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NON-DESTRUCTIVE SURVEY OF A PREHISTORIC FORTIFIED HILL SETTLEMENT IN MARCHOCICE, LITTLE POLAND

ABSTRACT

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The site 2 in Marchocice in Little Poland has been already known to archaeologists for more than one hundred years. Recent application of different approaches and research tools helped acquire a new, startling picture confirming the unique cognitive potential of this spectacular areal of ancient to activities. The initial impulse to study presented site by field-walking and the successive non-destructive surveys were the promising results of archive aerial and satellite images analysis. This paper presents the results of large-scale spatial approach with the use of magnetic gradiometry as the fastest and the most cost effective geophysical technique capable of detecting a wide variety of anthropogenic transformations. The Marchocice research project can be an example of how in a relatively short time important data which has the potential to be a firm basis or starting point for further, detailed studies may be acquired and mutualy complemented.

Keywords: settlement, non-destructive investigations, Neolithic, Bronze Age, Early Iron Age
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INTRODUCTION

The Miechów Uplands are an integral part of the distinctive landscape of the Western Little Poland loess highlands. This fertile area has attracted settlement steadily since the Neolithic. It is charactierized by numerous archaeological finds and sites and hence has been a subject of interest for researchers for over 100 years. Currently, the area is thought to be relatively well recognized archaeologically in a positivistic point of view. However, the conducted research in Marchocice shows that by supplementation of traditional approach by new research methods and tools it is possible to discover new types of archaeological structures and to complement inner patterns of previously known components by new spatial data, that may be helpful in the process of reconstructing the prehistoric landscape and the settlement framework functioning within it.

The initial impulse to study site no. 2 (AZP 97-59/12) in Marchocice (Racławice commune) by field-walking (Fig. 1) and the successive non-destructive surveys were the promising results of archive aerial and satellite images analysis from open domain sources (Brejcha 2010, 65–66), which revealed a series of clearly visible linear, coaxial soil marks. These features were thought to indicate the existence of a fortified hill settlement (Fig. 2–3), which is inherently logical taking into account the terrain form.

GEOMORPHOLOGICAL DESCRIPTION AND NATURAL CONDITIONS

Based on surface artefact dispersion site no. 2 encompasses an area of about 5.5 ha and is located on the western edge of a prominent headland, which on its longer axis is situated on the NW-SE line (Fig. 7). The headland itself is isolated from the plateau in the northwest direction and in its highest point measures 333 m above sea level, while the principal part of its surface is relatively flat (Fig. 4–5) with an average height of 320 m above sea level. The headland in its widest point measures 240–250 m and has a length of 1.9 km. It's very steep, forested slopes face South, West and North directions and rise above the Ścieklec river valley even up to 50 m.

These characteristic terrain forms, separated by relatively deep valleys (Gilewska 1958, Fig. 1) are found in numerous places in the Miechów Uplands mezoregion. The dominant soil cover in the area is chernozem formed on loess which lies over chalky marl (Gilewska 1958, 10). Site 2 in Marchocice is deemed to be heavily eroded due to intensive agricultural cultivation, which drastically speeds various natural processes. The Miechów Upland is an area of intensive and long-term agricultural activities that can be dated to the Neolithic. It is most likely that with the arrival of the first farming communities, the study area was deforested and was heavily transformed (Kruk 1973, 132–149). Currently only 4.7% of the mezoregion is covered by forested areas (Gilewska 1958, 52).

HISTORY OF THE SITE AND SURVEY

Undoubtedly, the natural defensive quality of the terrain was the main factor that attracted prehistoric settlement. The studied area was known as an archaeological site at least since the early twentieth century. The headland's local names itself were an interesting element arousing scholarly attention. The western (lower) part is known by local dwellers as "Winnica"/"Vineyards", whilst the eastern (higher) part as "Grodzisko"/"Hill-fort" or "Stronghold" and at the northern foot of the hill there is a toponym "Podgrodzisko"/ "Under-hill-fort".

The first mention of the archaeological finds from Marchocice comes from an article by one of the pioneers of Polish archeology — Marian Wawrzeniecki, who published a fragment of a copper axe found in "Markocice" (alternative, historical name for Marchocice — Wawrzeniecki 1908, Fig. XXI:2; Szpunar 1987, 12, Fig. 1:10). Findings from Marchocice are also cited by Julian Piwowarski, who authored the first catalogue of archaeological sites for the Miechów district (Piwowarski 1935, 179). The archives of the Archaeological Museum in Kraków contain information from Gabriel Leńczyk, who visited the study area in 1948 and acquired information about finds from places called "Winnica"/"Vineyard" and "Grodisko"/"Hill-fort". In 1998 Marchocice were surveyed by Jacek Górski and Mirosław Zając from the Archaeological Museum in Kraków as part of AZP programme. The researchers encountered numerous traces of intensive settlement activity associated generally with the Neolithic, Funnel Beaker culture, Trzciniec culture, Lusatian culture and Przeworsk culture. Fragments of human skeletal remains were also registered which may indicate the existence of skeletal burials.

THEORETICAL FRAMEWORK AND RESEARCH STRATEGY

The territory of Poland is constantly exposed to heavy damage as deep ploughing has culminated in the removal of ancient field boundaries and many shallow or earthwork sites, leading to the destruction of all off-site activity areas. Due to the fact that distribution of habitation areas followed similar principles to current settlements, many archeological sites have been destroyed by intensive building investments and industrial activities (such as mining). This reality has forced a more systematic, though selective, approach to rescue the vestiges of archeological heritage and was also one of the main causes of the chosen (non-invasive) research techniques. The current situation in Polish archaeology requires efficient, time and cost-effective strategies that can lead to a valuation of archaeological heritage in a relatively short time. We treat these non-invasive investigations as the only viable possibility in archaeological research and management in light of the growing threats and financial constraints.

A non-invasive approach was chosen with regards to this research project. As has been emphasized many times, integrated approaches to archaeological prospection are necessary to generate reliable information for understanding and management of archaeological sources (see Cowley 2011, 51). Although individual techniques can have significant impact and potential, without coordination and integration these highly effective tools of landscape archeology will confine to be applied piecemeal without exploitation their various capabilities. As our past achievements from the Western Lesser Poland region showed, efficiency and mutual complementarity depends on the proper decision process in applied researched strategy.

Since 2009, when we started process of systematical categorization of Eastern Miechów Upland area by using free archival vertical images, a series of above mentioned successive non-destructive methods have been applied on selected landscape components. In order to verify the first few discoveries a small scale aerial survey was organized with the help of professional pilot and archaeologist Krzysztof Wieczorek. Four flights were carried out using ultra-light aircraft spanning a total of 14 flight hours (during mid-June 2010 and at the beginning of July 2011) resulting in the discovery of over 300 crop mark clusters (Fig. 13–15). Selected sites and discoveries are planned to be gradually studied with ground based techniques (field-walking, geophysics and test trenches). Among them the Marchocice site was the first such attempt. All of obtained data was vectorised and georeferenced in QGIS and by this way is progressively being constructed a comprehensive GIS based databasis of Miechów Upland ancient landscape.

