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MEDITERRANEAN AND NON-EUROPEAN ARCHAEOLOGY

Warsaw 2018

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Rocznik Instytutu Archeologii
Uniwersytetu Warszawskiego

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PREHISTORICAL AND MEDIEVAL ARCHAEOLOGY. ARCHAEOLOGY OF POLAND
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Studia i materiały

Kronika wykopalisk

Dmytro Nykonenko, Marcin Matera, Miron Bogacki, Wiesław Małkowski, Paweł Lech

Konsulovskoe Hillfort, Ukraine. Non-Invasive Survey in 2015 Season

The Konsulovskoe site belongs to a group of the so-called Late Scythian/post-Scythian (Gavrilyuk, Krapivina 2005: 66) hillforts situated along the banks of the lower sections of the Dnieper River (Nikonenko 2015: 91; Gavrilûk 2013: 556). The hillfort is situated on the right bank of a steep slope of a high plateau about 1 kilometre from the today's village of Respublikanets (Ukraine, Zaporozhe). This site has never been explored on a regular basis. The identified components of the hillfort are the citadel, as well as close and distant suburbs.

An expedition of the National Reserve 'Khortytsya' started the research of the Konsulovskoe hillfort in 2014 (Nikonenko 2015: 91). Since 2015, the investigation of the network of lower Dnieper hillforts has been realised as a joint project in cooperation between archaeologists from Ukraine and the Institute of Archaeology as well as the Antiquity of Southeastern Europe Research Center at the University of Warsaw.

Fieldworks in 2015 were conducted between the 10th of August and the 10th of September. The non-invasive survey of the Konsulovskoe hillfort included aerial photography, topographical measurements, and geophysical prospection with the use of magnetic and electrical resistivity measurements. The first archaeological verification of the results of the non-invasive survey was also executed in the area of the newly-set Trench I.

Up to date, such non-invasive survey has been performed only on the territory of one hillfort called Chervonyi Mayak, localised about 8 kilometres to the south of the Konsulovskoe site (Gavrilûk, Smekalova, Čudin 2009: 90–94). Therefore, no complete standardized procedure of geophysical prospection for this kind of sites was available which could be applied to the Konsulovskoe fieldworks. Instead, the researchers from the University of Warsaw prepared a new method which combined electrical, magnetic, and aerial survey. Promising results of the first researches on the Konsulovskoe hillfort seem to confirm that this method is indeed the most appropriate.

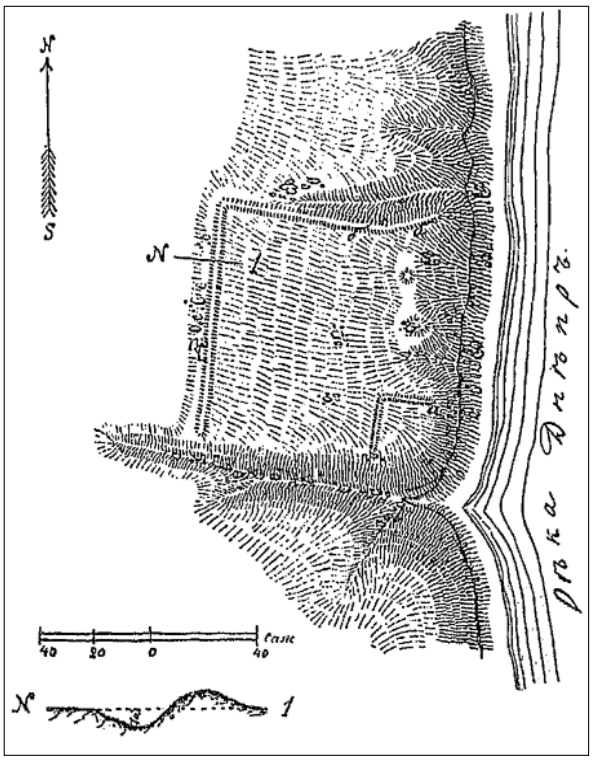

Fig. 1. Konsulovskoe hillfort. The topographical plan compiled by V.I. Goschkevich (after V.I. Goškevič, *Letopis' muzeâ za 1909, 1910 i 1911 g.g.*, Hersonskij Gorodskoj Muzej Drevnostej 2, Herson 1912, 8, fig. 3).

