

# Orheiul Vechi: the results of recent geophysical surveys

Alexandru Popa, Sergiu Musteață

## Abstract

Orheiul Vechi is one of the most attractive cultural sites in the Republic of Moldova and one of the most frequently discussed. The density of sites and the continuity of living in this space has made Orheiul Vechi attractive for the multidisciplinary research since 1946. In the context of preparing the dossier for the inscription of the historic-cultural and natural landscape reserve “Orheiul Vechi” into the World Heritage List, a series of studies have been carried out in the last two decades. Some of these scientific approaches include non-invasive surveys in various areas of the reservation. Thus, in this article, all the results of magnetometric surveys carried out by a Moldovan-Romanian-German team in 2009-2014, have been presented for the first time. The surveys confirmed a number of archaeological situations already known and facilitated new discoveries that should be developed in the coming years.

**Keywords:** Orheiul Vechi, the Republic of Moldova, non-invasive methods, magnetometry.

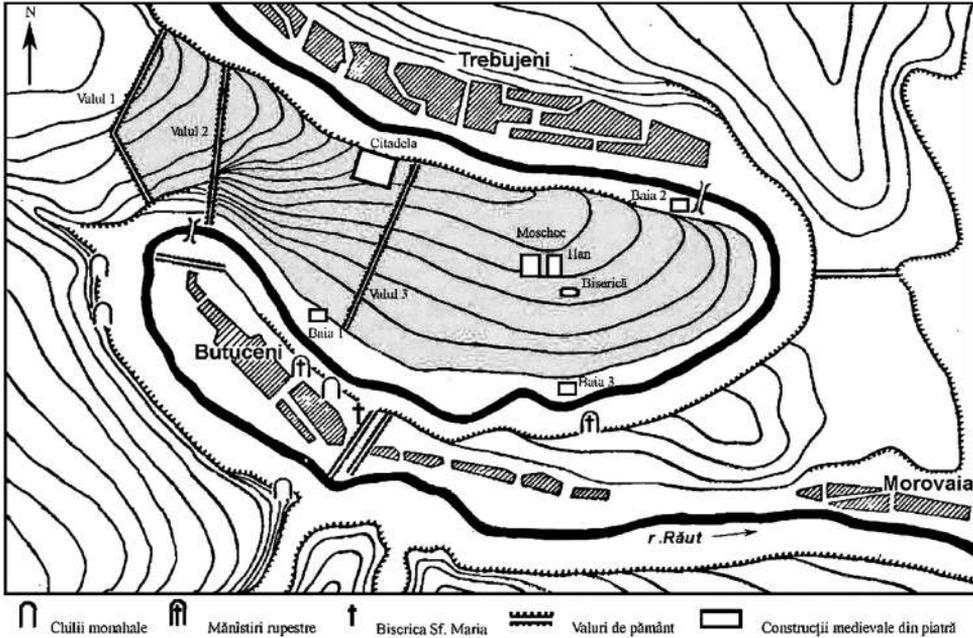
## 1. Introduction

In 2009-2014 the State Pedagogical University “Ion Creangă” of Chisinau, in partnership with the Römisch-Germanische Kommission des Deutschen Archäologischen Instituts, Frankfurt am Main conducted several geophysical surveys at a number of archaeological sites in the Republic of Moldova. One of the points where we would work during several campaigns is the historic-cultural and natural landscape reserve “Orheiul Vechi” (Fig. 1). Through this article, we intend to present briefly the results of these researches<sup>1</sup>.



**Fig. 1.** Orheiul Vechi on the map of the Republic of Moldova.

<sup>1</sup> We would like to thank, on this occasion as well, the scientific coordinator of the researches from Orheiul Vechi, dr. habil.prof. Gheorghe Postică for the support granted on the occasion of the acquisition, analysis and interpretation of the data, coming from the magnetometric researches carried out by us in Orheiul Vechi. Special thanks to Dr. F. Lüth and Dr. U. Voss, the colleagues from RGK, Frankfurt am Main for the sustainable partnership and for the transfer of Know-how in the field of non-invasive research in the Republic of Moldova.



**Fig. 2.** The general plan of the Orheiul Vechi site (after Postică 2006, Fig. 1).

Orheiul Vechi is one of the most important archaeological sites in the Republic of Moldova comprising the traces of human habitation from the Palaeolithic to the present time (Fig. 2). Systematic archaeological research began in 1946 and has continued up to now (Postică 2006, 14-17). The result of archaeological investigations has been the discovery of 26 sites from the Palaeolithic to the modern age, 5 hill fortresses from the ancient period and 2 fortresses from the Middle Ages, 2 medieval cities, 6 cemeteries from the ancient and medieval times, 177 cells in the limestone rocks by the river Raut from the Middle Ages to the modern age (Postică, Boboc, Chirică, Buzilă, Lazu, Corcimari, and Zubcov 2010, 53-57).

## 2. Research method

In our research, we used the method of mapping the vertical gradient of the terrestrial magnetic field. Its use made possible the creation of magnetic maps which represent the interpretation of the archaeological potential of the surface of the land. As a research method in archaeology, magnetometry is based on interpreting the contrast of the values of the magnetic field of the soil surface at a certain point and of the natural magnetic field of the earth. As a result, mag-



netic anomalies can be highlighted, indicating the existence of possible underground structures of natural or human origin. Used in conjunction with other research methods, magnetometry allows for a much more efficient recognition of underground archaeological traces. Unlike many other methods of archaeological research, magnetometry has particular features: its results do not depend significantly on the time of day, season, weather, agrarian cultivation or soil surface condition. Apart from this, the method offers the possibility to discover completely under-earth archaeological structures, at a depth of up to 2 m. Thus, magnetometry in archaeology is a non-destructive research method that does not affect the current surface of the soil by no means.

On the side-lines of our activities from Orheiul Vechi, data acquisition and processing involved the following work stage:

- The general assessment of the land and establishing the areas accessible for evaluation;
- Establishing a general plan for the acquisition of instrumental data;
- Designing and drawing on the ground the measuring perimeters with the help of geodesic equipment;
- Carrying out the acquisition of the magnetometric data sets;
- Topographic data processing and creation of the Project's GIS;
- Processing of geomagnetic data and making maps of variation of vertical gradient of the terrestrial magnetic field;
- Georeferencing and integration of archaeometry data into the Project's GIS;
- Archaeometry and archaeological interpretation of the sets of processed maps;
- Writing the land evaluation report<sup>2</sup>.

In order to map the magnetic anomalies from the site of Orheiul Vechi, we used installations composed of five „Fluxgate/Dr. Förster” vertical coils, set on non-magnetic mobile support. The distance in-between the coils was 0.50 m so that measurements were taken by 2.50 m wide stripes. Counting on movement direction measures were taken at each 0.05 m. Magnetometric coils of this type measure the vertical component of the magnetic field with an error margin of about 0.1-0.5 nT. When using the 5-coils magnetometer, the measurements were made in rectangular perimeters, which were georeferenced using a geodesic GPS. The magnetometric system with 16 coils had the GPS system mounted directly on the magnetometric equipment, fixing in real time the precise coordinates of all measurements. Initially, we worked with a differential correction system, using two GPS receivers paired as a base and a rover.

<sup>2</sup> For a brief description of magnetometric prospecting method, see, for instance, Milsom and Eriksen 2011, 75-84. For examples of good practice in Romania and the Republic of Moldova, see Ștefan 2012).