FIELD-WALKING SURVEY

Field walking surveys combines with non-invasive surveys presented in this article were carried out in 2010 and 2011 by a research team consisiting of students and researchers of the University of Warsaw, led by Przemysław Dulęba. Surface artefact finds were to confirm the existence of prehistoric settlement, verify and complement previous finds and help to specify the site's range. During fieldwork, the mentioned linear objects could be easily located from the surface as they clearly manifested as dark brown fillings against the natural yellowish subsoil (Fig. 6). This may seem to be the effect of heavy soil erosion of the site. The exceptionally good visibility of archaeological features from ground level may have been caused by a high soil humidity caused by long term snow cover and rainfall. High field boundaries also revealed cross sections of ploughed out sunken features.

The results of the 2010 and 2011 field walking surveys partially confirm the earlier findings regarding the chronology of site nr 2 in Marchocice. Our findings confirmed the presence of intensive settlement from the Neolithic period, which is represented by pottery forms typical of the Lengyel — Polgar complex and Funnel Beaker culture which are predominant in the Neolithic assemblage (Fig. 8). Apart from pottery finds, 37 flint tools

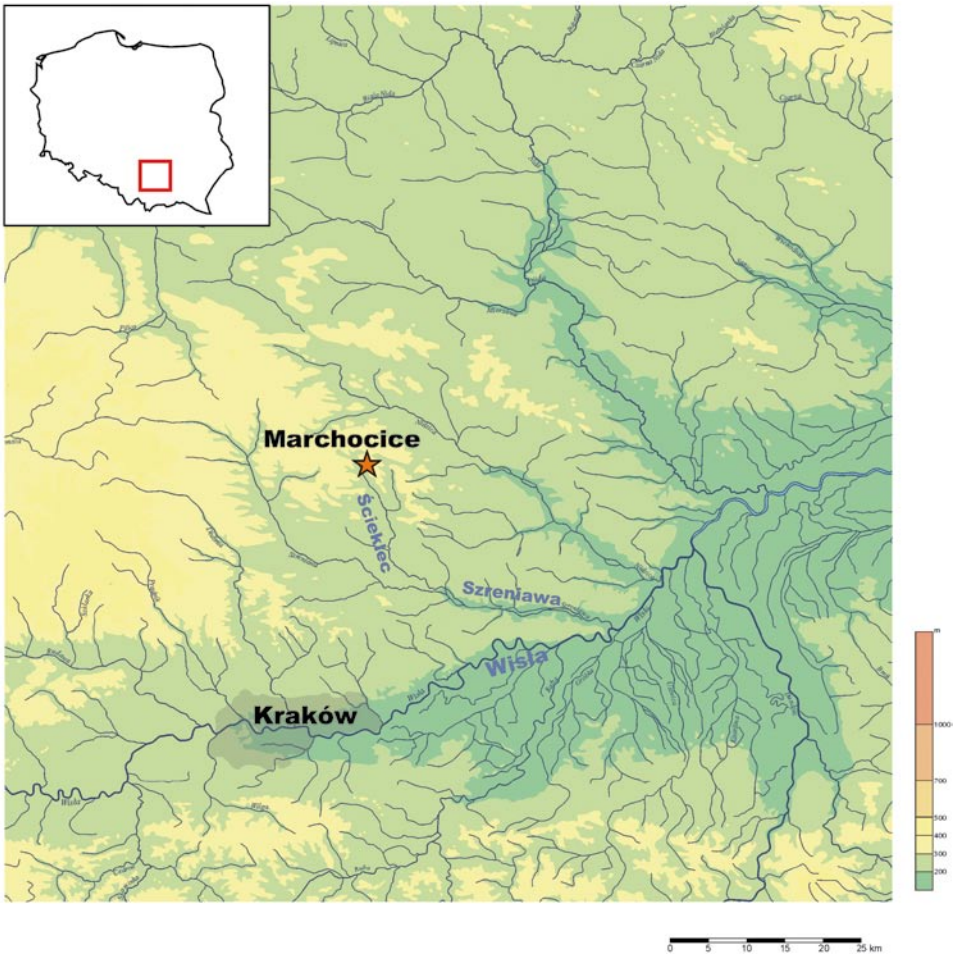

Fig. 1. Location of Marchocice
(elaborated by P. Dulęba, P. Martyński)

Fig. 2. Analysis of QuickBird (Digital Globe) satellite image from 7th September 2006 provided through Google Earth program — http://earth.google.com (elaborated by R. Brejcha)

Fig. 3. Interpreted linear features marked on QuickBird (Digital Globe) satellite image from 7th September 2006 provided through Google Earth program — http://earth.google.com (elaborated by R. Brejcha)

Fig. 4. Site 2 in Marchocice. View from the north
(photo by P. Dulęba)

Fig. 5. 3D-model of site 2 in Marchocice
(elaborated by P. Wroniecki)

Fig. 6. One of linear features observed during the surface survey carried out in 2010 (photo by P. Dulęba)

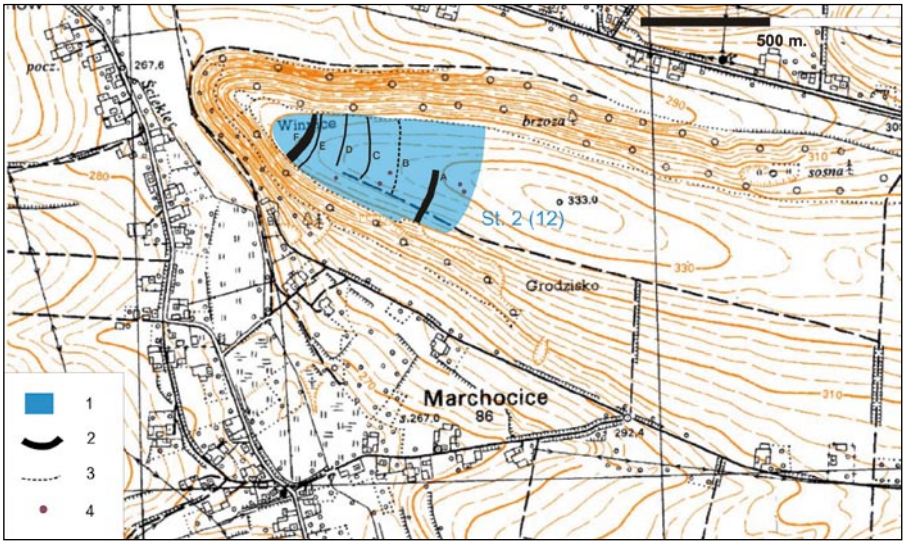

Fig. 7. Range of site 2 in Marchocice according to surface survey carried out in 2010–2011. 1 — range of the site determined on the basis of artefacts findings. 2 — linear features. 3 — hypothetical linear features. 4 — damaged features (elaborated by P. Dulęba)