Ryc. 1. Grodzisko Konsułowskoje. Plan topograficzny wykonany przez W.I. Goszkiewicza (wg V.I. Goškevič, *Letopis' muzeâ za 1909, 1910 i 1911 g.g.*, Hersonskij Gorodskoj Muzej Drevnostej 2, Herson 1912, 8, fig. 3).

Aerial photography and topographical survey

The first rough plans of the Konsulovskoe site were included on Russian military maps compiled in the mid-19th century (Nikonenko 2015: 92). A more detailed topographical plan of the hillfort (**Fig. 1**) was drawn and published

by V.I. Goschkevich in 1912 (Goškevič 1912: 8, fig. 3). A modern plan (**Fig. 2**) was prepared by D.D. Nykonenko (Nikonenko 2015: 94, fig. 3, 2). Despite their significance and many interesting details, it was decided that it would be appropriate to verify the results of the previous works. The first stage of the non-invasive survey consisted of drawing photogrammetric documentation on the basis of aerial photography and GPS measurements carried out for this purpose.

The topographic survey was performed automatically during magnetic survey and consisted of levelling measurements with the use of the GPS RTK system. A GPS device was also used to determine accurate position of the photopoints used to adjust kite aerial photographs.

The aerial photography was made with the use of a camera suspended to a kite on a special remotely-controlled self-levelling frame with a Picavet-type suspension (Aber). The method of aerial photography with the use of such devices was developed by Miron Bogacki in 2006 and tested at multiple archaeological sites. The aim of these works was to draw photographic documentation of the whole area of the site. During several sessions nearly 1200 oblique and vertical photographs were taken. This enabled preparing the Digital Terrain Model (**Fig. 3**) and ortophotomaps. A visualisation of the obtained results was compiled in the Photoscan Pro 1.1.6 software.

Geophysical survey

The magnetic prospection was carried out with a Geometrics G-858G caesium magnetometer with two sensors in horizontal configuration. It was performed on the area of 2.5 hectares. This solution enabled taking measurements of the total vector of magnetic field intensity and, at the same time, determining the value of the pseudo-gradient of its horizontal components. As a result of the measurements, two maps presenting the distribution of magnetic anomalies were prepared: the map of the values of the total vector of magnetic field intensity, and another one of the values of the pseudo-gradient of the horizontal component

