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Erased by the Plough, Spotted from the Air. Remains of Earthwork Sites from Silesia

ABSTRACT

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Since 2012 south-western Poland has been subject to regular aerial prospection campaigns that covered a vast area of the Upper Silesian, Lower Silesian and Opole regions. Eight surveys were conducted in with a total of 44 flight hours during late spring and summer dates. Their primary aim was the recognition of Neolithic and Early Bronze Age communities and landscapes. Additional photographic documentation of known and newly discovered features from other chronological periods was also obtained. The article presents a selection of data from five medieval settlements (Borucin site 2, Chrzelice site 1, Gniechowice site 1, Komorno site 1, Stary Zamek site 6), whose common feature is their nearly completely leveled earthworks, which makes the presented aerial imagery a basic source of information about them. The potential of remote sensing approaches in the case of quickly deteriorating archeological terrain forms, although not used frequently, has numerous advantages especially in contrary to the still favoured destructive excavation strategies. A visible intensification of archeological site destruction due to all-round development of urban and rural areas has affected all types of archeological sites – also those characterized (until relatively recently) by unique and complex earthwork remains. This situation requires an adaptation of new protection strategies, as well as alternative cognitive and methodical schemes. The case studies presented in this paper are a final wakeup call showcasing the scale of the ongoing, countrywide, systematic destruction of important yet unknown or poorly researched archeological sites. The remedy in our opinion is the recognition of non-invasive remote sensing and geophysical techniques as primary research methods as they allow defining crucial elements, such as form, size, layout, or functional interpretation.

Key words: aerial prospection, remote sensing, fortified settlements, Silesia, Medieval

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Introduction

Since 2012 south-western Poland has been subject to regular aerial prospection campaigns that covered a vast area of the Upper Silesian, Lower Silesian and Opole voivodeships. Eight surveys were conducted in with a total of 44 flight hours during late Spring and Summer dates (Fig. 1: A). Aerial reconnaissance is an important element of

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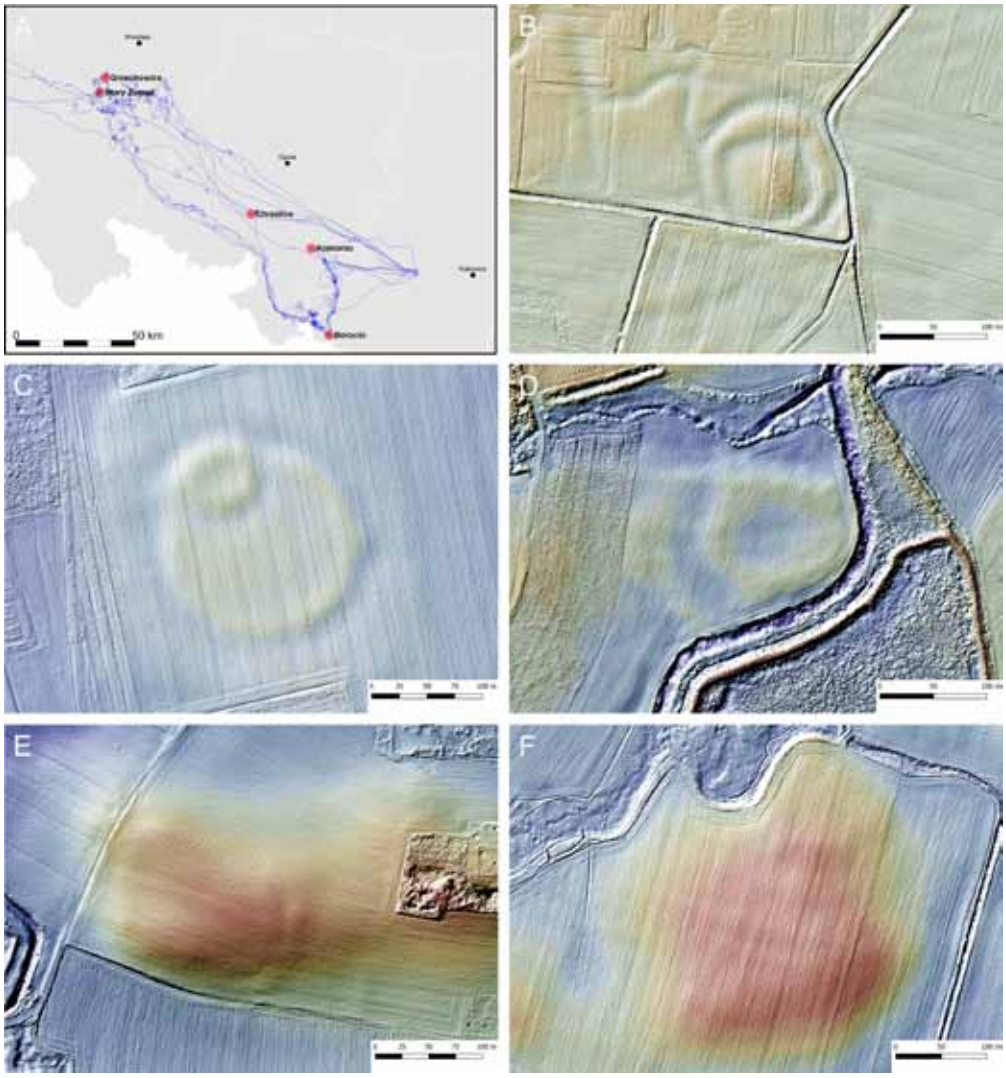

