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## Some Results of the Geophysical Investigation at the Late Eneolithic Settlement of Gordinești II-*Stînca goală*, Edineț District, Republic of Moldova

### ABSTRACT

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The aim of this article is to present the latest results of geophysical researches executed in April 2017 at the site Gordinești II-*Stînca goală* in northern part of the Republic of Moldova. Based on very intriguing discoveries (i.e. remains of a dwelling, part of a clay platform and one pit) during the excavations carried out in 2016 and earlier, it was decided to investigate a larger area using non-invasive geophysical method. As a result, a few types of anomalies of different shapes were identified. It seems that these anomalies indicate the occurrence of remains of the dwellings as well as hypothetical main square between them in the centre of this fortified settlement<sup>1</sup>.

**Key words:** geophysical methods, non-invasive survey, Gordinești group, Late Eneolithic, dwellings, ditch

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### Introduction

The Late Eneolithic settlement of Gordinești II-*Stînca goală* is located in the Prut-Dniester interfluvium in the northern part of the Republic of Moldova (geographic coordinates: 48°08'24.25" N; 27°09'34.58" E). It is nowadays situated about 1 km south from the village Gordinești on an elongated limestone promontory shaped by meander of the Racovaț

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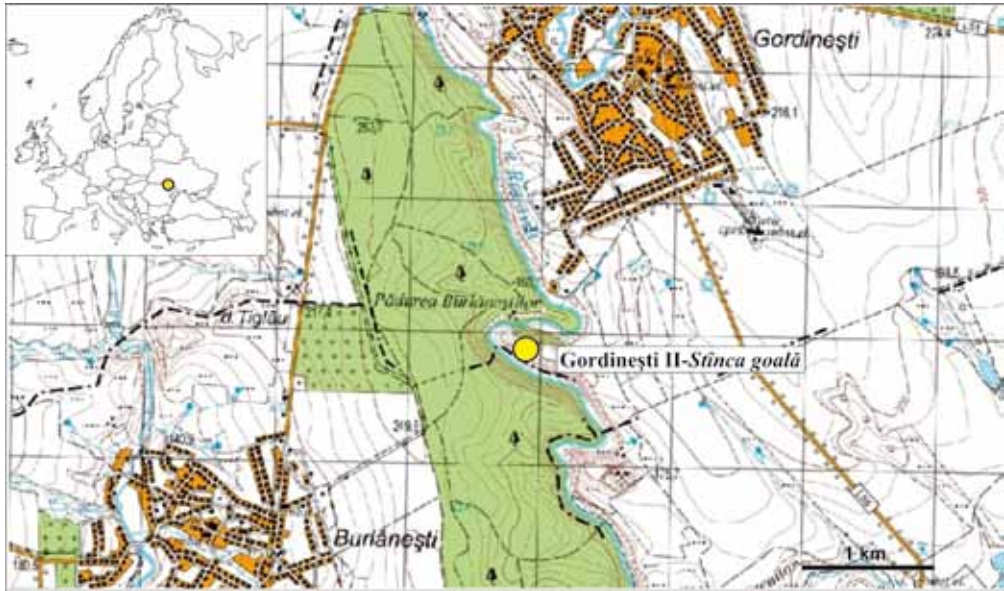
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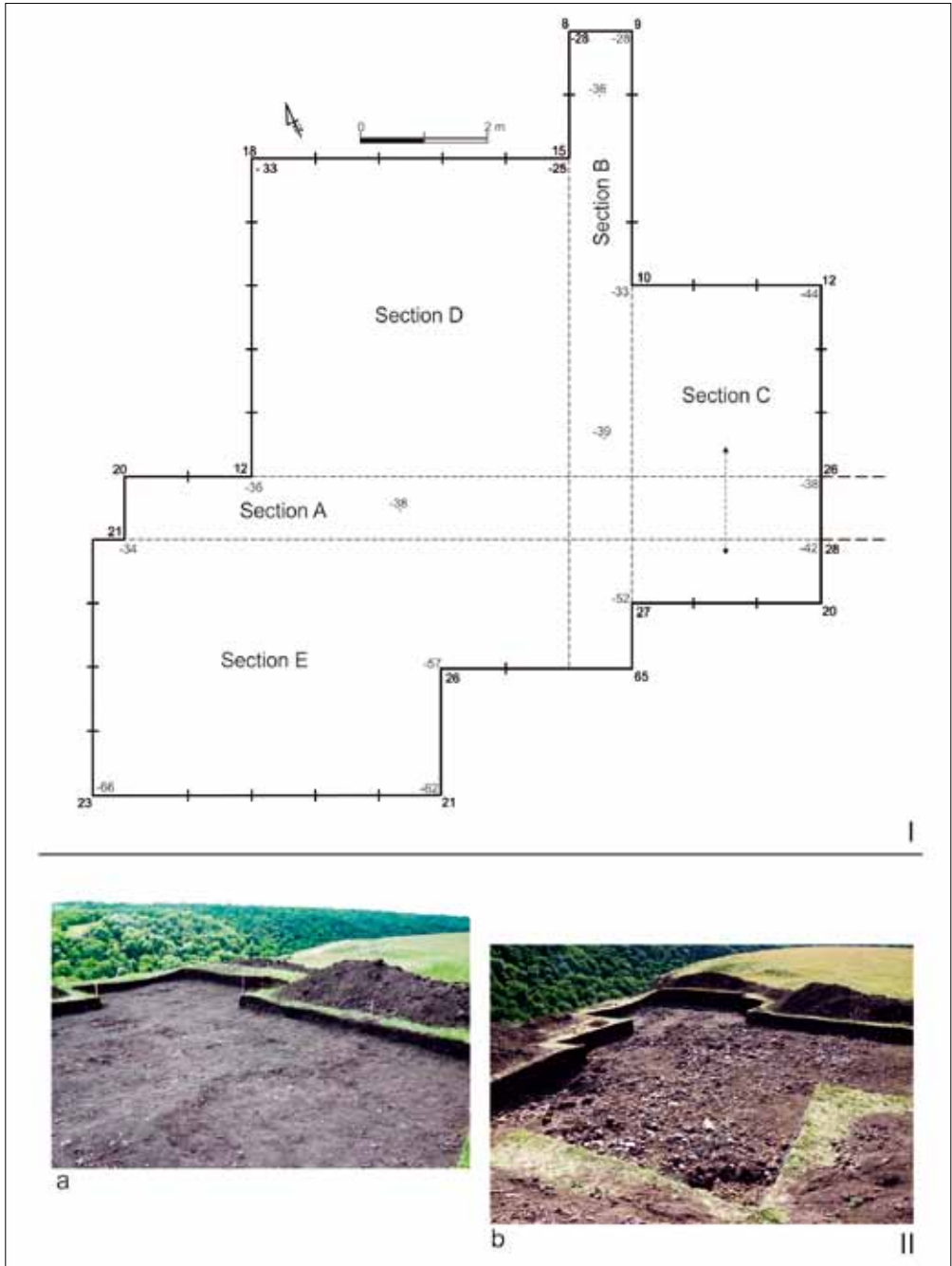


**Fig. 1.** Gordinești II-Stîncea goală, Dist. Edineț. Location of the site

river, left tributary of the Prut river (Fig. 1). The remains of the Late Eneolithic settlement occur on the *plateau* (500 m length and 100–120 m width) in the west area of promontory up to 80 m above the currently level of Racovăț river.

This site was discovered and first excavated in 1971 by Valentin Dergachev. During this precursory campaign two trenches covering a total area of 147 square m were explored. As a result of this investigation, no archaeological features were identified (Dergachev 1973, 90–100). However, during this research a large amount of ceramics was registered, not only in two mentioned trenches, but also on the surface of the site. Due to a number of unique decorative elements, this ceramics was consequently referred to as the Gordinești type (*памятники Гординештского типа* in Russian) (Dergachev 1973, 90–100; Dergachev 1980).