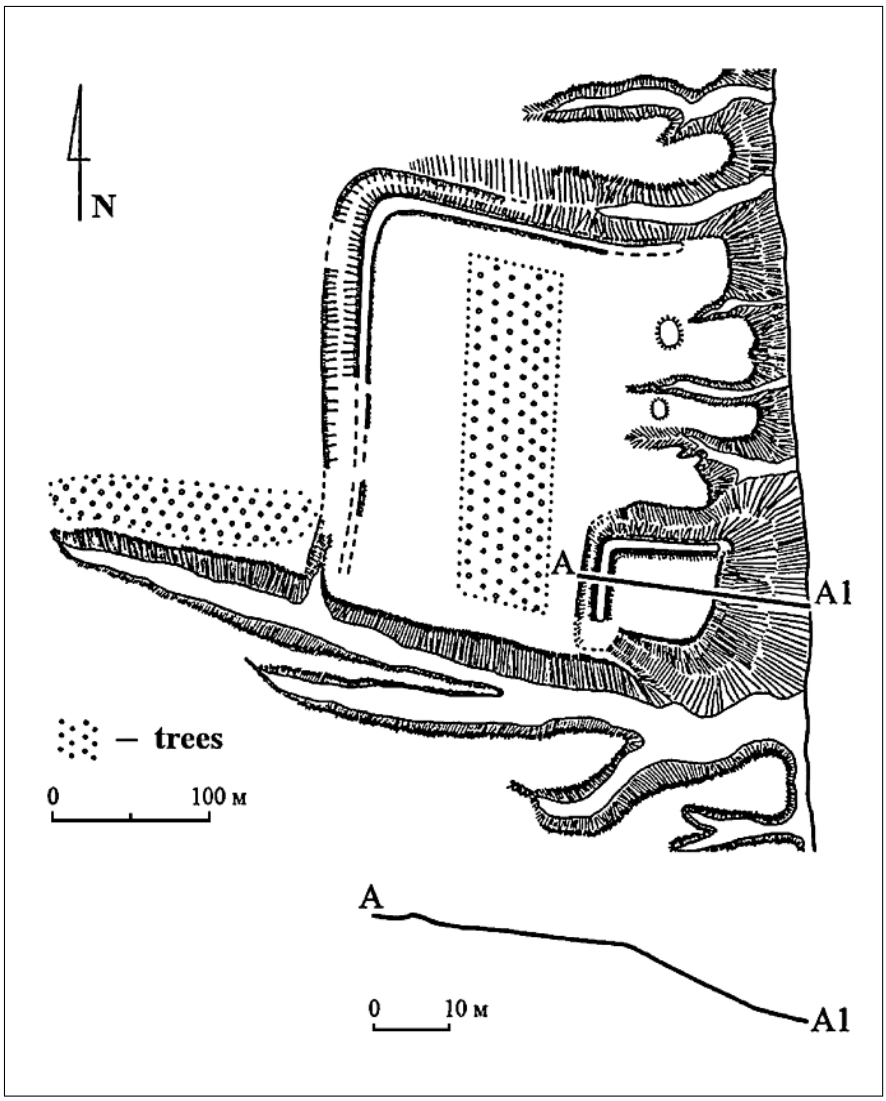

Fig. 2. Konsulovskoe hillfort. The topographical plan compiled by D.D. Nykonenko (after D.D. Nikonenko, *Pizn'oskifs'ke Konsulov'ske gorodiše*, "Arheologiâ" 2015/1, 94, fig. 3,2).

Ryc. 2. Grodzisko Konsułowskoje. Plan topograficzny wykonany przez D.D. Nykonenko (wg D.D. Nikonenko, *Pizn'oskifs'ke Konsulov'ske gorodiše*, „Arheologiâ" 2015/1, 94, fig. 3,2).