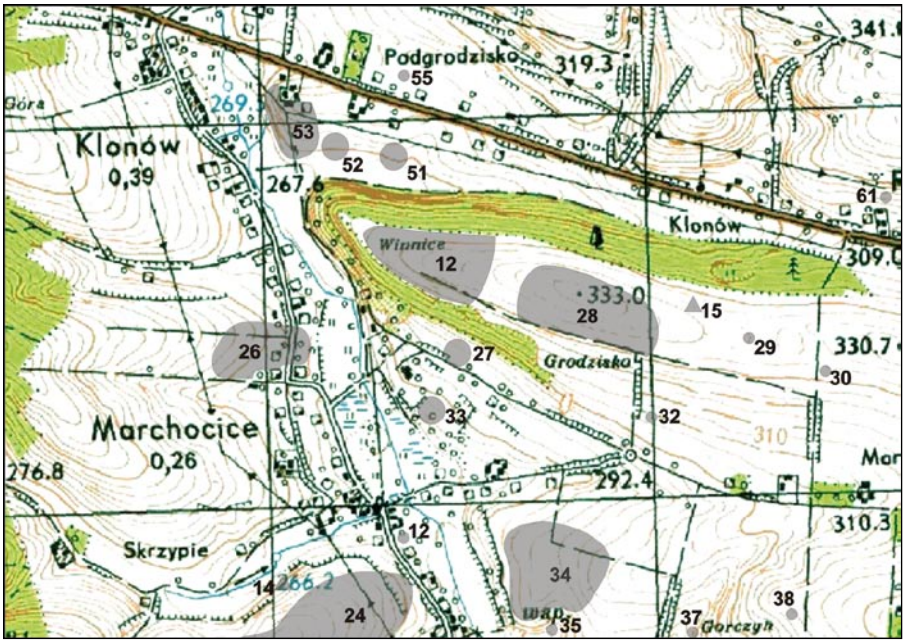

Fig. 12. Neolithic, Bronze and Early Iron Age settlement in the vicinity of Marchocice according to surface survey carried out in 2010–2011 (elaborated by P. Dulęba)

Fig. 13. Aerial photo of site 2 in Marchocice. View from the west (photo by P. Wroniecki)

Fig. 14. Aerial photo of site 2 in Marchocice. View from the north-west (photo by P. Wroniecki)

Fig. 15. Aerial photo of site 2 in Marchocice. View from the south-east (photo by P. Wroniecki)

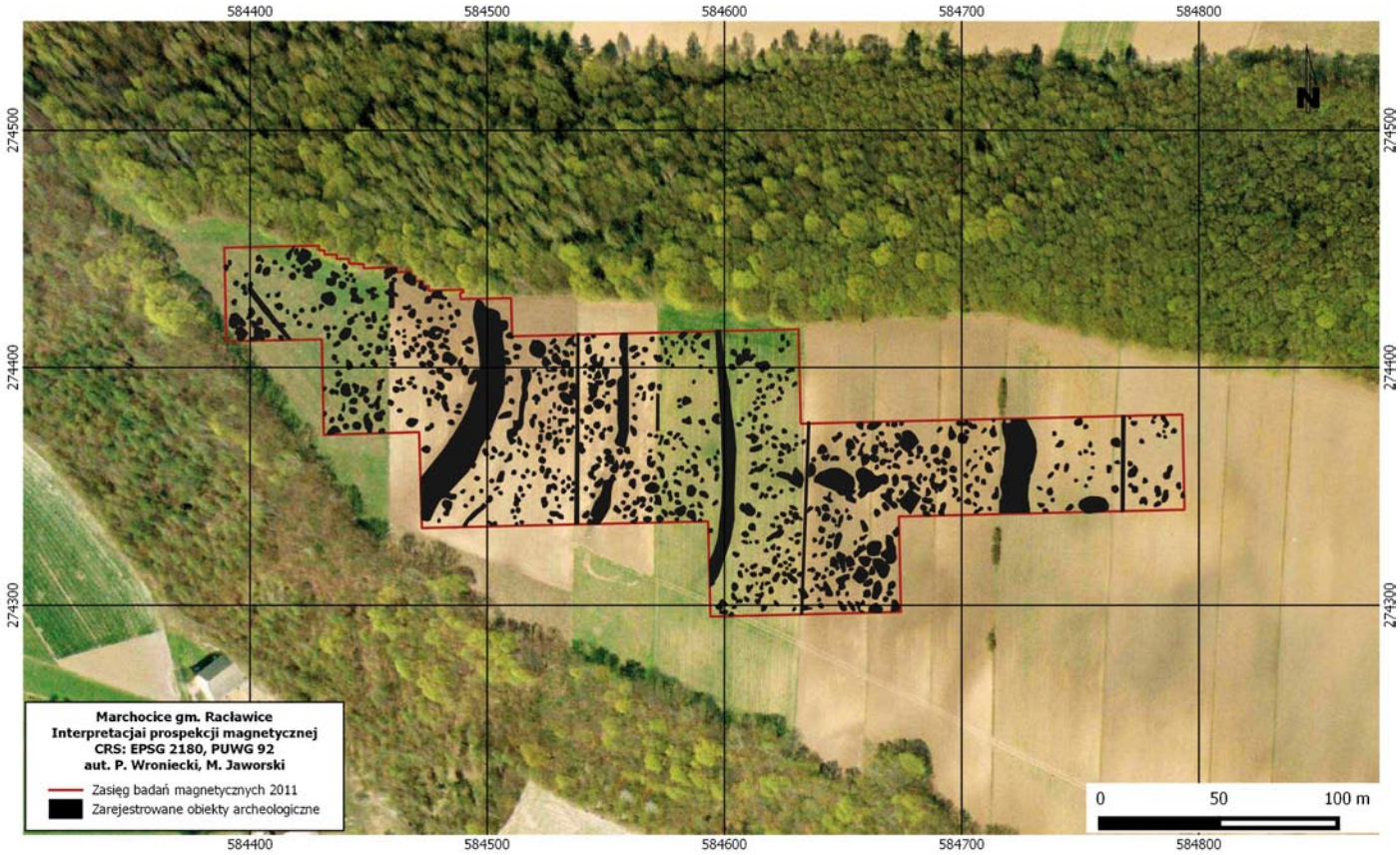

Fig. 17. Interpretation of magnetic prospection (elaborated by P. Wroniecki, M. Jaworski)