In the following years, the field campaigns was not continued. It was not until May 2016 that the next archaeological campaign in a form of systematic excavations with other methods were carried out there (see footnote 1). Concerning the results of the archaeological investigations in the Section III (divided into A–E sub-sections), total surface area of 90 square m has been recognized (Fig. 2: I–II). In such limited area



**Fig. 2.** Gordinești II-*Stinca goală*, Dist. Edineț, I – the schematic plan of the Section III; II a – situation after first layer exploration (view from the east); II b – situation after second layer exploration (view from the east)

discovered several interesting features, mainly the remains of one dwelling, part of a clay platform as well as one pit. In the context of mentioned features a very rich collection of artefacts was recovered such as vast amount of ceramics, as well as other finds made from clay (spindles, circular weights from the loom), flint (axes, blades), bone, antler, and also stone (Sîrbu *et al.*, 2017a: fig. 1A; Sîrbu *et al.*, 2017b). Moreover, a series of organic samples (i.e. wheat grain and charcoals) were also taken. In consequence of specialized radiocarbon analyzes of these samples, three absolute dates were obtained. Based on its values the age of discovered and identified remains of the Late Eneolithic settlement in Gordinești II-*Stînca goală* should be seen in the range of 3350–3000/2950 calBC.

The success of new excavation contributed to decision to carry out an extensive geomagnetic investigation of the area of Gordinești II-*Stînca goală*. Non-invasive researches were conducted by Marcin M. Przybyła and Michał Podsiadło in April 2017.

### Applied methods

For the geophysical survey at the Late Eneolithic Gordinești II-*Stînca goală* settlement, we have decided to use magnetic prospection. This method is one of the most efficient when it comes to covering an area of a substantial size. A magnetometer detects anomalies characterized by increased or decreased magnetic field intensity, caused by various human activities. Distinctive anomalies (anomaly points or linear anomalies of increased magnetic field intensity) are formed as a result of occurrence of sunken features, such as pits, ditches or pithouses. Specific high-amplitude anomalies are characteristic for furnaces, fireplaces, as well as other objects exposed to high temperature, for example burnt houses. The presence of ferrous metal objects produces N–S oriented dipolar anomalies, while large, zonal ones may be interpreted as signs of economic human activities. On the other hand, using magnetic prospection to detect inhumation graves may be very difficult. Physical attributes of their fills usually do not differ significantly from surrounding subsoil, therefore they do not cause detectable magnetic anomalies (David *et al.* 2008, 20–21; Misiewicz 2006, 78). Concluding, the magnetic method allows comprehensive prospection of an archaeological site in a relatively short time. One of its weaknesses is rather little depth of penetration, barely exceeding 1 meter (David *et al.* 2008, 16).

Magnetic measurements in Gordinești II-*Stînca goală* were conducted using 4.032 DLG Foerster Ferrex fluxgate magnetometer (Misiewicz 2006, 74–98) with two sensors of a measurement sensitivity of 0,2 nT. A fluxgate magnetometer measures a vertical gradient of a local magnetic field. The surveyed area was divided into a 1×1 m grid, while measurements were obtained along every 10 cm. Data were collected in a bidirectional manner. Results of the prospection were visualized on magnetic maps (Fig. 3–5) created using the program Terra Surveyor 3.0.29.3.

## Results

Grass-covered surface of the promontory on which the site is located was easy accessible for prospection. In Gordinești II-*Stînca goală*, the thickness of the humus layer does not exceed 50 cm, and directly below it residues the limestone bedrock. Sometimes, especially in the western part of *plateau*, the humus layer is severely damaged by erosion, and, as a result, the bedrock is exposed on the surface.