Subsequently, the real-time corrections from MOLDPOS and ROMPOS were used. In both cases, the work was done with an accuracy of 0.02-0.04 m. The acquired topographic data were stored during the first campaigns in the projection system "WGS 84", later the national projection system of the Republic of Moldova "MOLDREF 99" was used. The data acquired with the help of the magnetometric equipment were interpolated by the algorithm of "bi-linear rectangle" and subsequently compensated by means of the median filter. The results of the data interpolation were represented as gray tones. The small values, corresponding to a lower magnetization of the investigated surface, are represented in lighter shades of colour, the higher ones - by a suitable one in darker tones.

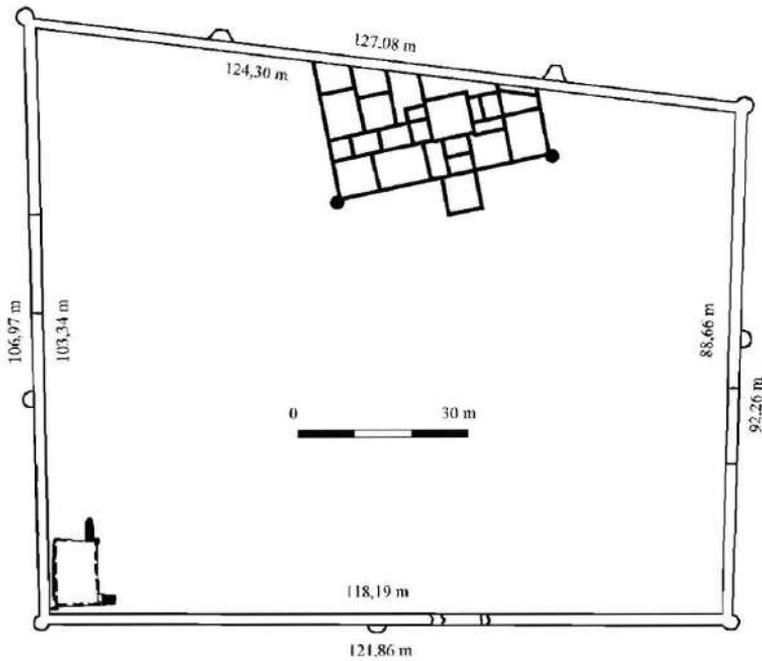
### 3. The Results

#### *Research inside the medieval citadel*

Within the framework of our first magnetometric researches from Orheiul Vechi, conducted in the autumn of 2009, our research was oriented towards the interior of the medieval citadel (Popa, Musteață, Bicbaev, Rassmann, Munteanu, Postică and Sîrbu 2010a, 145-157; Popa, Musteață, Bicbaev, Rassmann, Munteanu, Postică and Sîrbu 2010b, 171-179), considered in the specialized literature as the "central element of the fortress and, respectively, of the city of Orhei itself ..., which represented the headquarters of the local command and control and military administration" (Postică 2006, 41).

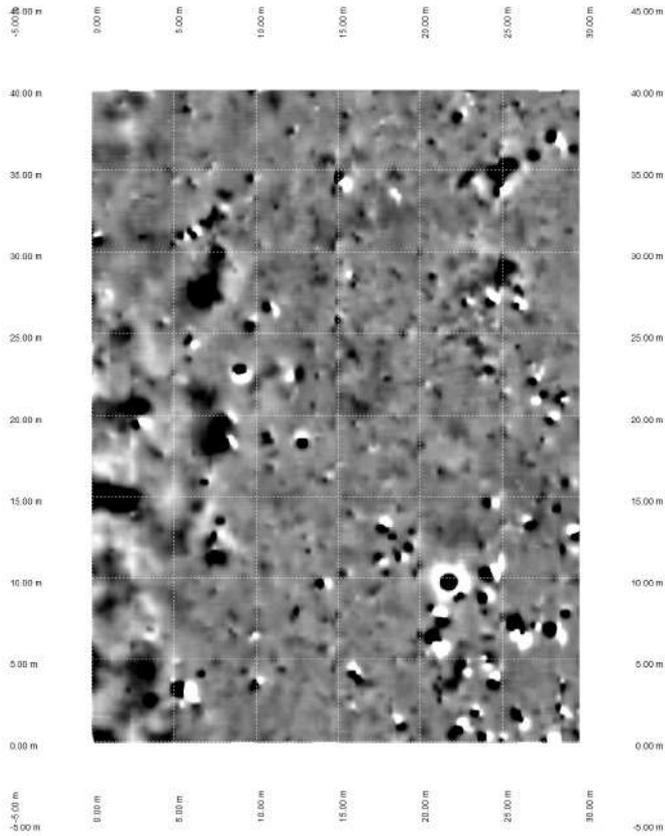
The Orheiul Vechi Citadel is a trapezoidal construction with a single access gate, located on the south side, with the dimensions of about 127 (north) x 92 (east) x 122 (south) x 107 (west) (Fig. 3)<sup>3</sup>. The objective of our research inside this complex was oriented towards identifying some possible archaeological complexes, masonry or other structures hidden within the citadel. In order to reach this objective, a rectangular perimeter with the dimensions of 30x40 m was investigated. Its tracing in the field was conditioned by the accessibility of the land with the magnetometer, mainly due to the terrain slopes and the ruins of the former invasive archaeological research sections, as well as of the works carried out during the reconstruction of the enclosure in 1974-1976 (Postică 2006, 41-43). An attempt was made to approach the southern side of the perimeter of the southern side of the wall of the medieval enclosure.

<sup>3</sup> These dimensions are based on measurements made by Gheorghe Postica in 1998 (Postică 2006, 41, note 2).



**Fig. 3.** The general plan of the Orheiul Vechi stone citadel (after Postică 2006, Fig. 48).

The measurements were made with the five-sensory magnetometer, the distance between the coils of the magnetometer being 25 cm. The result obtained when processing the results indicates a surface with numerous magnetic anomalies (Fig. 4), a part of which denotes the existence of numerous bi-polar anomalies in the ground, probably of some objects with significant magnetic peculiarities. The contours of some structures, marked by anomalies with a significant magnetic amplitude (over  $\pm 25$  nT), are observed on the south side. The identified magnetic anomalies are not grouped together into a single complex but are apparently aligned along the wall of the medieval enclosure (Fig. 5). Due only to the outline of these anomalies we cannot safely deduce the functionality of the signal structures. However, we can suppose that they denote the presence of some archaeological complexes, somehow related to the arrangement of the entrance, documented in the same area of the south side of the enclosure (Postică 2006, fig. 2, 48).



**Fig. 4.** The result of the geomagnetic survey inside the citadel from 2009.



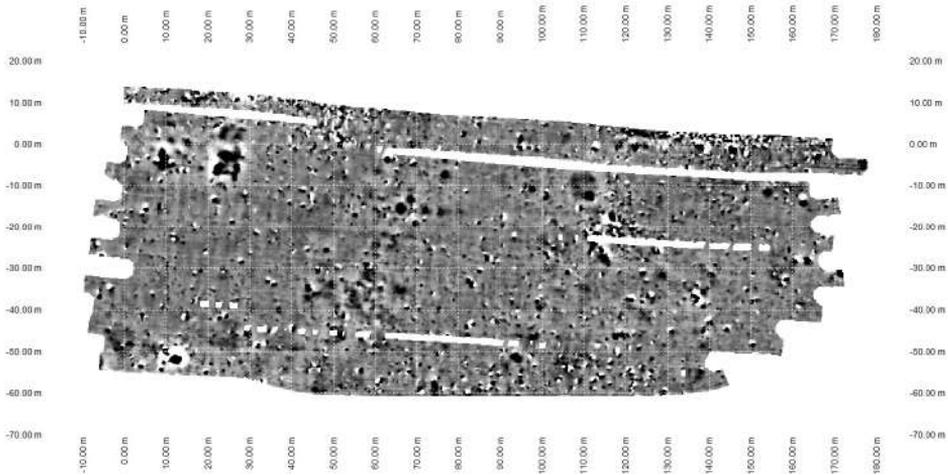
**Fig. 5.** The result of the 2009 geomagnetic survey from inside the citadel overlapped on the orthophotoplan and the plan of the citadel.