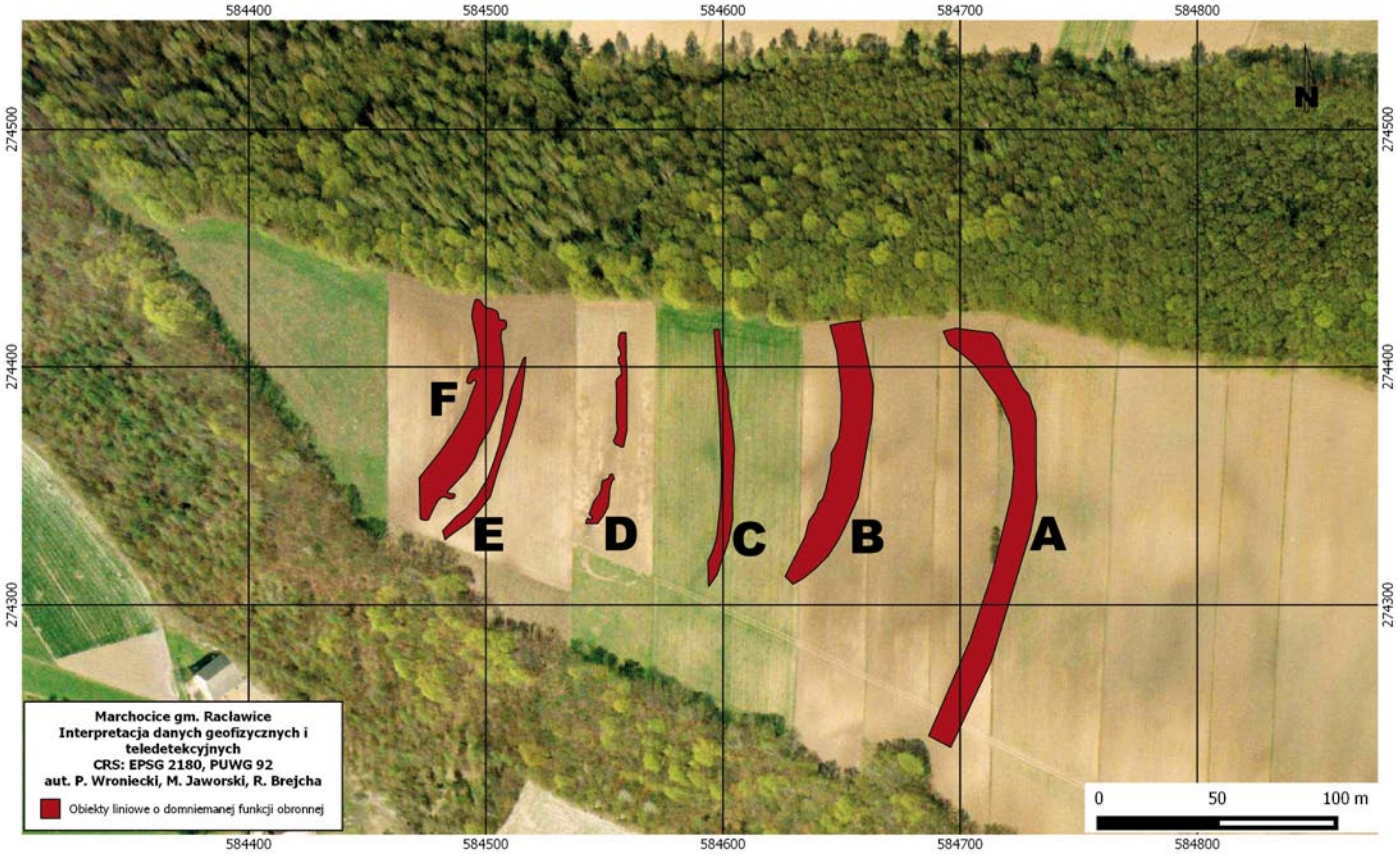

Fig. 18. Interpretation of geophysical and remote sensing data (elaborated by P. Wroniecki, M. Jaworski, R. Brejcha)