The magnetic survey was conducted in the area of 2,7 ha, measuring 300 m along the NW–SE axis, with 115 m along the SW–NE axis. Edges of precipitous slopes of the promontory marked northern and



**Fig. 3.** Gordinești II-*Stînca goală*, Dist. Edineț. Magnetic map in the range of -5/5 nT in the grayscale imposed on the satellite image (source: geoportal.md)

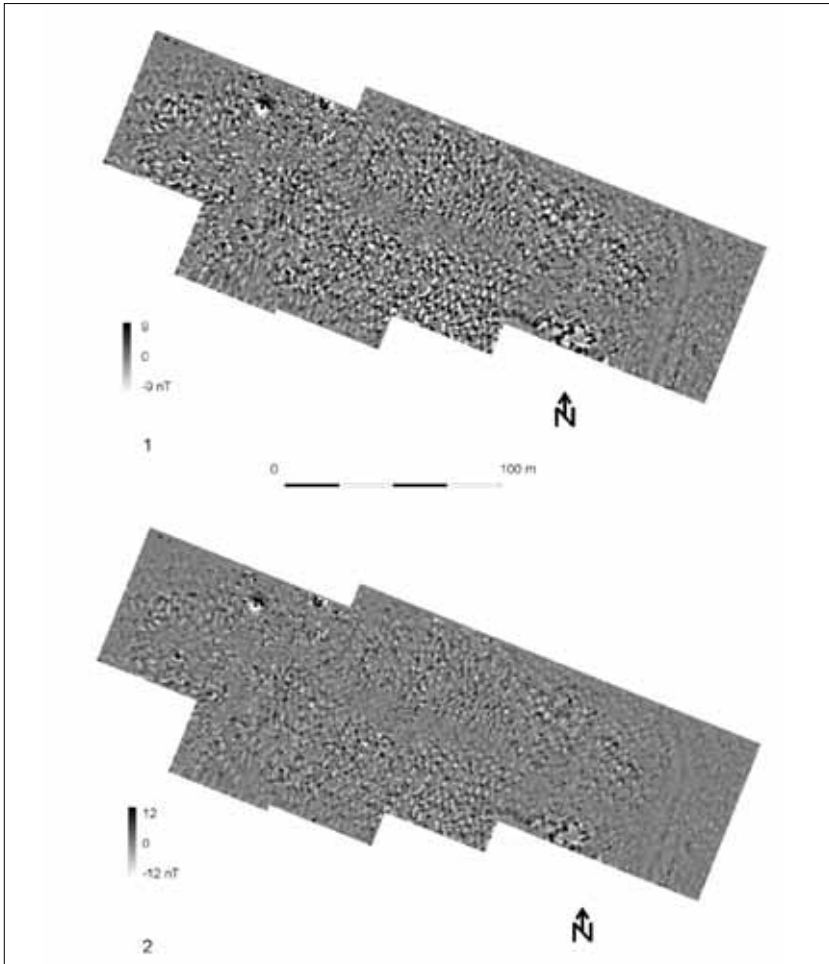


**Fig. 4.** Gordinești II-*Stînca goală*, Dist. Edineț. Magnetic map in the range of -5/5 nT in the colour scale imposed on the satellite image. The highest values are highlighted

southern limits of the prospected zone, while its eastern border was established about 30 m beyond a ditch, still visible in the field, which was originally enclosing the settlement from this side. Lastly, on the west the prospection was carried until it reached the area of the limestone outcrops mentioned above.

Sadly, an exploitation of the territory of the archaeological site in the modern times affected significantly the results of the recent magnetic investigations. In the 2<sup>nd</sup> half of the XX century, a forest was planted on the hilltop of the promontory. The area was deforested back again some time later, resulting in numerous oval holes after tree removal covering all over the territory of the site. They are close to each other and arranged in regular rows, which is clearly visible on satellite images (Fig. 6).