Fig 1. A) Location of archeological sites discussed in this paper with flight tracks from aerial prospection campaigns 2012–2017 and ALS derived hillshaded Digital Elevation Models (B – Borucin,site 1, C – Chrzelice, site 2, D – Gniechowice, site 1, E – Komorno, site 1, F – Stary Zamek, site 6). *Elaborated by. P. Wroniecki*

research projects related to the study of Neolithic and Early Bronze Age communities in Silesia (e.g. Furmanek *et al.* 2015). It was implemented based on the deep conviction of its potential, not only from the perspective of archeological site discovery but also in the understanding of transforming approaches to spatial forms, changes in the cultural

landscape, monumentality connected with the emergence of enclosed extensive timber and earthwork constructions and their social, cultural and economic role in past societies. Aerial prospection in this perspective is both a source of new data for the interpretation of these phenomena as well as an element of a more complex program involving the use of non-invasive and other analytical methods ranging from artifact analysis to more advanced geoarcheological and bioarcheological research. Such a comprehensive methodological approach allows creating complex and advanced (re)constructions of past realities. As a side-effect of landscape oriented aerial prospection is the photographic documentation of features and sites from chronological periods that evidently go beyond this scope, falling into two categories: new discoveries and new data about already known archeological sites. For instance selected Iron Age features such as small rectangular enclosures were researched with terrestrial geophysics and test trenches (Dulęba *et al.* 2017).

In the past the geographic region of Silesia was subject only to ad-hoc prospection flights conducted to monitor known and register new archeological sites (e.g. Otto Braasch, Dariusz Krasnodębski, Włodzimierz Rączkowski, Wiesław Stępień, Eugeniusz Tomczak, Mirosław Furmanek; Braasch 1999; Tomczak 2001; Krasnodębski 2005). Some surveys took place along with the construction of the Wrocław Motorway bypass, the S8 expressway (Rączkowski 2009) or for the purposes of documenting selected types of monuments (e.g. medieval strongholds and castles) which were the basis for popular science publications (e.g. Gorgolewski, Tomczak 1996; Tomczak 2012).

The application of aerial prospection in the case of Silesia seems to reflect the wider situation in Polish archeology. Twelve years have passed since the publication of "Biskupin ...and what next?" dedicated to the promotion of remote sensing in archeology, which is freely available for all who are interested as an open access work (Nowakowski *et al. (eds.)* 2005). It included more than 500 pages detailing varied views of individual authors, international case studies and guidelines on implementation. These form a powerful compendium of knowledge about the capabilities of non-invasive prospection. It is however worrying that not much has changed with regards to the popularization of aerial prospection. Its use in research projects as well as cultural heritage strategies is still rare. There have been notable exceptions, for instance by archeologists from Poznań (e.g. Nowakowski, Rączkowski 2000;

Maciejewski, Rączkowski 2005; Prinke *et al.* 2005; Dernoga *et al.* 2007), systematic projects in Lesser Poland (Wroniecki, Maksymowicz 2014, Wroniecki 2016; 2017) and several projects in other parts of Poland (e.g. Kobyliński *et al.* 2000; 2005; Miałdun, Mirkowska 2001a; 2001b; Krasnodębski 2007; Stępień 2005; Sosnowski 2005).