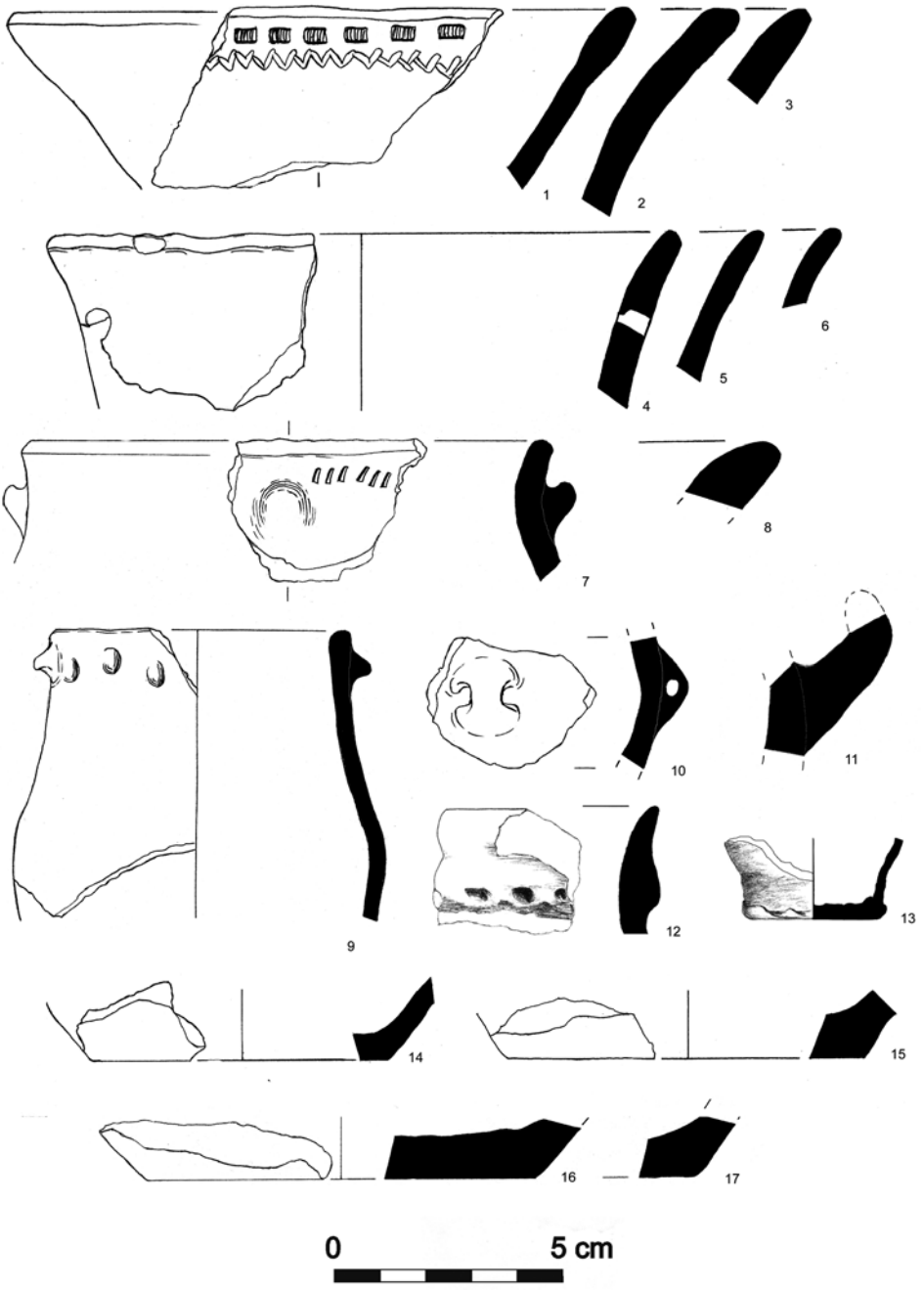

Fig. 8. Neolithic pottery from site 2 in Marchocice (drawing by P. Dulęba, K. Gubała-Kerneder)

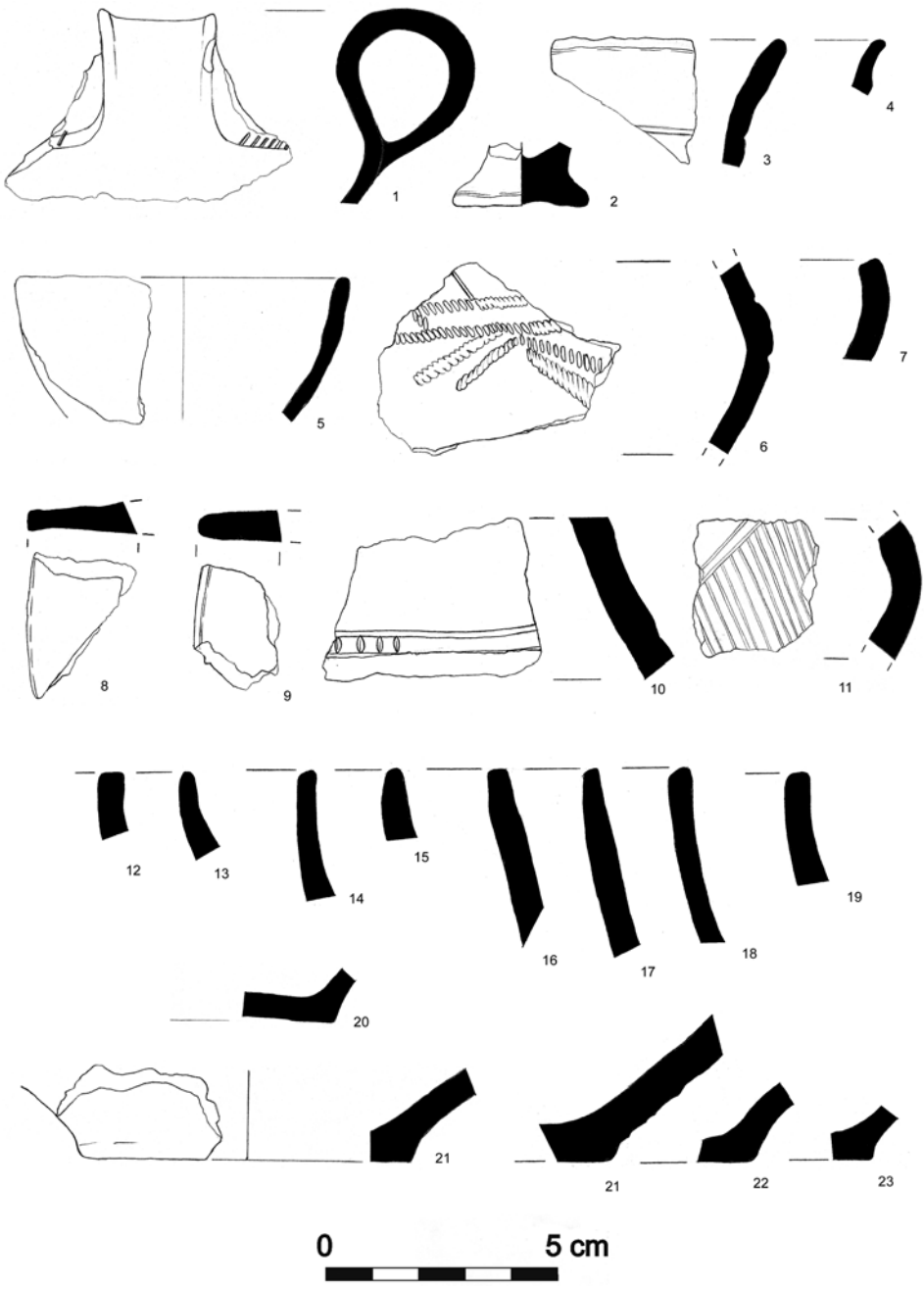

Fig. 9. Bronze and Early Iron Age pottery from site 2 in Marchocice (drawing by P. Dulęba, K. Gubała-Kerneder)