**Fig. 6.** The placement of the geomagnetic surveyed area on the north terrace of the medieval city (A), compared to the medieval citadel (B) and the Tatar bath C).

### ***Researches on the Raut terrace between the medieval citadel and the Tatar bath***

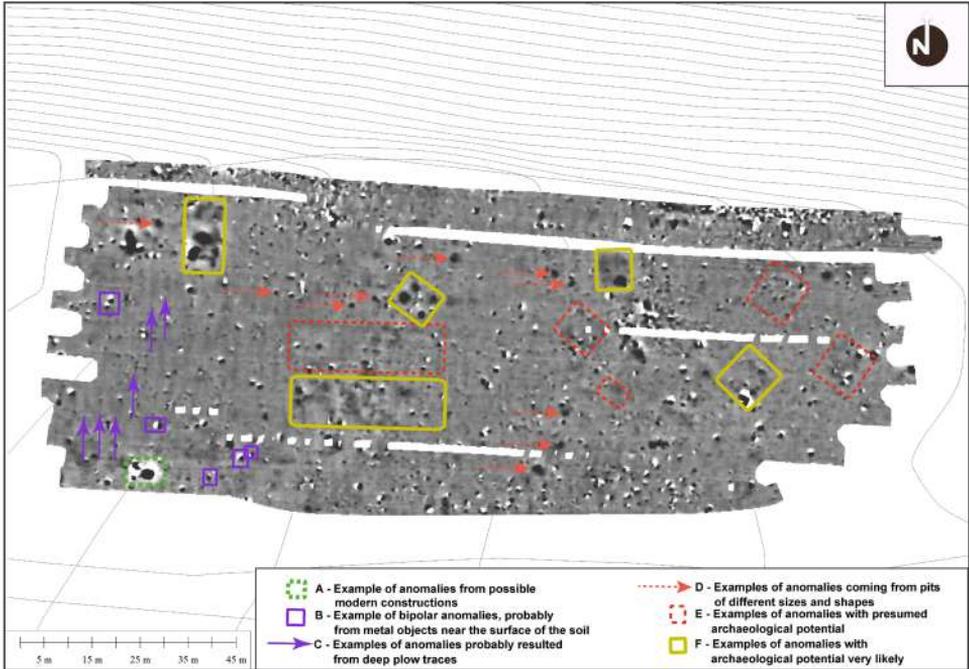
During the 2010 research campaign, our investigations focused on studying an area of the medieval city on the quaternary terrace of the Raut river (Postică Postică et alii, 2010, 18) between the citadel and the Tatar bath. It is an area located to the north of the road to the village of Trebujeni (Fig. 6). The research was carried out with the help of a 16-coils magnetometer, arranged at a distance of 25 cm from each other and the GPS system integrated directly on the self-propelled trolley of the magnetometer. An interval of 20 cm was established in the direction of the movement of the equipment. The research objective represented the identification on a larger scale (compared to the one in the campaign of 2009) of the archaeological potential from the content of the Golden Hoard city and/or of the medieval Moldovan one (Postică 2006, 41). The amplitude with which the investigations can be made with the self-propelled 16-coils magnetometer and the accessibility of the site surface in this area (grassland) are the factors that contributed to the result obtained in the campaign of 2010. In total, an area of about 10,700 s.m. has been investigated, the magnetometric map, processed by interpolation, indicates the presence of anomalies both of archaeological nature and of natural origin (Fig. 7).



**Fig. 7.** The results of the geomagnetic survey from 2010.

The anomalies of non-archaeological nature are elongated in shape, oriented approximately in the north-south direction (Fig. 8. C). In all probability, it is the impact of the depth plow, whose traces can be distinguished in the interpolated image from the measurements with the magnetometer. Apart from these relatively large anomalies, a number of small anomalies known as “metallic bi-poles” (Fig. 8. B) were also found in the investigated area. They are noticeable by their approximately round shape, with halves in opposite colors, i.e. black and white, corresponding to very high and very low magnetic values. These are usually separate objects, arranged at certain depths in the ground. The paleo-archaeological nature of this category of anomalies cannot be determined solely on the basis of measurements of the magnetic gradient of the soil. Most often they are small objects and magnetic properties unintentionally reached on agricultural land during the last 100 years.

Within the investigated area, a series of anomalies of different configurations and dimensions have been discovered and which are noticeable by positive, relatively small values of the vertical gradient of the magnetic field (Fig. 8.E). From experience, we appreciate this type of anomalies as the expression of underground structures, which do not always have archaeological potential. In this case, they could be structures that appeared due to either way of carrying out past agricultural work, or some traces of vegetation burning in the ground, or traces of some rodents’ holes, etc. Nor can the possibility be excluded that they represent traces of human habitation, dating in the same chronological period with the archaeological site, that is, in the medieval period.

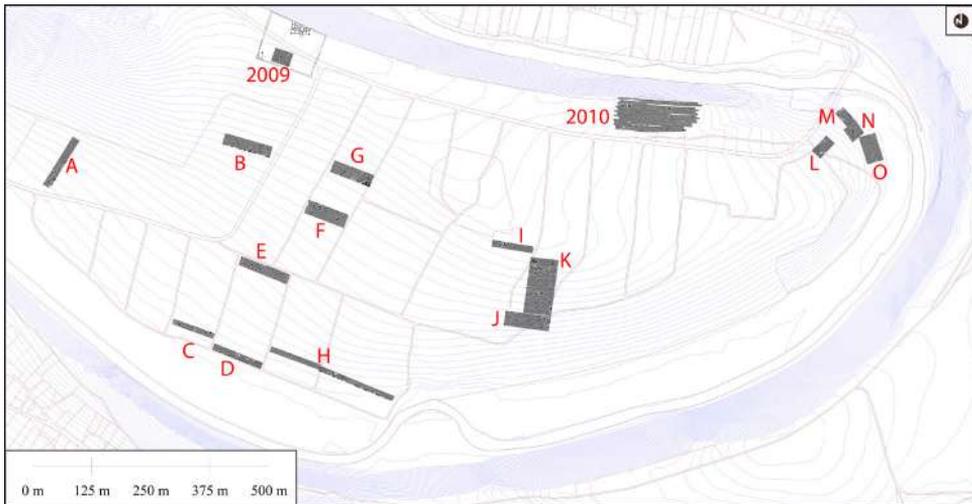


**Fig. 8.** The 2010 results of the geomagnetic survey overlapped on the topographic sketch with level quotas.

Within the framework of our research, apart from these types of anomalies, we have identified several areas with very probable archaeological potential. They are the agglomerations of anomalies delimited by us on the interpretive plan of the research results through the rectangles of yellow color (Fig. 8.F). Along with them, a series of approximately circular anomalies were also distinguished in the magnetometric plan made in 2010, interpreted by us as the traces of some pits with archaeological material (Fig. 8. D).

### ***Magnetometric researches in the context of preparing the dossier for registration of Orheiul Vechi cultural landscape into the List of UNESCO World Heritage***

In the autumn of 2014, our team was entrusted with the magnetometric research of the medieval site of Orheiul Vechi in order to prepare the scientific documentation for the dossier of the inscription of Orheiul Vechi cultural landscape into the UNESCO World Heritage List. The primary objective of that campaign was to document the archaeological potential of representative sequences within the promontory known among the locals as “Peștere” on the



**Fig. 9.** The placement of the surveyed areas in 2014.

surface of which archaeologists had identified not only medieval but also other eras' vestiges.