It is particularly worrying that remote sensing approaches have not found their way into standard heritage management strategies. In a key document related to the currently ending *National 2014–2017 Monument Protection Programme* (pol. *Krajowym programie ochrony zabytków i opieki nad zabytkami na lata 2014–2017*), aerial survey as well as other non-invasive methods are not once mentioned, although AZP (pol. *Archeologiczne Zdjęcie Polski*, a national programme aimed at recognition of archeological sites with the use of field-walking) is mentioned over 30 times.

The case studies selected for this article are effects of aerial prospection aimed at monitoring known archeological sites for the purpose of future research with the use of non-invasive methods (Borucin, Chrzelice and Komorno)[1]. The rest (Gniechowice and Stary Zamek) were registered by chance as they are located in the vicinity of known Neolithic sites. They also fall into the category of monuments eagerly studied in Polish archeology – medieval (?) strongholds. Medieval fortifications in general have often been the target of aerial documentation and can be described as one of the most eagerly photographed monuments beginning in the 1920's (e.g. Hellmich 1926; Kowalenko 1938, Rajewski 1962). Most work was done however on sites with clearly visible and well preserved earthworks. Aerial images served mostly as a visual overview without any scientific reflection or for popular publications and albums (Gorgolewski, Tomczak 1996; Tomczak 2012).

In order to show the other side of aerial prospection (one more related to using aerial imagery as means of studying the past) we would like to present five case studies of different fortified settlements in terms of form and chronology in this preliminary report paper: Borucin (site 2, Racibórz district, Silesian voivodeship), Chrzelice (site 1 Prudnik district, Silesian voivodeship), Gniechowice (site 1, Wrocław district,

[1] Borucin and Chrzelice have already been the subject of multi-faceted non-invasive studies conducted by Maksym Mackiewcz nad Bartosz Myślecki. The results have been published (Mackiewicz, Myślecki 2014, 2015a, 2015b)

Lower Silesian voivodeship), Komorno (site 1, Kędzierzyn-Koźle district, Opole voivodeship), Stary Zamek (site 6, Wrocław district, Lower Silesian voivodeship). Their common denominator is their considerably poor state of preservation caused primarily through agrotechnical activities. This makes the aerial imagery presented here a basic source of information about them – not noticeable from the ground and often unreadable in precise ALS derivatives.

Borucin, site 2

The archeological site in Borucin was discovered by Max Hellmich in the interwar period (Kaźmierczyk *et al.* 1977, 66–69). In the 1940's Gerhard Fock (more about G. Fock's activity see Chmielewski 2014) presented a schematic plan with a simplified reconstruction of the monument as a tower located on top of a mound (Fock 1942). Field-walking was conducted in 1968 (A. Kudła) within the AZP framework. In 1998 excavations were carried out by T. Kosmala. Numerous finds, including medieval militaria, were found in soil layers, dating the monument between the 13th–14th centuries. The lack of architectural remains of any sort was interpreted as a result of significant destruction of the archeological site. The results and conclusions of these excavations became one of the elements of polemics concerning the methods of protection of medieval strongholds (Tomczak 2000). In 2013, non-invasive studies including magnetic gradiometry prospection and ALS data analysis were performed by Maksym Mackiewicz and Bartosz Myślecki (Mackiewicz, Myślecki 2015a).