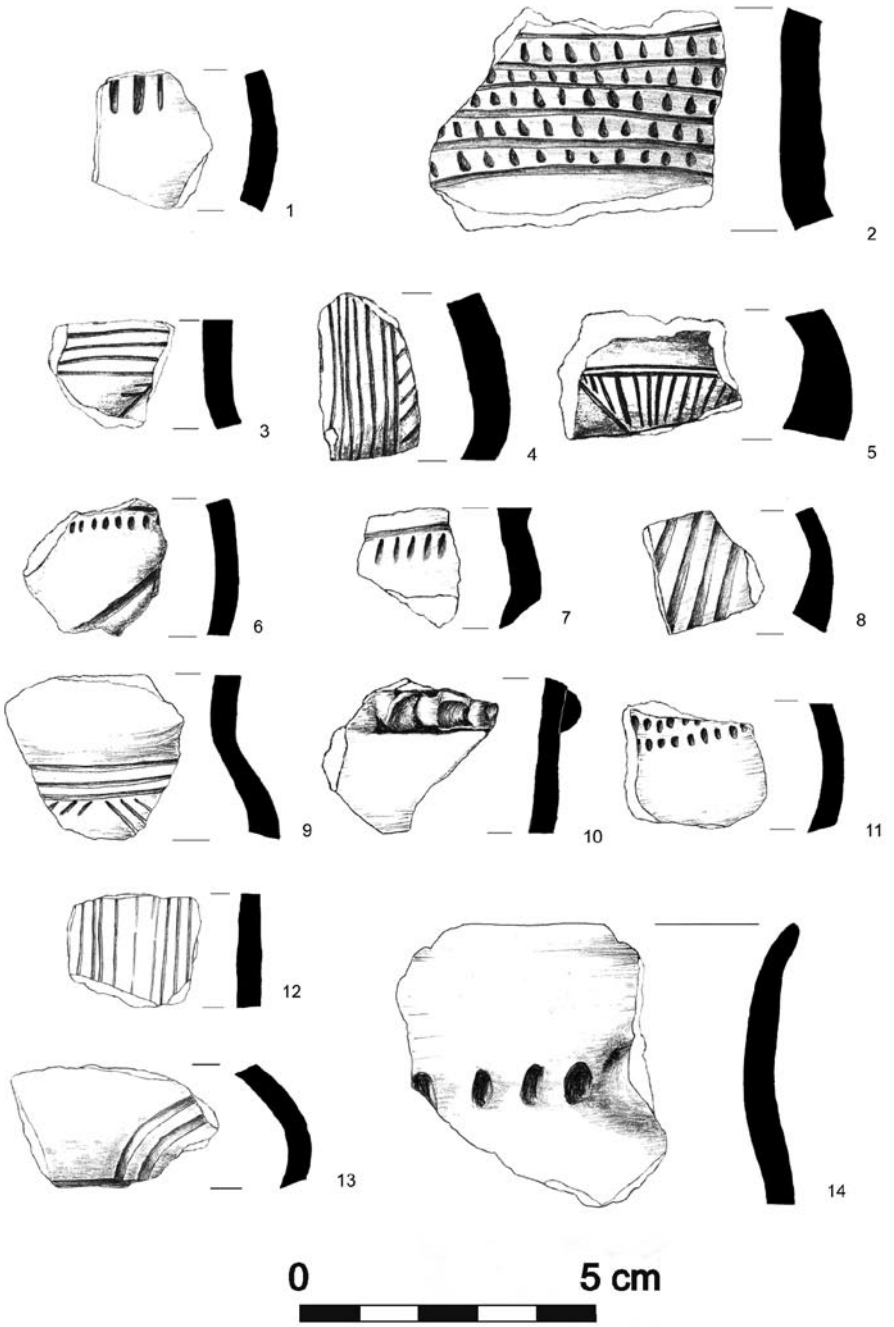

Fig. 10. Bronze and Early Iron Age pottery from site 2 in Marchocice (drawing by P. Dulęba, K. Gubała-Kerneder)

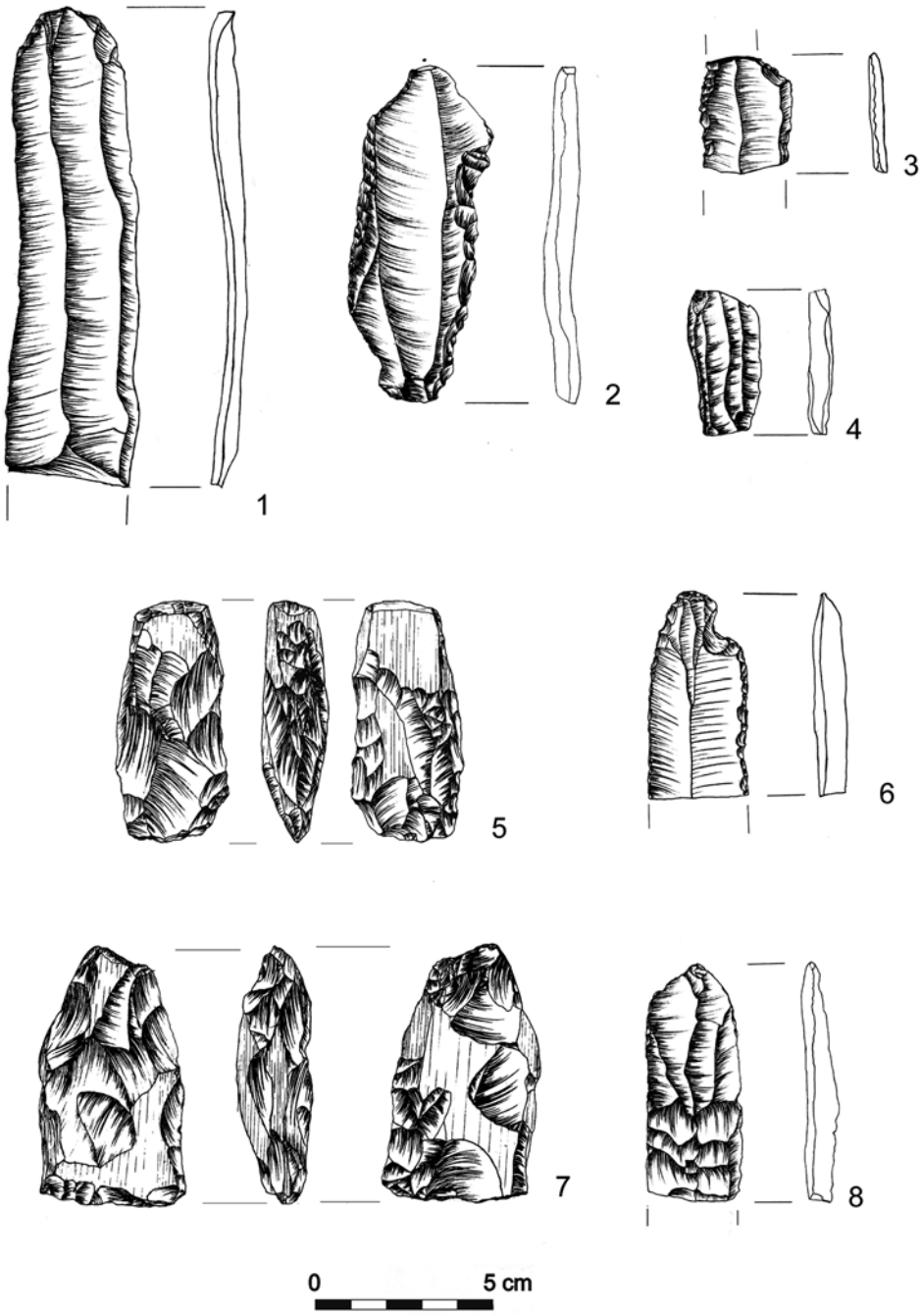

Fig. 11. Flint tools from site 2 in Marchocice (drawing by K. Gubała-Kerneder)

(Fig. 11) were obtained from the site of which the vast majority must also be associated with Neolithic settlement (flint artefacts were identified by Katarzyna Gubała-Kerneder of the Polish Academy of Sciences). Traces of Bronze Age settlement were also confirmed, however, by far the largest number of pottery finds can be attributed to the Lusatian culture of the Late Bronze and Early Iron Age. These finds accounted for 50% of all the material (Fig. 9–10). Among the large collection of pottery finds (in total 291 fragments), none may be attributed to the Przeworsk culture, which was faintly registered from the 1998 survey. This may have been due to an error. Additionaly in the Western Małopolska area, such headland sites usually lack traces of Przeworsk settlement. Lastly, 2 fragments of pottery vessels attributed to the late medieval period were found, which can be explained as a trace of casual exploitation of the studied fields in said period.