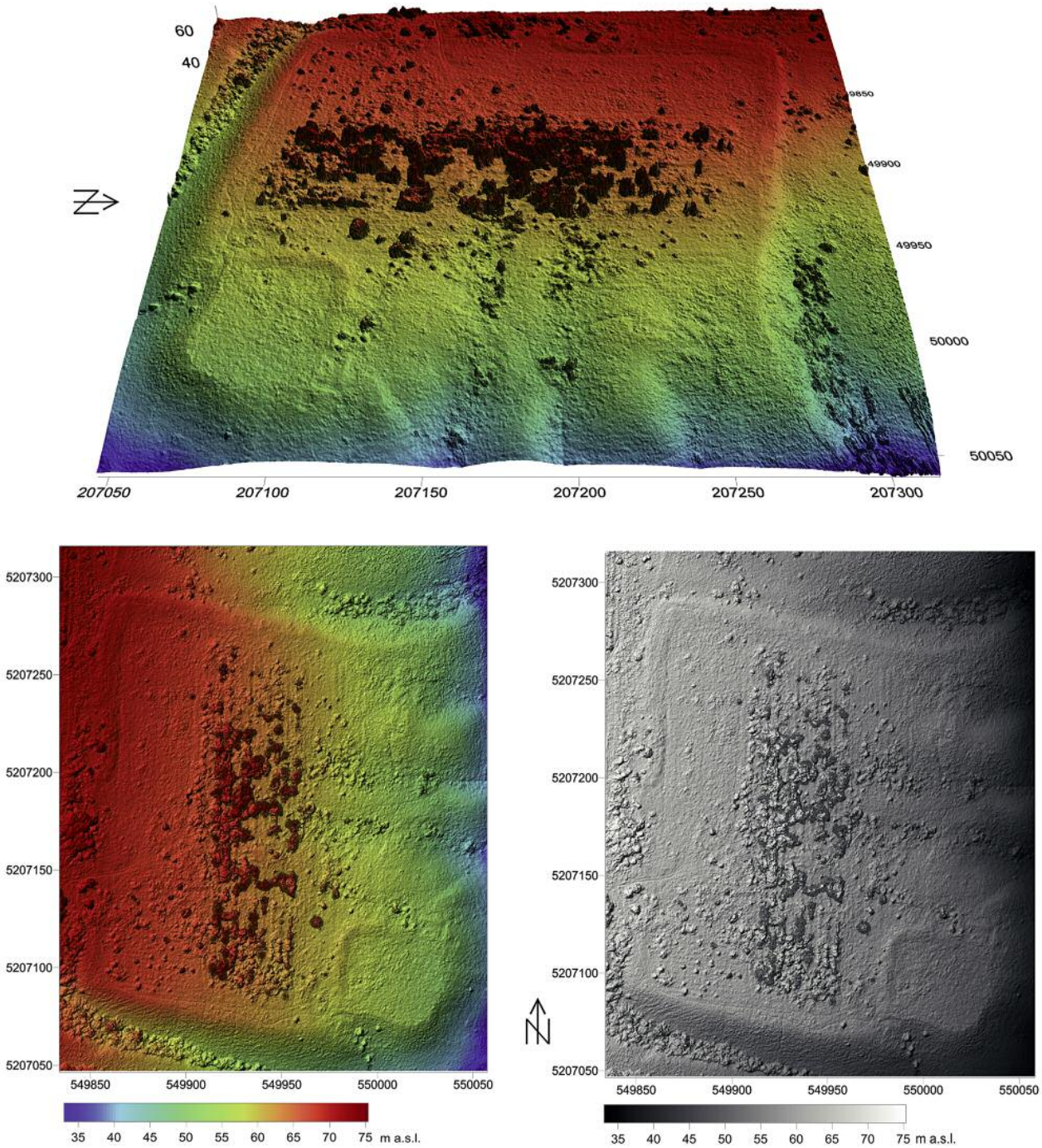

Fig. 3. Konsulovskoe hillfort. The Digital Terrain Model (compiled by M. Bogacki).
Ryc. 3. Grodzisko Konsułowskoje. Numeryczny model terenu (oprac. M. Bogacki).

of the total vector of magnetic field intensity (**Fig. 4**). The dipole anomalies visible on the maps occurred irregularly throughout the whole investigated area and could be caused by single metal objects present in the subsurface layers.

Two concentrations of dipole-dipole anomalies are visible in the western part of the investigated area: I and II (**Fig. 5**). The range of values of the total vector of magnetic field intensity on the surveyed field exceeded 100nT. It may indicate the presence of iron artefacts or heavily-burnt materials. However, it cannot be excluded that modern human activities could produce this effect. Anomaly III has a similar character (**Fig. 5**).

Most likely the linear anomalies indicated on the map as IV, V, VI, VII, and VIII (**Fig. 5**) were caused by remains of the western line of fortifications. However the