Aerial images (Fig. 2) of the area were acquired in 2008 (27.06), 2013 (7.07), 2014 (7.07), 2015 (25.06) and 2016 (6.07). The area is located in the center of the rather wide Psina valley (Fig. 1: B). The current riverbed is a few hundred meters to the north and northeast from it. Aerial photographs indicate the presence of moats/ditches surrounding the remains of the almost leveled central earthwork from the east and south. Its western part is used as an arable field, and the eastern part, although originally used as a meadow, is also nowadays also a plough field, which undoubtedly contributes to accelerating the process of destruction of the earthwork (the eastern meadow and western arable land based on ALS analyses clearly present a different state of preservation; Mackiewicz, Myślecki 2015a).

Fig 2. Borucin, site 1, Racibórz district: 1 – moats/ditches, 2 – former riverbed *(photo by. P. Wroniecki)*

Visible changes in crop color and growth (Fig. 2) clearly reveal the shape of the earthwork and also ideally illustrating its quite poor state of preservation. It consists of two concentric moats surrounding a quadrate, fairly regular plateau. In between these moats an earthwork embankment was located. In certain details (e.g. size, plan), the form visible from a bird's eye view differs from the one published so far (Kaźmierczyk *et al.* 1977, 66–67). A detailed magnetic gradiometry survey was carried out, which revealed additional remnants of three structures located in the centre, possible timber constructions and perhaps elements of the fortification system (Mackiewicz, Myślecki 2015a). The comparison of their layout with the location of 1998 trenches reveals that excavations missed their mark. Aerial images and ALS data point to a significant symbiosis of the man-made and natural structures. This concerns primarily the adaptation of the old river system as a defensive element and partly transformed into a moat.

Aerial imagery also allows some correction of the location of the archeological site. The AZP map (grid 103–39) and a more precise KEZA (archeological site evidence card) locate it in fact to the northeast beyond the factual location of the stronghold!

Chrzelice, site 1

The Chrzelice archeological site is still, despite years of erosion and leveling through agricultural activities, one of the most magnificent early medieval fortifications in Silesia, (Fig. 1: C). The earthworks are easily discernible on the ALS data even though their relative height does not exceed 50–90 cm (Mackiewicz, Myślecki 2014, 170). Its initial discovery was published by Max Hellmich (1930, 47) before World War II. In 1967 Z. Bagniewski conducted small test trenches (Bagniewski 1967, 26). Another series of survey excavations were carried out by K. Macewicz in 1996 (Macewicz 2000). For many years it was described incorrectly as located within the bounds of the Pogórze village and as such can be found in specialist literature (e.g. Kaźmierczyk *et al*. 1977, 395–398). In 2012 analytical surface artifact collection survey, magnetic gradiometry, ALS data analysis and archival queries were conducted as part of a research project lead by M. Mackiewicz and B. Myślecki (Mackiewicz, Myślecki 2014; 2015a; 2015b). The entire

Fig 3. Chrzelice, site 1, Prudnik district: 1 – inner bailey, 2 – *suburbium*, 3 – entrance *(photo by P. Wroniecki)*

complex can be dated to the Early Medieval (8th–10th and 10th–11th centuries, Kaźmierczyk *et al.*, 397).

Extremely clear crop marks indicate the existence of two circular structures, a small oval inner bailey/acropolis located within the north-west bounds of a larger ovaloid structure. These structures take up an area of around 3 ha (Fig. 1: C). The feature is extremely favourable for aerial prospection, as uniform crops and phenomenally visible crop marks reveal much detail about its structure. Particularly discernible are fortification elements, especially the moat fill and ramparts and in the case of the 2015 survey (Fig. 3: A–B) the course of an embankment's stone construction (registered in previous research). Although crop marks in a spectacular manner and high detail reveal the general layout of the feature, no new information has been acquired with regards to any interior structures (Fig. 3). In this case more details have been provided by magnetic gradiometry (Mackiewicz, Myślecki 2014; 2015a; 2015b). Aerial images also bring information about the surrounding environment, its natural context and landscape changes, both in the periods preceding the formation of the stronghold and in the subsequent centuries after its functioning (e.g. remnants of roads, polygonal structures, relics of ponds and reservoirs). In fact these changes have been very significant. For instance complementary analysis of archival data and historical maps (Mackiewicz, Myślecki 2014; 2015a; 2015b) show that the stronghold was at some point an insular feature, located on a lake that was drained in Modern times. This area is very grateful target for non-invasive prospection as the number and repeatability of the various types of anomalies and crop marks related both to human activity at different times as well as to the geological past of the area.