Additional field walking surveys were also conducted in the micro-region. Most of the previously registered site areas in the vicinity of the Ścieklec river were enlarged. This is further proof that site nr 2 in Marchocice was an integral part of an intensively settled micro-region (Fig. 12) from the Neolithic, through the Bronze Age and early Iron Age. In the light of presented study the most interesting are: sites 25 (AZP 97-59/26), 27 (AZP 97-59/28) and 33 (AZP 97-59/34) situated in Marchocice, Racławice commune and site 14 (AZP 97-59/53) situated in Klonów, Racławice commune. Site nr 27 in Marchocice is located approximately 100 m to the East from site nr 2 and occupies the culmination of a high point (333 m asl) dominating the nearest vicinity. The 2010 survey revealed that in reality this site may occupy an area of up to 4 ha. Based on pottery and flint tools finds the site may be dated to the Neolithic Funnel Beaker Culture and Bronze Age. In the South-East part of the site small amounts of human bone fragments were registered, which may indicate the existence in this place of a skeletal burial site. Taking into account the chronology, size and location of site nr 27 in Marchocice, it may be assumed, that along with site nr 2 it is part of an extensive settlement area dating from the Neolithic to the Bronze Age. Any further studies should treat these two sites as one feature within the landscape and field studies should be conducted simultaneously.

AERIAL PROSPECTION

In late spring of 2010, a team composed of Krzysztof Wieczorek (pilot) and Piotr Wroniecki (photographer) carried out a series of sorties over Western Little Poland, including the area of Marchocice (Fig. 13–15). Oblique aerial photos confirmed the existance of the relics of a large settlement on site no. 2 in Marchocice. Despite non-favourable weather conditions not conducive to this type of prospecting, numerous crop marks, located a very large number of alleged archaeological features (Fig. 14–15). These can be attributed to remnants of sunken features (resource pits and sunken houses). Aerial so called maculae photos also confirmed the existence of linear features visible on satellite

images, which, according to conjecture may be a residue extensive system of fortifications. Their impressive amount of crop marks confirms the supposition of a very intensive settlement occupation of the area bounded by the linear features. Interestingly the western edge of the Marchocice promontory, theoretically the best protected in the whole structure, is characterised by a small amount of such sunken features. This may be due to the fact that the place for a long period it was used not as arable field, but as a meadow.

MAGNETIC PROSPECTION

The geophysical technique applied in Marchocice was magnetic gradiometry. It was carried out with the use of a two sensor hand-held fluxgate system (Bartington Grad 601-2). The survey took place over the span of 4 days in 2011. Data was collected within 40 m grids and parallel traverses with a data sampling of 1 m x 0.25 m. An area of 3.5 ha was surveyed. Processing included the use of a destriping and interpolation (0.5 m x 0.5 m) algorithm (Fig. 16).

As the investigated area is covered by loess formations and valleys with accumulated miocenic clays is typical for this mezoregion. From the point of view of geophysical methods the presence of loess is an advantage, because this kind of eolian sediment is non-magnetic but on the other hand it is highly liable to erosion (see Fu *et al.* 2009) which causes many geological features to be visible as anomalies and therefore impedes geophysical interpretation. Typical land use of this region is plough cultivation which has been causing the destruction of cultural layers and upper parts of features, but on the other hand it exposed deeply sunken parts and turned over lower materials which could be well visible as soil marks and produce strong magnetic anomalies.

Due to limitations of field availability the entire terrain form unfortunately could not be surveyed. This situation, obviously undesirable, was caused by the presence of crops in the western part of the site and a young tree nursery school in the southern part. The geophysical prospection of the site in general verified the sites range and spatial make up known previously from aerial images and field walking surveys (Fig. 7, 16–17). 5 out 6 linear features known from aerial images were visible on magnetic maps (Fig. 18). Their fillings, visible from the surface and kite aerial photography which was conducted simultaneously as soil marks during the survey, were characterized by a magnetically enhanced soil. In the case of features C, D (approx. 6 m wide) and E (approx. 2 m wide), which are much narrower compared to the rest, we suggest a high probability that they are the remains of infilled ditches, once separating successive batches of the promontory settlement. As for features A, B and F, which are decisively wider (approx. 15 m wide) further investigation is necessary to designate their function. It is probable however that they are the remnants of the base of ramparts. In the case of feature B it is interesting to note that the magnetic survey, contrary to aerial imagery, failed to register this rather large feature. This