In order to achieve the objectives of the project, 29 rectangular perimeters were traced and measured. For a brief presentation of the investigation results, the measurement perimeters were grouped into 14 research sectors, noted by us from A to O (Fig. 9). Within the measurements of the 2014 campaign, the same types of magnetic anomalies could be identified as those of the 2009-2010 campaigns, described above: from plow traces and parcels' boundaries to those ones that could show traces of some archaeological complexes. Therefore, we will confine ourselves to reminding the reader that the anomalies able to indicate possible archaeological complexes, following the detailed analysis of the traces discovered and, above all, their interpretation in the archaeological context of different cultural levels and epochs from the promontory "Cave" will remain on the account of the archaeologists responsible for the research in Orheiul Vechi.

Sector A covered an area of  $17.5 \times 120$  m (Fig. 10) and is located in the area where so far, apart from the medieval cultural level, traces of the Iron Age (from the early period and up to the Poienești-Lucașeuca culture) have been identified (Postică and Kavruk 2018, 68-70). Within this perimeter, we point out a number of pits of different shapes and sizes, but especially a possible rectangular structure with the dimensions of about  $7 \times 5$  m. We refer to the contour with negative values, next to which there is a strong anomaly in the middle and two or three smaller ones - probably it could have been a rectangular construction

with a fire pit and some pits from support pillars (Fig. 10).

Sector B covered an area of 104×24.5 m. Magnetic anomalies corresponding to pits of different shapes and sizes were discovered on it (Fig. 11); also, a series of approximately rectangular anomalies with the dimensions of about 5-6×3-4 m, with relatively weak magnetic values were recorded there and whose interpretation as traces of archaeological complexes would be very tempting, but also very uncertain. The southern limit of the sector is marked by a series of strong anomalies that come from a parcel boundary.

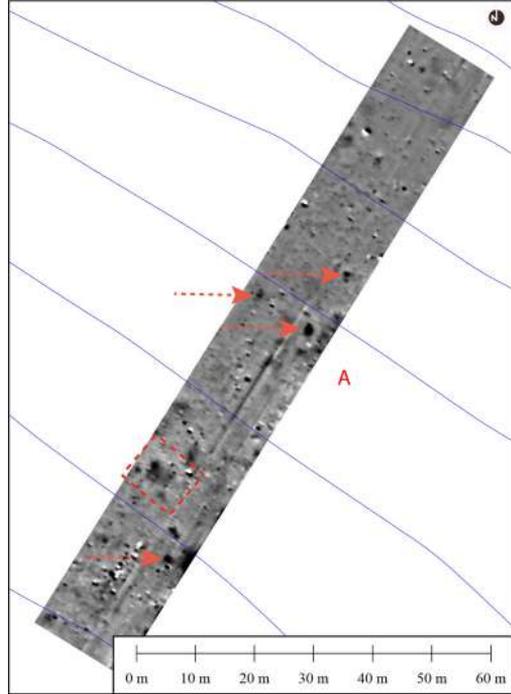


Fig. 10. The survey results of area A.

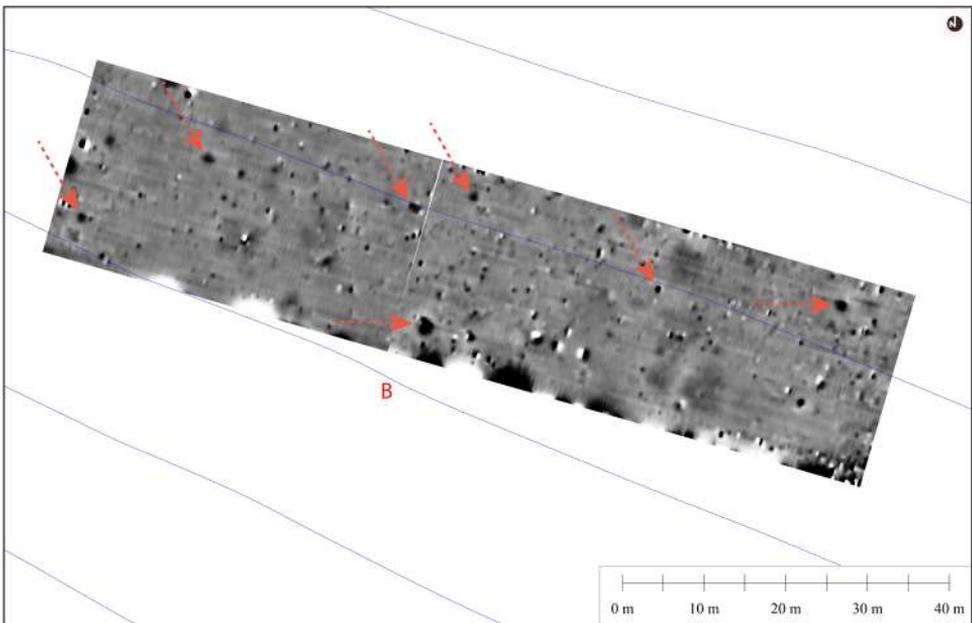
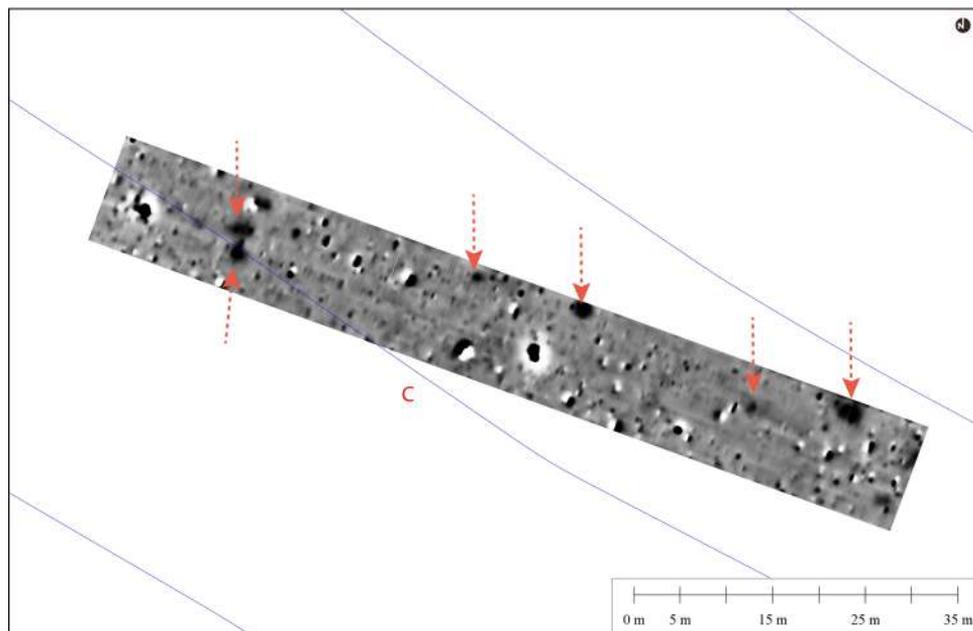


Fig. 11. The survey results of area B.