Gniechowice, site 1

Gniechowice are known from post-war research and several surface surveys conducted after 1945. In 1876, a hoard of silver coins and ingots dating to around 990 AD was discovered in then existing rampart earthworks. A 1968 catalogue publication "*Grodziska wczesnośredniowieczne województwa wrocławskiego*" informs that the archeological site has been leveled by ploughing, although before World War II its wood-earthen constructions were still clearly visible in the field (Kaletynowie, Lodowski 1968). On the sole basis of terrain configuration it was supposed that the

Fig 4. Gniechowice, site 1, Wrocław district: 1 – stronghold, 2 – *suburbium*, 3 – entrance? *(photo by P. Wroniecki)*

fortifications were oval in form. During field walking conducted in 1982 within the AZP framework pottery material was noted on the surface. Research conducted so far dates the feature to the 9th to 10th centuries.

In the context of the available very general data, a large amount of new information is provided by aerial prospection surveys conducted in 2014 (Fig. 4). Irregular curvilinear and ovaloid crop marks reveal a previously unknown outline of a fortification system mostly of infilled moats. It can be interpreted as a form of an inner and outer enclosed area consisting of about 120×150 m and adjacent to the western subdivision, the largest of which is approximately 190 m (Fig. 1: D). The shape of the feature seems to be adapted to the course of nearby small rivers, the Czarna Woda and a nameless small stream. Crop marks indicate that it was enclosed from all sides.

ALS data indicates that the object is not yet fully leveled (Fig. 1: D). The relative height difference between the possible moat feature and the top of an embankment is on average about 0.3–0.4 m, and in the best-preserved part it slightly exceeds 0.6 m. In the aerial photos there are no crop marks that could be associated with interior constructions. Analysis of the data is hindered by features associated with the geology of the Czarna Woda valley. Aerial data also documents a high concentration of mostly round crop marks on the northern side of the stronghold, behind the nameless watercourse (Fig. 4). Their quantity indicates the presence of an extensive archeological site, although not necessarily chronologically and functionally connected with the stronghold. This archeological site is a new discovery and does not appear in the archeological record (AZP).

Komorno, site 1

Komorno was first mentioned as an archeological site in the 19th century and was the focus of field walking research several times in the interwar period, conducted by M. Hellmich, G. Raschke and after 1945 by M. Gedl, J. Kaźmierczyk and K. Macewicz (Kaźmierczyk *et al.* 1977 201–203). In 1971 and 1977 excavations were carried out by M. Parczewski (Parczewski 1976). On the basis of finds, it is dated broadly to the 8th–9th centuries. It was hypothesised to be a possible Bronze Age feature – based on Lusatian Culture pottery finds – but data from excavations precluded this. It is located at the top of an oval

Fig 5. Komorno, site 1, Kędzierzyn-Koźle district: 1 – moat/ditch *(photo by P. Wroniecki)*

elevation (Fig. 1:E). Remains of defensive structures in the form of a rampart and moat are almost completely leveled. It is indicated that the embankment was on the exterior of the ditch. Schematic plans show them as an irregular oval expanding in the western part. On some archival maps (e.g. *Urrmesstischblatt*, 1:25000, 1825, Blatt 3364 *Cosel*) it is marked as a "Schwedenschanze" within a forest. On this map there is also a quadrilateral structure, which does not correspond to the form of current knowledge about its form (trace of some later construction?). Intense forest cultivation practices began in the 1930s and in the following years led to almost a complete degradation of archeological earthwork structures (in 1930 the remnant of the moat was still referred to as a "deep ditch").

In aerial photographs from 2015 and 2017, the elements of the fortification system were clearly visible as crop marks (Fig. 5). These allowed an initial reconstruction of the stronghold's form through the characteristic moat. The object is uniquely univocal, without additional elements of the fortification and was adapted to the shape of the terrain on which it was located. Inside the enclosed area there are singular features, which may be related to the presence of settlement features, but the available data does not allow determining the layout of the area within the enclosure.