Those holes produced numerous, very distinctive magnetic anomalies. On the contrary, archaeological features excavated on the site so far were either shallow, sunken pits, or remains of burnt buildings in the form of clay debris. It seems that planting and then cutting down trees resulted in damaging at least upper parts of those features. As a result of the forestry activities, construction clay from dwellings was



**Fig. 5.** Gordinești II-*Stîncă goală*, Dist. Edineț. Magnetic maps in the grayscale. 1 – in the range -9/9 nT; 2 – in the range -12/12 nT

deposited in fills of the holes after removed trees. For that reason, the holes on the territory occupied by remains of Late Eneolithic buildings produce distinctive dipolar anomalies, characterized by higher values (in the range of -5/15 nT) as well as significantly greater amplitudes of pole values than ones beyond the limits of the settlement. Despite substantial difficulties in interpretation of the results of the magnetic survey, based on this observation it is possible to give a general account of the layout of the site.



**Fig. 6.** Gordinești II-*Stîncea goală*, Dist. Edineț. Satellite image of the site (source: Google Earth) with visible holes after tree removal

The one clearly distinguishable anomaly caused undoubtedly by an archaeological feature is a positive linear anomaly marking the ditch enclosing the settlement from the east (Fig. 7: 1). Judging from the shape of the anomaly, the trench connected two very steep edges of the promontory (northern and southern), therefore separating its western, higher part, on which the settlement was erected. There were no additional defensive structures in the rest of the surveyed area. It seems that the ditch, guarding the only gentle slope of the promontory, was enough to successfully secure the settlement. Examples of similar trenches are known from many fortified Late Eneolithic sites.

The magnetic prospection revealed that beyond the ditch there was a zone lacking the characteristic dipolar anomalies caused by construction clay. Such anomalies cumulate westward from the trench, in an oval-shaped space of diameters of 250×115 m. It seems that this area should be regarded as a main part of the settlement (Fig. 7: 3). Unfortunately, observable rectangular or linear formations of some of anomalies were produced rather by regularly planted trees (Fig. 6) than archaeological features (in this case: walls of buildings). Along the longer axis of the discussed oval-shaped space lies a zone of scarce or even lack of the dipolar anomalies. We can deduce that in the core of the settlement there was an area with no buildings, used possibly as a main





**Fig. 7.** Gordinești II-*Stînca goală*, Dist. Edineț. Magnetic map imposed on the satellite image with marked anomalies discussed in the text. 1 – positive linear anomaly caused by the ditch; 2, 2a, 2b – area without dipolar anomalies, interpreted as main communication tract of the settlement and hypothetical internal squares; 3, 3a – area with dipolar anomalies caused by construction clay; 4 – anomalies caused by an archaeological trench

communication tract, or an internal square (squares?). The layout of anomalies suggests that a square may have existed in the eastern (Fig. 7: 2b), and, perhaps, also in the central part of the settlement (Fig. 7: 2a). Inside the area of scarce dipolar anomalies it was identified a single place, where anomalies seem to cluster (Fig. 7: 3a). If the anomalies were not produced by forestry activities, then we might expect that some building (buildings?) could have been located also in the innermost part of the settlement. It is worth mentioning that those structures must have been positioned opposingly to the remaining settlement dwellings, fashioned in a clear radial layout. Observable reduction of number of the characteristic dipolar anomalies in the western part of the surveyed area indicates that a boundary of the settlement has been recorded. Based on lack of such dipolar anomalies beyond the ditch, we can deduce that houses were built only within the fortified space.

To conclude the results of the magnetic prospection at the Late Eneolithic Gordinești II-*Stînca goală* settlement, Edineț district, we have to stress that modern forestry activities on the territory of the archaeological site made the survey very difficult. In consequence, it

was nearly impossible to distinguish single anomalies caused by specific archaeological features. Despite the hard conditions, the main layout of the eneolithic settlement was reconstructed. Houses were most likely arranged radially, forming an oval shape adapted to local topography. In the central part of the settlement there was located an oblong-shape zone without any dwellings. As an exception, the single accumulation of anomalies within this area was documented, suggesting that some building (or buildings) may have functioned there. Houses occupied whole space between the edges of the promontory and the central square (squares?) as well as hypothetical main communication tract of the settlement. The site was fortified only from its eastern side.

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