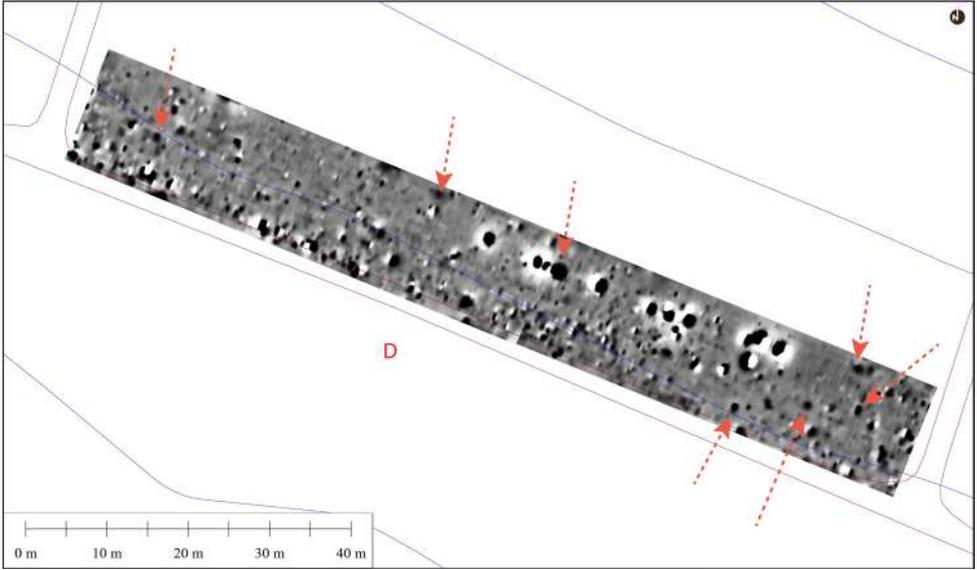


**Fig. 12.** The survey results of area C.

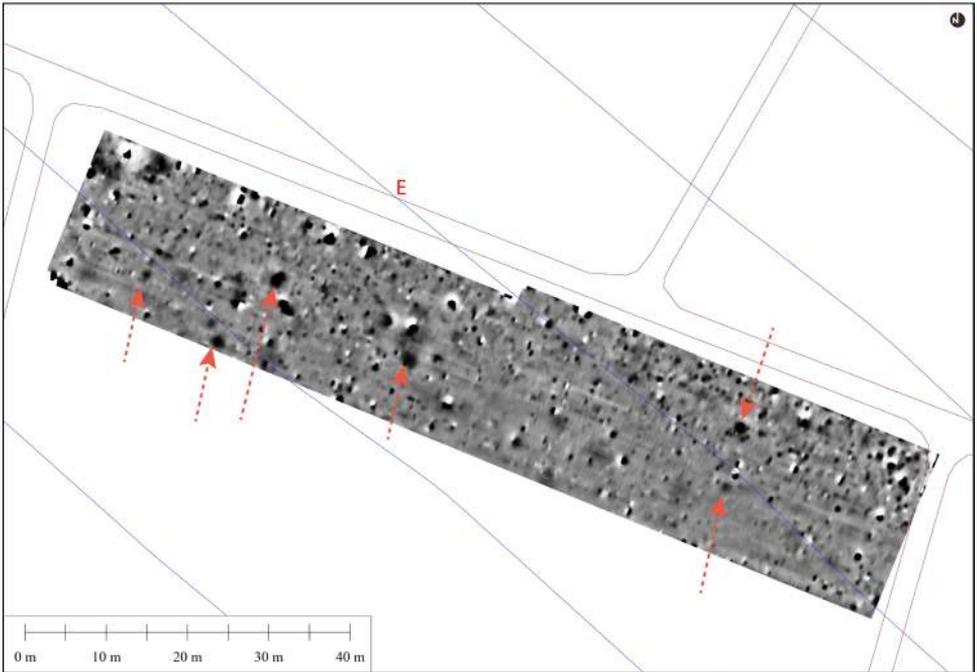
Sector C has dimensions of  $92 \times 12$  m (Fig. 12). From its contents, we can notice not only the strong bipolar anomalies from the western boundary and the middle of the sector but also some round or elongated anomalies up to 2.5 m in length and with strong magnetic values. In all likelihood, they represent traces of habitation in this area of the investigated site.

Sector D covers an area of  $110 \times 14.5$  m (Fig. 13). Its surface is largely covered by bipolar anomalies of smaller sizes (on the south side) or larger ones (on the north side). At the same time, we notice a number of round or elongated anomalies that may indicate traces of archaeological complexes, the nature, and functionality of which would be worth checking by intrusive excavation or by coring.

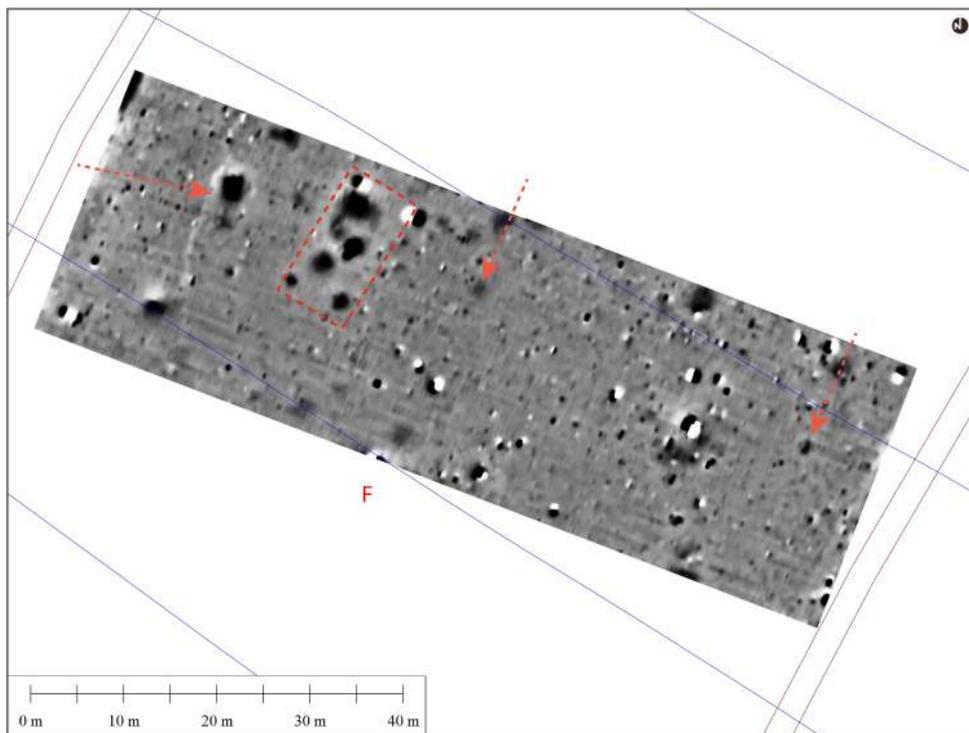
In Sector E, two perimeters were worked, covering together an area of  $110 \times 19.5$ – $22$  m (Fig. 14). As in the case of the previous perimeters, anomalies have been identified that can be interpreted as traces of some pits or even larger archaeological complexes. An elongated anomaly with positive magnetic values disposed of approximately in the center of the western half of sector E stands out of these, for example. After a more detailed analysis, it can be noticed that another anomaly is observed around this anomaly – however, with the negative magnetic values, reaching the size of circa  $2.5 \times 3.5$  m. Our proposal for interpreting this complex would be related to the existence of a pit-house there with a fire pit in the middle.



**Fig. 13.** The survey results of area D.



**Fig. 14.** The survey results of area E.



**Fig. 15.** The survey results of area F.

Sector F covered an area of  $90 \times 29.5$  m and allowed the identification of a series of archaeological anomalies on it, some out of which having been marked by us on the magnetometric plan of the sector (Fig. 15).