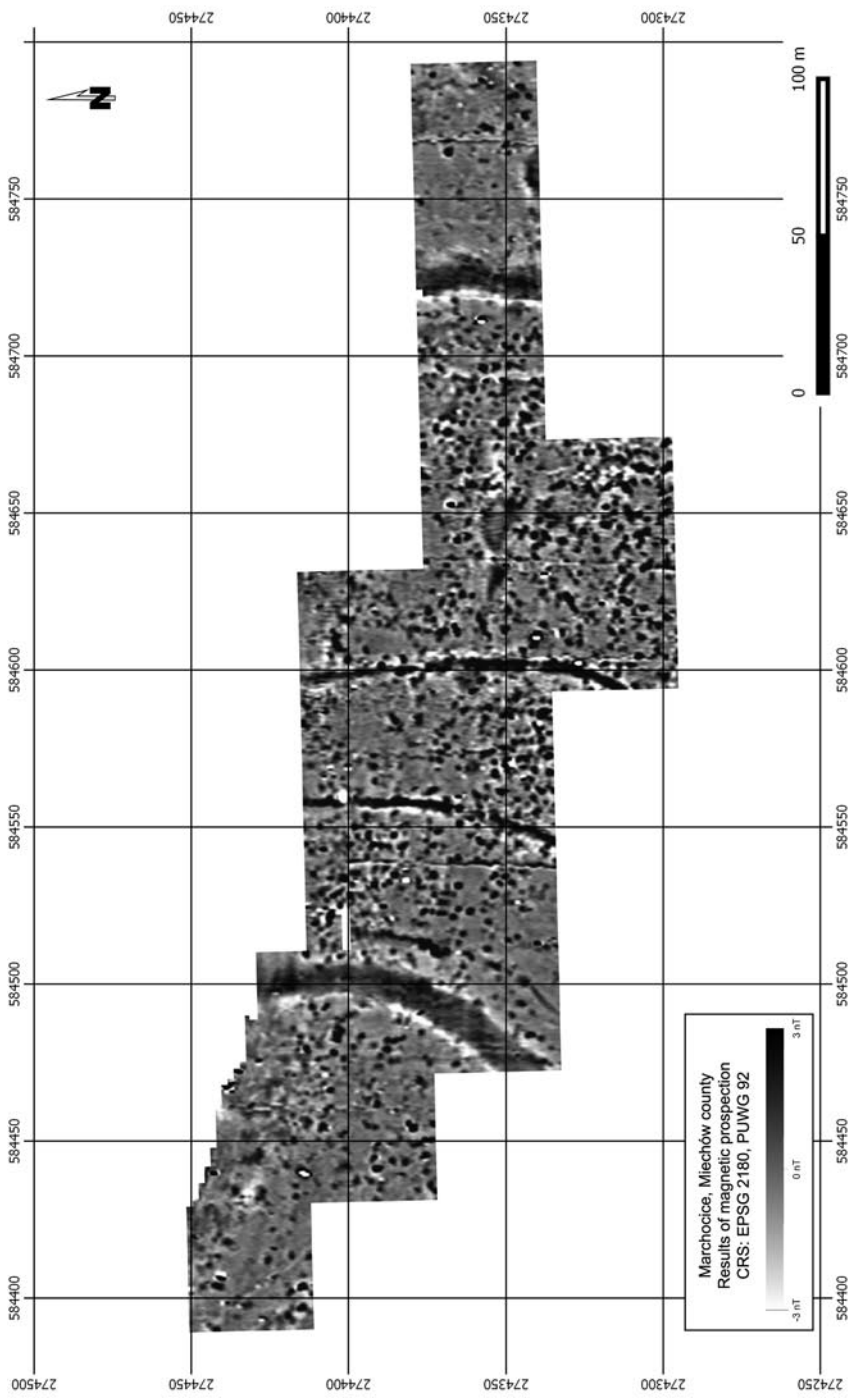

Fig. 16. Results of magnetic prospection (elaborated by P. Wroniecki, M. Jaworski)

is an interesting practical example of the need for data integration and limitations of various prospecting techniques. A question that needs further scientific research is why does this feature not generate even a slight magnetic signal. It may be hypothesized that this is caused by either a poor state of preservation, a different construction technique or a different cause of deterioration (dismantling *vs.* destruction) or, what is most likely, a mixture of these causes.

DISCUSSION

The currently available dataset clearly indicated that the Marchocice settlement is characterised by an extremely intensive and long term occupation. Chronologically, this occupation starts in the Neolithic and with roughly the same intensity continues through the Bronze Age into the Early Iron Age. This intensity is not only visible just through surface finds but also through a series of crop and soil marks and magnetic anomalies that reveal numerous dot features — so called maculae — with possible interpretation as storage pits, sunken houses etc., as well as a series of linear features.

The biggest, yet to be solved, mystery is the chronological attribute of these linear features, interpreted as traces of fortifications. It is unknown whether they may be linked to a specific archaeological unit or if they were developed steadily along with the various phases of settlement occupation. It is in this aspect that the non-invasive research will unfortunately not reveal a decisive conclusion.

Surface finds are able to give us the chronological range, i.e. the upper and lower limits, however, due to post-depositional processes it is not possible to determine to which period belong particular features. This kind of problem remains problematic in many polycultural sites, even with evidence of stratificated finds from their fillings. Contemporary archaeological theory has already left the positivistic conviction that sunken features contains only the finds from the period of their construction, nevertheless the formation processes bring considerable amount of residual and infiltrated finds (e.g. Kuna 2004, 322–323; Rączkowski 2005, 15). A certain idea about chronological classification is possible to obtain by comparison of analogies. Settlements, on which such characteristic defenses in the form of a coaxial series of ramparts, moats and palisades and accompanying settlements, are generally known from Polish territory. They are dated primarily to the Neolithic period and are associated in particular with the societies of the Lengyel-Polgar complex (Milisauskas, Kruk 1990; Kowalewska-Marszałek 1990; Grygiel, Bogucki 1997). An important aspect that needs to be taken into account is the spatial proximity (about 12 km) of Marchocice to the extensively excavated, famous fortified settlement site of the Lublin-Volhynia culture in Bronocice (Kruk, Milisauskas 1985). It is not excluded that the Marchocice finds may be linked to this taxonomic unit. The final piece of the puzzle is the large number of Lusatian culture surface finds. These cautiously point out as probable that the discovered linear fortifications may attributed even to the Halstatt period. Such forms are also well known from the larger vicinity (Puziuk 2010, Fig. 1).

SUMMARY

The application of non-invasive research methodes can be a significant chance of overcoming problems of archaeological research and heritage management. It may also break the existing helplessness regarding the vast amount of constantly growing (traditional) datasets in settlement pattern studies, which do not represent a purposeful new quality. We hope that the Marchocice research project can be an example of how in a relatively short time important data which has the potential to be a firm basis or starting point for further, detailed studies may be acquired and mutualy complemented.

Although the site 2 in Marchocice has been already known to archaeologists for more than one hundred years, recent application of different approaches and research tools helped acquire a new, startling picture confirming the unique cognitive potential of this spectacular areal of ancient activities. It is a considerable leap in data quality in comparison with the bleak interpretative possibilities of data gathered just through AZP (Polish National Archaeological Field-Walking Programme). In many cases, this AZP data, might be carried out thoroughly but often even very prosaic factors (manpower, crops, weather conditions, limited surface visibility) may generate critical detrimental effects. In the theoretical respect, it is important to realize that surface collections is not possible to consider as a direct reflection of past human activities, but rather as a reflection of contemporary state of preservation of subsurface archaeological structures caused by natural and cultural post-depositional processes (see Schiffer 1987). For this reasons it is very important to adhere to uniform standards that allow for specific research activities to be integrated and compared. An escape from the dogma of field-survey as the only reliable prospection method, which shaped and consolidated the traditional way of thinking about archaeological site among Polish archaeologists, has been proposed by Włodzimierz Rączkowski (2011). The new concept of co called AZP_2 is based on pilot projects which were realized in the Wielkopolska region where the standard AZP was completed more than ten years ago. According to that proposal, the settlement pattern studies within AZP should be supplemented with non-invasive methods as integral part of research strategy (Rączkowski 2011, 153–154). Although our project started earlier than AZP_2 standards were published, it seems that our multi-approach non-invasive survey corresponds with its philosophy.

In Poland are currently witnessing a situation without precedence in Europe, which gives contemporary archaeology a tremendous potential to expand and develop research approaches and understanding of past processes. The AZP is a globally unique huge database of surface collection prospecting carried out over the past 35 years nationwide. Despite drawbacks, the most prominent being the varying quality of the data, non-invasive techniques and methodologies in connection with AZP have the potential to dramatically shift and boost archaeological knowledge on a scale that has so far been unattainable.

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