Stary Zamek, site 6

Site 6 in Stary Zamek is located within the Czarna Woda Valley, surrounded by a system of creeks: the meandering Czarna Woda on the north-western and western sides and irrigation ditches (Fig. 1: F). In 1973 and 1974 J. Lodowski (based on his excavations) payed attention to the remarkable cognitive value of this site for Early Medieval studies. In addition to pit houses and storage pits, three parallel ditches were excavated and numerous ceramics and other finds (including spurs dating back to the 9th century) within them. Most of these date to the 8th–9th centuries. Sparse finds of Funnel Beaker Culture and La Tene were also noted (Lodowski 1974; 1975; 1976).

Aerial surveys in the area were conducted in 2013 (July 7) and in 2014 (April 8 and July 6). In 2013 a crop mark revealed a moat that cut off the promontory from the south and enclosed an area of about 6 hectares (Fig. 6: A). Within it there are numerous mostly round or

Fig 6. Stary Zamek, site 6, Wrocław district: 1 – outer moat/ditch, 2 – pit features, 3 – inner moat/ditch *(photo by P. Wroniecki)*

oval maculae, which are related to possible past settlement activities (pits). A smaller cluster is located also on the outer part of the ditch. Images acquired in the spring of 2014 did not provide new and relevant information due to poor crop cycle (Fig. 6: B). Only in the northern part a bright light belt of soil is visible in the form of a circle section reflecting the configuration of the terrain here. The images taken 3 months later reveal more interesting data (Fig. 6: 3–4). In addition to the ditch noted in 2013, a system of two moats: broader (about 8 m width) and narrower (about 2 m wide) is visible within the depression (visible as a soil mark feature in photos from April 2014. They cover an area of about 1.5 hectares. It is not excluded that drainage ditches could have partially damaged the fortification system from the East and North.

This complementary data obtained during a series of surveys reveals a complicated and large-scale feature consisting of a smaller part most probably surrounded by a double ditch and palisade and an adjoining, larger extensive structure. Although it is not possible to completely exclude an earlier chronology (e.g. Neolithic or Bronze Age), due to its morphology and location it seems very unlikely. Aerial prospection data proves that the Stary Zamek site should be considered as a previously unknown closed settlement site with a completely leveled fortification system. This interpretation is upheld by archival excavation data from the 1970s, during which fragments of ditches and militaria finds were documented.

Discussion

The presented case studies show a considerable potential of aerial images as sources of new and valuable information about earthwork defensive structures in various phases of degradation. It is worth stressing that in one case (Stary Zamek), despite some suggestive discoveries made during excavations (Lodowski 1974; 1975), the archeological site was then not interpreted as a remnant of a possible stronghold – adhering to the idea that "no new hillforts/strongholds are left to discover". Examples of such observations are multifold (e.g. Spychała 2006), which is especially noticeable particularly in recent years, mainly due to the widespread use of publicly available remote sensing data sources (e.g. www.geoportal.gov.pl, Google Earth, etc.) which have now clearly debunked the lack of "new" earthwork sites left for detection. The

number of such discoveries is significantly increasing, activating not only professional archeologists but also a large group of hobbyists.

The observations made for some of the presented archeological sites indicate that there is a need for regular prospection based on a series of systematic aerial surveys. This is due to, among other things, the variability of conditions influencing the appearance of crop and soil marks. This is particularly evident on the example of Stary Zamek, where during the 2013 summer survey a linear feature was identified and interpreted as an external moat along with numerous traces indicating the presence of pit features. In turn, images taken in the following year especially in July enabled the identification of an internal fortification system. Similarly, in the case of Chrzelice, where the most significant information was acquired in 2015, where thanks to crop marks various elements of the fortification system can be identified, such as the moat, the course of stone architecture of the external rampart, location of gate entrances and individual building elements. Images from subsequent surveys in 2016 and 2017 did not provide such abundant data.