In sector G, which covered the surface of  $90 \times 27$  m, we managed to identify fewer anomalies than in the previous one. Of note is the agglomeration of strong anomalies in the northeast corner of the sector (Fig. 16). Unfortunately, due to the inaccessibility of the neighboring parcel, we could not extend the research to the south-southwest, which could have allowed us to follow the continuation of those anomalies and, respectively, to estimate its origin.

We have grouped several research perimeters into Sector H (Fig. 17), together covering an area of about  $280 \times 12$  m. In its contents, two anomalies stand out first of all, seem to have an “archaeological” character. The rest of the anomalies seem to come from either a hedge (on the south side) or from the household waste thrown onto the field by the owners of the land on the respective parcels.

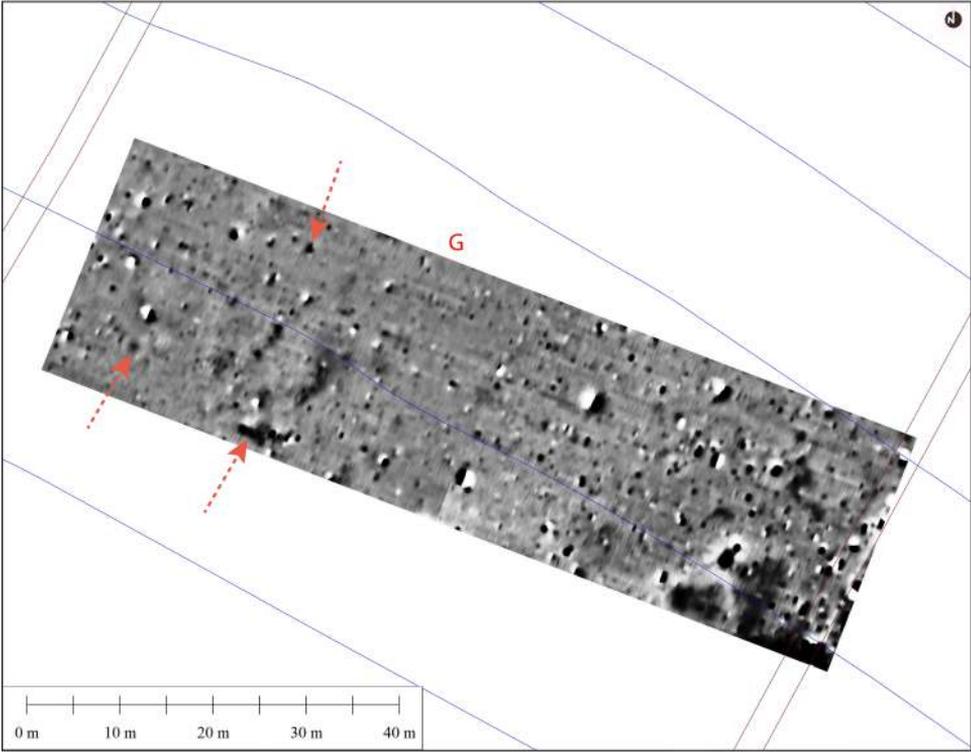


Fig. 16. The survey results of the area G.

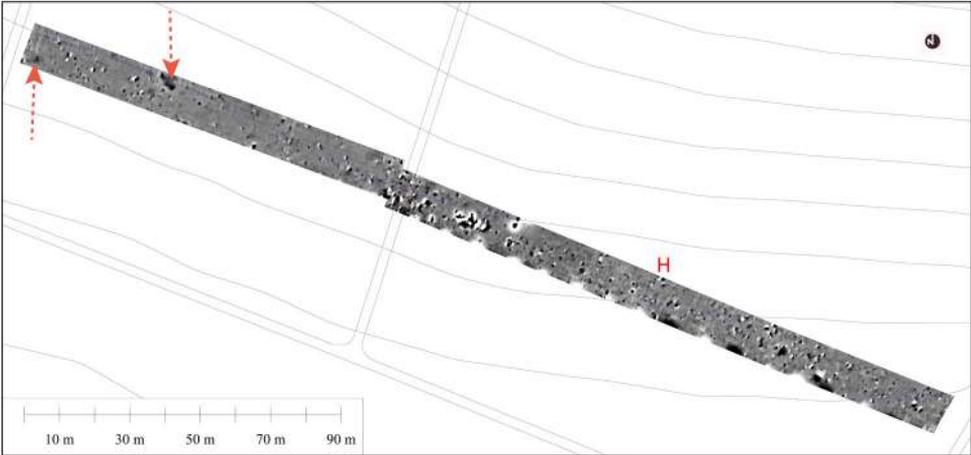
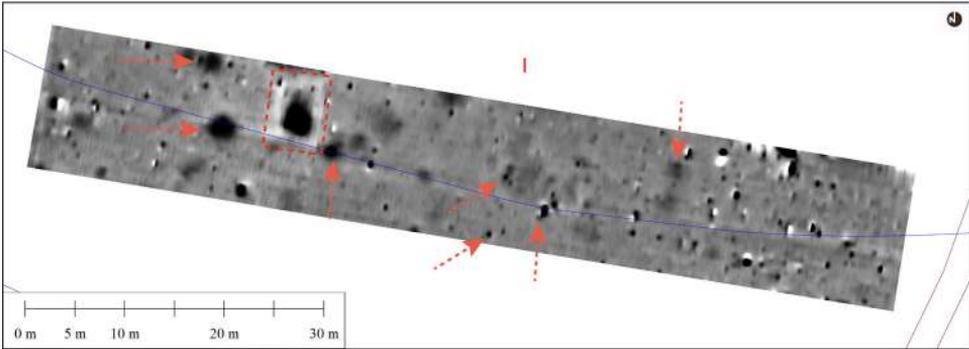
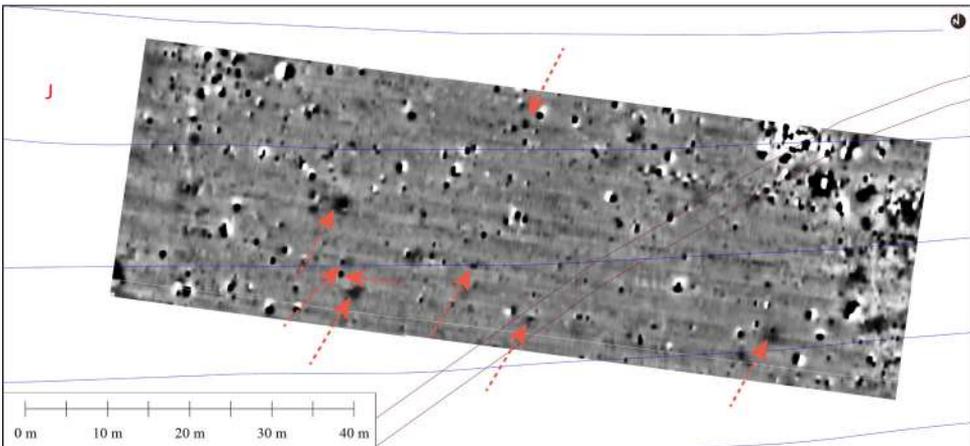


Fig. 17. The survey results of the area H.