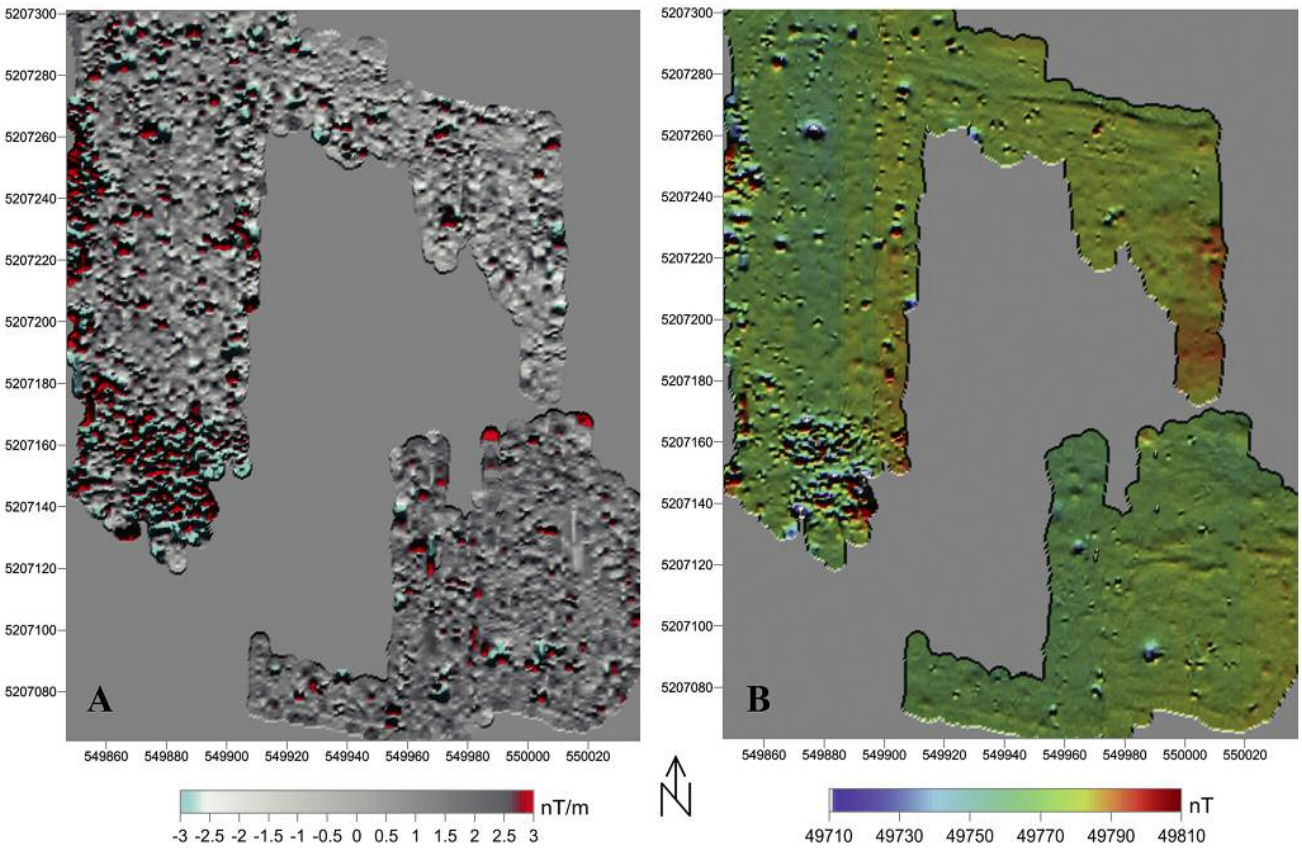

Fig. 4. Magnetic map of the site: A – map of values of the pseudo-gradient of the horizontal component of the total vector of magnetic field intensity within a range of -3 to +3 nT/m; B – map of values of the total vector of magnetic field intensity within a range of 49710 to 49810 nT (compiled by M. Bogacki, W. Małkowski).

Ryc. 4. Wizualizacja wyników prospekcji magnetycznej: A – mapa wartości pseudogradientu składowej poziomej wektora całkowitego natężenia pola magnetycznego w przedziale +/-3nT/m; B – mapa wartości wektora całkowitego natężenia pola magnetycznego w przedziale 49710 – 49810nT (oprac. M. Bogacki, W. Małkowski).

anomalies IV, V, VI, and VIII are perpendicular to the remains of the rampart visible on the surface of the hillfort. Thus, their connection with the construction of the fortifications should be archaeologically verified.

Near the western rampart of the Konsulovskoe hillfort, another dipole-dipole anomaly (IX) 7 metres long was recorded (**Fig. 5**). By all probability it should not be connected with the structures of the rampart. Three point anomalies (X, XI, and XII) registered in the eastern part of the site might be a result of high temperature involved in operating such devices as ovens, kilns, or hearths (**Fig. 5**).

Within the area of the rampart of the citadel, two lines of anomalies were recorded. Presumably this could be linked with technical features of the fortifications with two lines of stone structures. The average distance between them, indicated on the map as A1–A2, was 7 metres (**Fig. 5**). Suppos-ing that the boundaries of the citadel were defined by the inner line of the rampart, one can assume that its surface amounted to about 2400 m^2. A break in the anomaly observed in the central part of the rampart of the citadel can be supposedly interpreted as a gateway or other type of passage connecting two parts of the site.

Anomalies recorded in the northern part of the site (A3, A4, A5, and A6) were undoubtedly connected with the line of the fortifications, protecting the vicinity of the hillfort (**Fig. 5**). In the central part of the northern section of the fortifications along the distance of 45 metres a double line of anomalies (A4–A5) was recorded.

It should be noted that the remains of the defensive system of the hillfort observed on the map of the magnetic anomalies conform to the forms of surface relief visible in the field.

The resistivity survey was carried out with ADA-7 using electrodes in dipole-dipole configuration. Surveys were performed on five sectors (E1–E5) of the total area of 1500 m^2 (**Fig. 6**). The resistivity measurements were taken down to the depth of 1 metre, since the distance between measurement frames was 2 metres. The most evident results were recorded in the areas E1, E3, and E5. All these sectors were situated between or near the ramparts. The linear anomalies of high values of resistivity were recorded in all

Fig. 5. Interpretation of results of the magnetic measurements (compiled by M. Bogacki, W. Małkowski).
Ryc. 5. Mapa interpretacyjna rezultatów prospekcji magnetycznej (oprac. M. Bogacki, W. Małkowski).

the areas. They were probably caused by technical features of construction of the fortifications.

