Combined geophysical surveys on medieval and post medieval build structures

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Abstract
The goal of this paper is to precisely locate medieval or post-medieval buildings. A method is suggested to quickly zoom in by using combined geophysics. Seventeen cases are compared in a study to check the proposed integrated method. The work is carried out in cooperating with local historical societies.

Keywords
archaeological prospection; EMI; magnetometry; Medieval buildings; resistivity

Introduction

Finding a castle, monastery or church is one of the most visible and satisfying works in archaeology. Very often, local historical societies have a rough knowledge of that old, medieval building where the location is known to an accuracy of about 1 to 2 ha. The exact location is unknown. Excavating is not an option but knowing and visualizing the building adds value to the local heritage. A nice way to find these buildings is the use of geophysics. In the Netherlands, many villages and regions have local historical societies with a broad knowledge of the local history. These local societies very often initiate a search for a lost medieval of post medieval building but lack the instrumentation for a prospection survey. A good cooperation between the local historical society and the professional archaeologist can produce some good results.

Over the last 5 years, 17 surveys have been done on medieval and post medieval sites with moats and walls, very often in cooperation with local historical societies (Fig. 1).

Fig. 1: Surveyed sites in The Netherlands and Belgium.

Materials and methods

A standard way of working has been created for these medieval and post medieval sites with walls and moats where the area to be studies is mostly 1 to 2 ha in size. It always starts with a desktop study, carried out by the professional archaeologist using the knowledge gathered by the local historians matching the EAC Guidelines (Schmidt et al. 2015).

The field work is usually a one- or two-day field survey where the volunteers of the local historical society assist the professional archaeologist during the field work.

The standard way of working is to split a field day in two. The morning session is an EMI survey of the complete site, normally 1 to 2 ha. The instrument used for the

Fig. 2: Surveying with the CMD Mini Explorer.

EMI survey is a CMD Mini Explorer with RTK GPS positioning (Fig. 2). Depending on the field conditions, the survey lines are 1 to 2.5 m apart. The measurements take place at 5 measurements per second. With a normal walking speed, this results in one measurement every 25 cm.

At the end of the morning, the EMI data is downloaded and visualized during the lunch break. Out of the EMI data, an area is selected for a detailed survey with resistivity and magnetometry. Usually, 0.25 ha is more than enough to fit the building being prospected.

After the lunchbreak, the selected area of 0.25 ha is surveyed with resistivity and magnetometry. The resistivity measurements are taken with the RM15 in single electrode spacing modus with an electrode spacing of 0.75 or 1 m. The measurements are taken in a 1x1 m grid survey. The same area is then surveyed with the Bartington Grad 601 Dual magnetometer to gain information on the magnetic properties in the underground. The measurements are taken in a 1x0.25 m grid survey. Most medieval buildings fit within these constraints so a full survey is possible in one day.

At the end of these two detailed surveys, that data is quickly reviewed in the field. First to check if all went well and secondly to satisfy the curiosity of the volunteers.

Very often, the geophysical survey is carried out in combination with an augering campaign to gain even more information.

The field data is reported and shared with the local historical society, usually resulting in a publication in the local historical magazine. The results are satisfying to add knowledge to the local history, but also to add methodological knowledge to the local people for them to know how to prospect for archaeology.

Results

The 17 surveyed locations form a nice database to check the effectiveness of the method. The results are given in Table 1. All sites were surveyed with the CMD Mini Explorer for a first scan. All but one site were then surveyed with the RM15 in either single electrode mode or in ERT