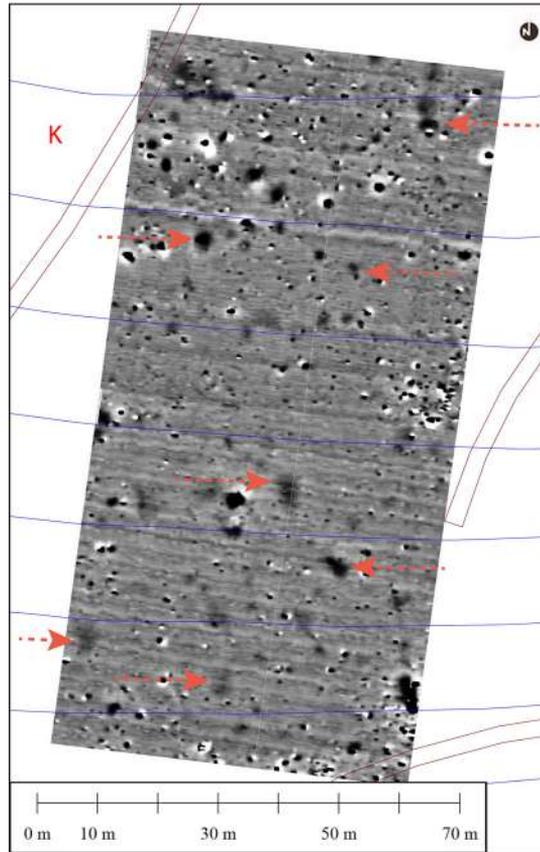
**Fig. 18.** The survey results of area I.



**Fig. 19.** The survey results of area J.

Sector I had the dimensions of  $88 \times 14.5$  m, being drawn at about 40-45 m to the south from the stone church of Orheiul Vechi (Fig. 18). In its contents, we have identified a number of anomalies that can be associated with archaeological complexes, out of which we absolutely distinguish the one marked by quadrangle. In all likelihood, it could be a complex similar to the one identified in sectors A and E: an anomaly of rectangular shape with negative values with the dimensions of about  $4 \times 6.5$  m, including an anomaly with high positive values inside. Our assumption also rests on the role of the two anomalies (with positive values) on the north side of the large anomaly, which can be easily associated with two pits from pillars.

Sector J occupies an area of  $96 \times 32.5$  m. Its surface is surrounded by small bipolar anomalies and in its northeast corner, there is an agglomeration of anomalies with high amplitude of magnetic values. These include some smaller anomalies that may have an “archaeological” character (Fig. 19).

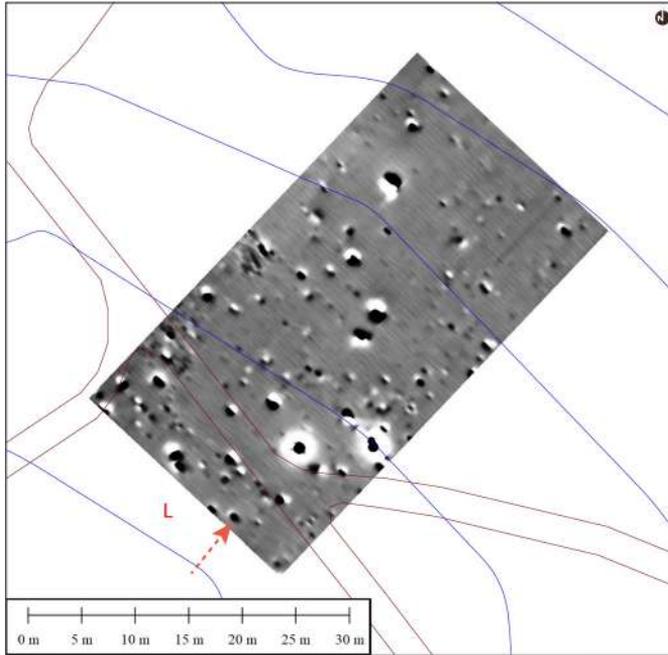


**Fig. 20.** The survey results of area K.

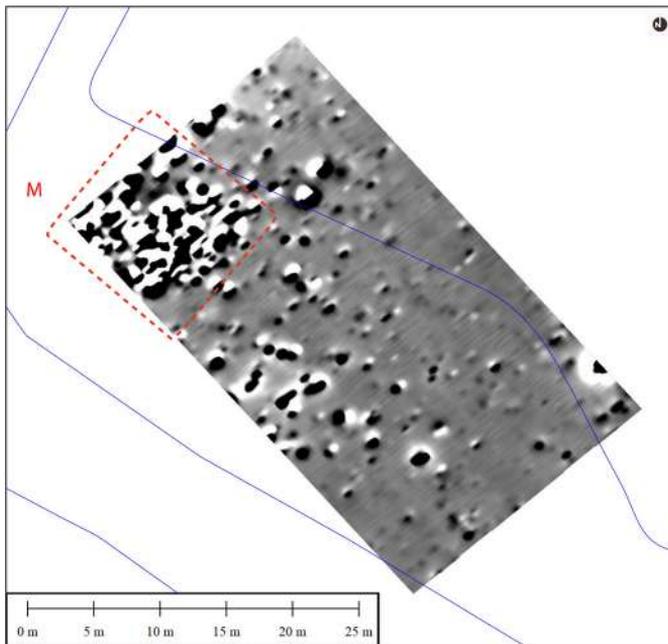
Sector K covered an area with dimensions of  $120 \times 59.5$  m, being bounded on the south by sector J (Fig. 20). Within it, a series of magnetic anomalies have been identified, some of which appear to be traces of habitation. The sector is crossed by linear anomalies from east to west, due to deep plow furrows which could not be filtered from the Software.

Sector L (Fig. 21) covered an area of  $44.5 \times 24.5$  m. Only a few anomalies that could be interpreted as traces of habitation were discovered in its contents.

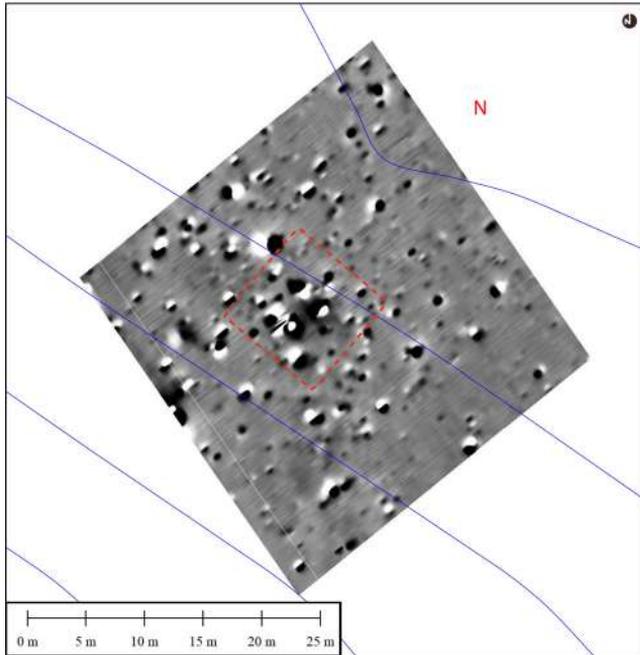
Sector M covered an area of  $38 \times 22$  m (Fig. 22). Judging by the position of this sector within the contents of an Eneolithic settlement (Postică and Kavruk 2018, 67), we can hypothesize that the agglomeration of anomalies in the northwest corner of sector M, visible on an area of about  $8 \times 10$  m, could represent the traces of an Eneolithic “platform”, composed of a massive layer of burnt clay.