In the sector E1, situated in the north-eastern part of the citadel, three linear anomalies were recorded. However, archaeological verification carried out in Trench I, directly adjoining the sector E1, revealed only two linear stone structures with stone debris between them. Most likely they were remains of a defensive wall (**Fig. 7**).

In the sector E3, two linear anomalies were recorded. Both were oriented along the N-S axis and placed maximally 7.5 metres from each other. Their presence confirms the results obtained from the magnetic prospection.

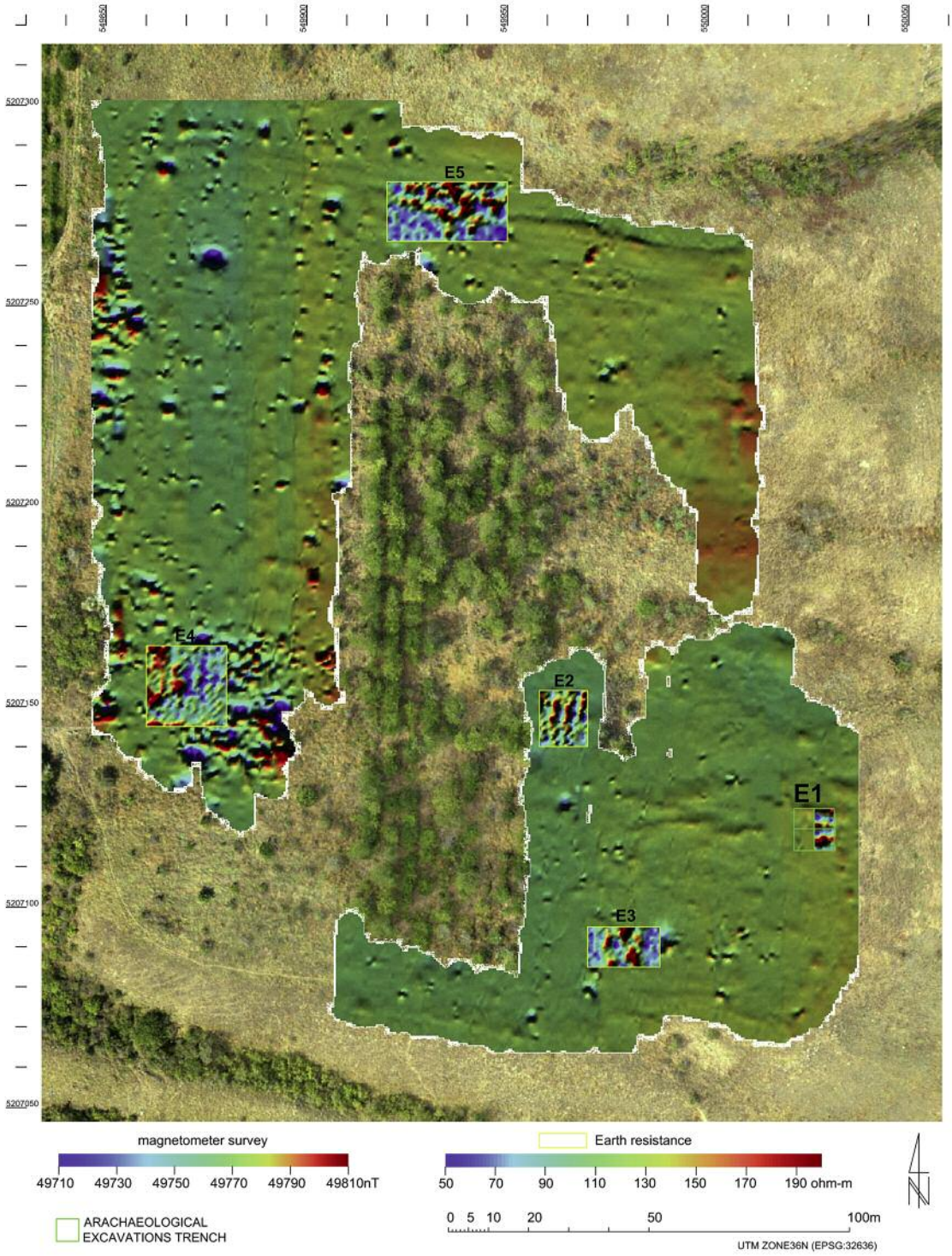

Fig. 6. Konsulovskoe hillfort. An ortophotomap with results of the magnetic survey and marked area of the resistivity survey (compiled by M. Bogacki, W. Małkowski).