Information obtained through a series of aerial surveys is also extremely valuable from the perspective of cultural heritage preservation, especially in the era of modern agriculture, infrastructural and industrial development. Repeated multi-year prospecting facilitates the control and monitoring of archeological sites. For example the observations made in Borucin indicate that in 2015 a part of the stronghold used as a meadow was converted into arable land, which will undoubtedly accelerate the feature's degradation (e.g. Tomczak 2000). It is also worth mentioning that it was often possible to notice considerable land use changes (infrastructural investments, new buildings) in areas directly adjacent to earthworks that were not always accompanied by appropriate activities related to the protection of monuments or rescue research.

Until recently the information about most of the presented archeological sites was obtained through small-scale excavations and in this way was mainly related to chronology based on the analysis of finds, stratigraphy, form, size or structural details of their fortifications. The data that we owe to aerial imagery has enabled us to often enrich our knowledge about them and our impression is that the cognitive value of remote sensing data is often greater than the destructive and often times accidentally located excavations. The progressing destruction of these archeological sites is so great that even analysis of ALS data

would not be particularly useful here. In addition, the implementation of complementary non-invasive research using geophysical methods and other remote sensing data or archival data sources based on the analytical capabilities of spatial information systems (GIS) allows to obtain unique and useful knowledge. The integrated approach enables multi-faceted identification of archeological heritage resources, and provides a wealth of detailed information about the places being investigated as well as their context. An example of such a methodology, apart from the mentioned studies of Borucin and Chrzelic (Mackiewicz, Myślecki 2014, 2015a, 2015b), has also being carried out for several years in the research projects in Central Poland (for example Sikora *et al.* 2015).

It should be noted that not only earthworks undergoing degradation and destruction should be the aim of aerial prospection and monitoring. We have noticed, however paradoxical, that the worst preserved or even extremely leveled sites often yield large amounts of valuable new information contrary to their better preserved counterparts. The ongoing destruction process is conducive to the emergence of crop and soil marks. This process however also has its end, which is the complete destruction of the monument, and thus the disappearance of factors affecting the development of any information that can be observed from the air.

It has often been pointed out that the widespread use of aerial prospection and the application of geophysical methods, especially on a larger scale, may ultimately contribute to a new understanding of archeological monuments – not only confined to a circle on a map but related to the broader cultural landscape context (see Nowakowski, Rączkowski 2005, 16–17; Kiarszys 2005). The designation of archeological sites in Poland based on the dispersion of surface material such as pottery sherds is often unrealistic. Even ceramics, which are sometimes treated as a particularly lasting category of finds, are subject to erosion and may eventually vanish. The consequence of this can be their modest representation or even the total absence on the surface. In such situations according to the conventional AZP methodology there is no basis for treating an area as archeologically significant or an archeological site at all! The established cognitive scheme which is basically looking at sites through surface finds most likely results in a false positive view of the quantity and existing categories of archeological resources in Poland. The aerial cognitive scheme, or rather the multi-method approach of

which they are part of facilitates the understanding of such resources within landscapes and is key in finding and studying areas that were important places in the past cultural landscapes but due to lack of seemingly impressive or large amounts of surface finds and advanced degradation currently seem insignificant.

Conclusions

A visible intensification of archeological site destruction due to all-round development of urban and rural areas has affected all types of archeological sites – also those characterized (until relatively recently) by unique and complex earthwork remains of their original structures. This situation requires an adaptation of new protection strategies, as well as alternative cognitive and methodical schemes. Despite many successes and well-known examples of its use abroad, remote sensing approaches (and other non-invasive methods) are stubbornly resisted as far as their systematic implementation goes. Aerial archeology is an activity reserved for a small group of enthusiasts (or perhaps academic misfits?) and is not part of a wider archeological heritage recognition and protection program. The ever-changing reality has been giving archeologists in Poland regular wake up calls. Often aerial images document the last moments of archeological site existence – just before their complete destruction or liquidation of their key elements. The case studies presented in this paper are yet another or perhaps a final wakeup call showcasing the scale of the ongoing, countrywide, systematic destruction of important (yet unknown or poorly researched) archeological sites. The remedy in our opinion is (especially in the case of degraded fortified settlements devoid of their own terrain form) the recognition of non-invasive remote sensing and geophysical techniques as primary research methods as they allow defining crucial elements, such as form, size, layout, or functional interpretation.

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