, димензијама, оријентацији и међусобној удаљености аномалија, док је у другим зонама распоред аномалија неуједначен, тако да се могу издвојити зоне са израженом правилном организацијом и зоне где је примењена потпуно другачија организација простора. Поред неолитских кућа, на геомагнетном снимку регистроване су и три аномалије које указују на постојање ровова.

Након обављене геомагнетске проспекције, археолошким ископавањима извршено је тестирање резултата снимања. Тестирање је обављено на три микро-локације: једно у зони централног дела налазишта, где су констатоване три аномалије са веома високим вредностима геомагнетног градијента и две на лучним аномалијама за које се претпостављало да одражавају присуство ровова. У првом случају отворене су сонде XIX–XXII у којима је истражено пет неолитских кућа. Интересантно је да један од истражених објеката уопште није био регистрован у виду аномалије на геомагнетском снимку. У другом случају истражена је сонда XXIII, која је пресекла лучну аномалију на источном делу налазишта. Овде се показало да се заиста радило о рову, који је био окренут ка периферији насеља. На крају, сондом XXIV, пресечена је аномалија на западној периферији насеља, за коју се претпоставља да је представљала гранични ров. Међутим, резултати ископавања нису потврдили претпоставку да је реч о рову.

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