Ryc. 6. Grodzisko Konsułowskoje. Ortofotomapa z nałożonymi wynikami prospekcji magnetycznej i zaznaczonymi obszarami pomiarów elektrooporowych (oprac. M. Bogacki, W. Małkowski).

In result of the electrical measurements carried out in the sector E5 two linear anomalies of high values of resistivity were recorded. The distribution of values on the map of the total vector of magnetic field intensity shows a clear break in anomalies. In this case, the resistivity method was complementary to the magnetic prospection, and detected the presence of stone constructions related to the structures covered by the rampart.

Moreover, the two areas were surveyed with soil resistivity measurements. The sectors E2 and E4 were selected for obtaining extended knowledge about anomalies registered there during the previous magnetic prospection. The

Fig. 7. Konsulovskoe hillfort. The western section of Trench I and a cross-section through the northern rampart of the citadel (photo by D.D. Nykonenko).

Ryc. 7. Grodzisko Konsułowskoje. Profil zachodni wykopu I. Przekrój przez północny wał cytadeli (fot. D.D. Nykonenko).

area E2 was located in the central part of the hillfort, where three point anomalies (X, XI, and XII) were recorded during the magnetic survey. The resistivity measurements detected four linear anomalies oriented along the N-S axis. The question of their anthropogenic origin would require archaeological verification.

The map obtained as a result of the electrical measurements in the sector E4 located in the south-western part of the hillfort, where two large groups of magnetic anomalies (I and II) were recorded, shows low resistivity in the eastern and high resistivity in the western part. Electrical anomalies do not coincide with magnetic ones, which indicates their different sources. It cannot be excluded that the magnetic as well as the electrical anomalies registered in the sector E4 reflect modern human activities.

A general conclusion after the geophysical non-invasive survey carried out during the 2015 season on the Konsulovskoe hillfort suggests that in this case the magnetic and resistivity methods were complementary. The electrical resistivity measurements were more informative for understanding remains of the stone constructions below the ramparts due to the non-magnetic properties of the local limestone. The magnetic prospection, in turn, proved valuable in case of searching and documenting buried features simultaneously with surveying of the entire part of the hillfort.

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Dmytro Nykonenko, Marcin Matera, Miron Bogacki, Wiesław Małkowski, Paweł Lech

Grodzisko Konsułowskoje, Ukraina. Badania nieinwazyjne w sezonie 2015

Należące do grupy tzw. grodzisk późnoscytyjskich/postscytyjskich stanowisko Konsułowskoje położone jest w pobliżu wsi Respublikaniec na prawym brzegu Dniepru. Badania archeologiczne grodziska rozpoczęte zostały w roku 2014 przez archeologów z Muzeum-Rezerwatu „Chortyca". W 2015 roku odbył się pierwszy sezon wspólnych polsko-ukraińskich badań archeologicznych z udziałem archeologów z Uniwersytetu Warszawskiego. Prace obejmowały wykonanie pomiarów geodezyjnych, zdjęć latawcowych oraz prospekcji geofizycznej terytorium grodziska. Ponadto rozpoczęto weryfikację archeologiczną wyników uzyskanych przy pomocy metod nieinwazyjnych.

Na podstawie wykonanej dokumentacji fotograficznej i przeprowadzonych przy użyciu aparatury GPS RTK pomiarów geodezyjnych stworzona została ortofotomapa, model pokrycia powierzchni, a także trójwymiarowy model grodziska Konsułowskoje.

Na terenie stanowiska wykonana została również prospekcja geofizyczna – magnetyczna i elektrooporowa. Pomiary magnetyczne wykonane zostały przy użyciu magnetometru cezowego Geometrics G-858G i objęły powierzchnię 2,5 hektara. Badania elektrooporowe pięciu obszarów o łącznej powierzchni blisko 1500 m^2 przeprowadzone zostały z wykorzystaniem aparatury ADA-7.