**Fig. 21.** The survey results of area L.



**Fig. 22.** The survey results of area M.



**Fig. 23.** The survey results of area N.

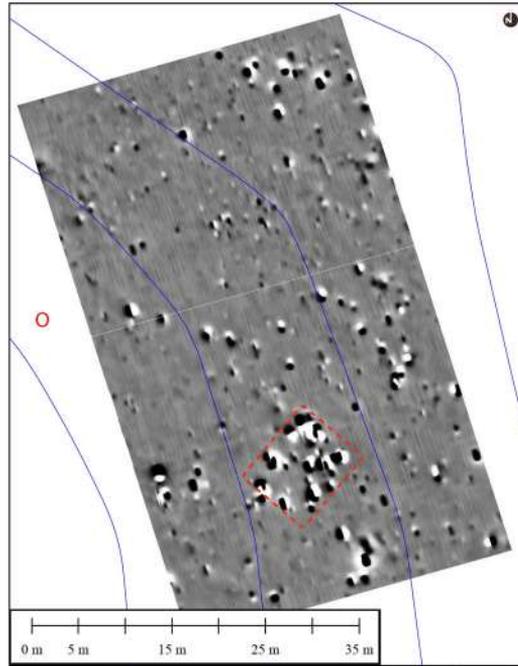
The N sector is joined to the previous one on the north side and covered an area of  $3 \times 32.5$  m. Its surface is dominated by bipolar magnetic anomalies, an agglomeration of which can be observed in the central part of the sector (Fig. 23).

Sector O was drawn to the south from sector N but without having common sides with it. As in the case of the previous one, the surface of sector O is plagued by bipolar anomalies, an agglomeration of which is observed on an area of about  $8 \times 6.5$  m, in the center of the southern half of the sector (Fig. 24).

#### 4. Conclusions

Our magnetometric researches from Orheiul Vechi have been carried out during three distinct campaigns and with different types of equipment used for data acquisition. Initially, they represented the materialization of the initiatives of the German project partner<sup>4</sup> to contribute to the cross-disciplinary research in the Republic of Moldova, subsequently, the research was continued by the State Pedagogical University “Ion Creangă” in Chisinau, representing our con-

<sup>4</sup> Römisch-Germanische Kommission des Deutschen Archäologischen Instituts, Frankfurt/Main.



**Fig. 24.** The survey results of area O.

tribution to the efforts of the initiative group for the elaboration of the registration dossier of the Site and subsequently of the archaeological and natural landscape of Orheiul Vechi for the World Heritage List. Regardless of the fate of the vote on the file in the decision-making forums of UNESCO, we are glad that we were able to contribute within the limits of our possibilities to the elaboration of that documentation.

Our researches have covered only a small number of parcels of land on the surface of the medieval site of Orheiul Vechi and have not led until now to some spectacular discoveries on the site. However, we consider that the objectives of our approach have been achieved - we have tested the magnetometry method in Orheiul Vechi, we have demonstrated its possibilities of application not only in organizing invasive archaeological research but also in organizing safeguarding for this archaeological monument of national importance to a greater extent.

### **Bibliography:**

Milsom, John and Asger Eriksen. 2011. *Field Geophysics*. The Geological Field Guide Series. 4th ed. Hoboken, NJ: Wiley.



Musteață, Sergiu. 2015. „Preserving archaeological remains in situ: from the legal to the practical issues. The Romanian case”. In *Current Trends in Archaeological Heritage Preservation: National and International Perspectives*, edited by Sergiu Musteață and Ștefan Caliniuc, Proceedings of the international conference, Iași, Romania, November 6–10, 2013, 15-19. BAR International Series 2741, Oxford.

Popa, Alexandru, Sergiu Musteață and H.-U. Voss. 2013. „Prospecțiuni magnetometrice în Republica Moldova: rezultate și perspective ale unui proiect moldo-german.” *Zargidava. Revistă de istorie* XII: 251-263.

Popa, Alexandru, Sergiu Musteață, H.-U. Voss. 2012. „Landscape Archaeology și prospecțiuni magnetometrice în Republica Moldova: rezultate și perspective ale unui proiect moldo-german.” *Akademios. Revistă de știință, inovare, cultură și artă* 1/24: 102-108.

Popa, Alexandru, Sergiu Musteață, Veaceslav Bicbaev, Knut Rassmann, Octavian Munteanu, Gheorghe Postică and Ghenadie Sîrbu. 2010. “Rezultate preliminare privind sondajele geofizice din anul 2009 și perspectivele folosirii magnetometriei în Republica Moldova.” In *Arheologia ontre știință, politică și economia de piață*, edited by Sergiu Musteață, Al. Popa and Jan-Peter Abraham, 145-57. Chișinău: Pontos.

Popa, Alexandru, Sergiu Musteață, Veaceslav Bicbaev, Knut Rassmann, Octavian Munteanu, Gheorghe Postică and Ghenadie Sîrbu. 2010. “Considerații privind sondajele geofizice din anul 2009 în Republica Moldova.” *Revista Arheologică (Chișinău) Serie nouă* VI, no. 1: 171-179.

Popa, Alexandru and Sergiu Musteață, “Geophysikalische Prospektionen in Rumänien. Ein deutsch-rumänisch-moldauisches Forschungsprojekt an der Ostgrenze der römischen Provinz Dacia.” *Humboldt-Kolleg in Chișinău, Republik Moldova, Internationale Fachtagung von Humboldtianern für Humboltianer „Der Swarzmeerraum vom Äneolitikum bis in die Früheisenzeit (5000-500 v. Chr.). Globale Entwicklung versus Lokalgeschehen”*, 4.-8. Oktober 2009: 56-58.

Postică, Gheorghe and Valerii Kavruk. 2018. *Orheiul Vechi. Archaeological Landscape*. Chișinău: Tipografia Centrală.

Postică, Gheorghe, Nicolae Boboc, Lazăr Chirică, Varvara Buzilă, Ștefan Lazu, Nicolae Corcimari and Nicolae Zubcov. 2010. *Peisajul Cultural Orheiul Vechi*. Chișinău: CEP USM.

Postică, Gheorghe. 2006. *Orheiul Vechi. Cercetările Arheologice 1996-2001*. Bibliotheca Archaologica Iassiensis, edited by Victor Spinei and V. Mihăilescu-Bîrliba. Iași: Editura Universității “Alexandru Ioan Cuza”.

Ștefan, Dan. 2012. *ArheMAG. Aplicații ale metodei magnetice în arheologie. Manual de bune practici*. Brăila: Editura Istros a Muzeului Brăilei.

## Orheiul Vechi: rezultatele prospecțiunilor geofizice recente

### Rezumat

Orheiul Vechi reprezintă unul dintre cele mai atractive situri culturale din Republica Moldova și respectiv unul dintre cele mai des discutate. Densitatea siturilor și continuitatea de locuire în acest spațiu fac ca Orheiul Vechi să fie atractiv pentru cercetările pluridisciplinare sistematice începând cu anul 1946. În contextul pregătirii dosarului pentru înscrierea Rezervației istorico-culturale și natural-peisagistice „Orheiul Vechi” în Lista patrimoniului mondial, în ultimele două decenii s-au realizat un șir de cercetări. Printre aceste demersuri științifice se înscriu și câteva cercetări non-invazive în diverse zone ale rezervației. Astfel, în acest articol sunt prezentate, pentru prima dată, integral rezultatele sondajelor magnetometrice realizate de o echipă moldo-româno-germană în anii 2009-2014. Rezultatele acestor sondaje au confirmat un șir de situații arheologice deja cunoscute și au facilitat noi descoperiri, care merită a fi dezvoltate în anii următori.

**Cuvinte-cheie:** Orheiul Vechi, Republica Moldova, metode non-invazive, magnetometrie

### Alexandru Popa,

University of Regensburg, Germany /

National Museum of Eastern Carpathians in Sfântu Gheorghe, Romania.

Email: alexandru.popa@geschichte.uni-regensburg.de

### Sergiu Musteață,

State Pedagogical University of Chisinau, Republic of Moldova.

Email: sergiu\_musteata@yahoo.com