KIEL-UP • DOI: https://doi.org/10.38072/978-3-928794-83-1/p40

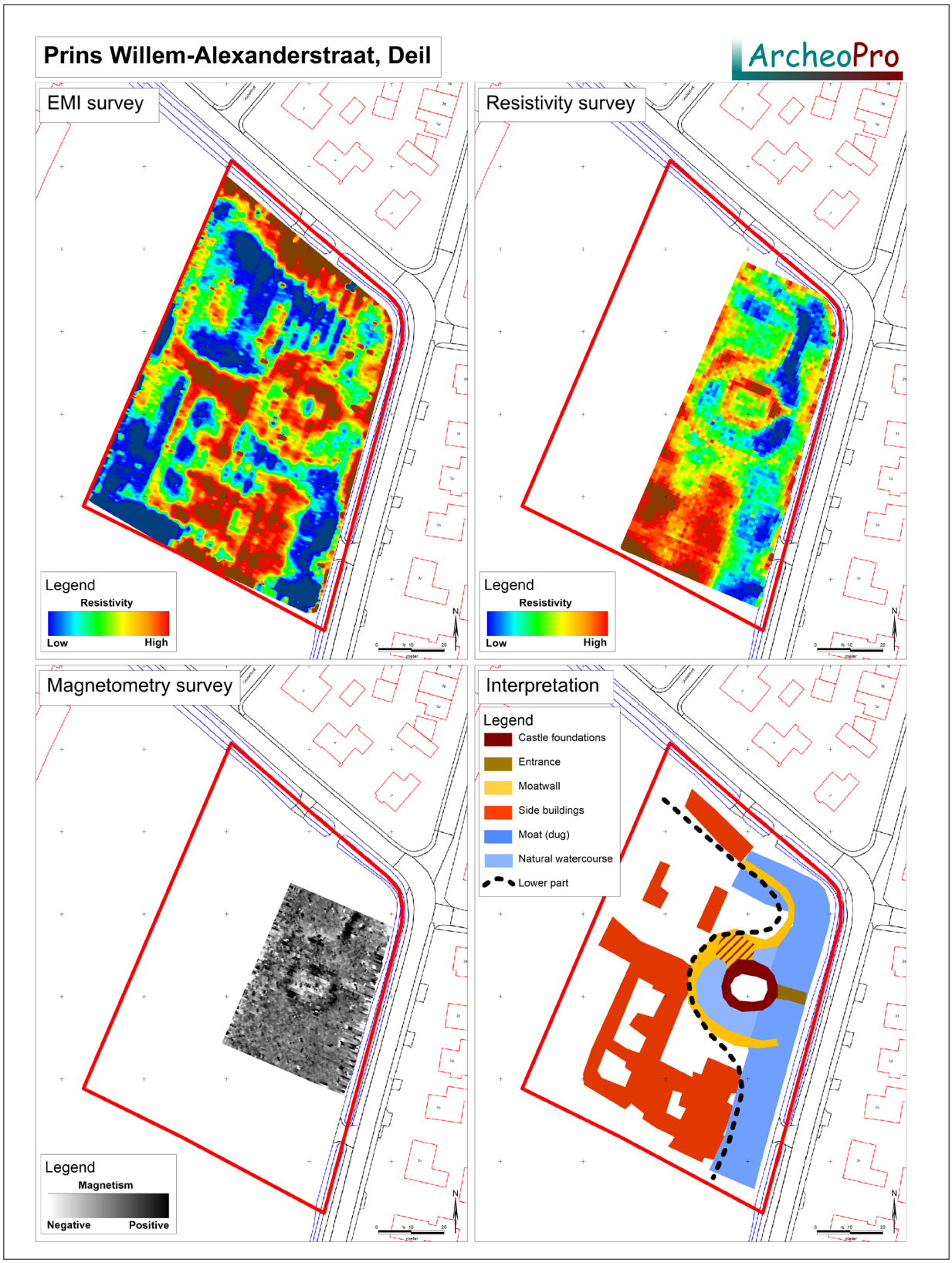

Fig. 3: Results of Castle Bakersbos, Deil Survey, Site 13 (Orbons 2021).

Site	Projectname	CMD Mini	RM15	RM15_ERT	Magnetic	Urban	Result
1	Twee Getuigen, Brielle	X			X		1
2	Laathof, Schey	X	X		X		1
3	Kasteelterrein, Vlijmen	X	X		X		1
4	Landgoed Steenenburg	X	X		X		1
5	kartuizerklooster Olland	X	X		X		0
6	Stift Kekerdom	X	X		X		1
7	Hof van Maarland, Eijsden	X	X	X	X		2
8	Bastion IX, Brielle	X		X		X	2
9	Kapelstraat Lith	X	X		X		2
10	Terp Kerkbrink, Groet	X	X			X	1
11	Brigittenpoortje, Brielle	X	X			X	1
12	De Stuyver, Ten Esschen	X		X	X		1
13	Kasteel Bakersbos, Deil	X	X		X		2
14	Dorpshart, Zonhoven	X	X			X	1
15	Kasteel Spaldorp	X	X		X		2
16	Steegstraat, Eijsden	X	X		X		2
17	Abdij Berne, Nederhemert	X	X		X		2

Table 1: Surveyed sites.

mode. 13 sites were also surveyed with the magnetometer. The 4 sites that were not surveyed with the magnetometer were the sites located in an urban setting with a lot of metal objects in and around the site.

The results of the surveys can be categorized in 3 divisions:

Only one site (Site 5) was surveyed with no indication of the expected early medieval monastery, probably because the monastery is not present at the given location.

Nine sites (Sites 1, 2, 3, 4, 6, 10, 11, 12 and 14) gave a good indication of the presence of the walls and moats, indicated in table 1 with a "1" in the result column. The results are not very clear features because of the complexity of the situation, disturbance of the soil or other unfavorable situations for geophysical prospections. 3 of the 4 urban sites (Sites 10, 11 and 14) fall within this category confirming the complexity of urban geophysics (Trinks et al. 2009).

Seven sites (Sites 7, 8, 9, 13, 15, 16 and 17) produced some very clear and beautiful images of the walls and moats, indicated in table 1 with a "1" in the result column (Fig. 3). One of the urban sites (Site 8) was very successful.

Conclusion

From these 17 cases, it can be concluded that the chosen method of working is effective and efficient. The one site that did not produce the expected monastery (Site 5) is probably at the wrong location. All other surveys produced a result that added knowledge to the site. 7 out of the 17 sites even produced some beautiful images that are very publishable for the general public.

The speed of working works well for these sites. The cooperation with the local historical society is effective, not only to assist during fieldwork but also in publishing and presenting the results to the local population.

The zooming-in method from EMI to resistivity and magnetometry is very efficient. Most medieval buildings fit within the 50x50 m size and can thus be surveyed, even if the exact location is not known within a couple of hectares. The EMI survey works very well for a quick scan, pointing to the interesting location. The combination of resistivity and magnetometry prove very helpful in understanding the nature of the archaeological features under investigation.

KIEL-UP • DOI: https://doi.org/10.38072/978-3-928794-83-1/p40

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