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A Geophysical Multi-Method Approach to Investigate the Archaeological Landscape of Lanakerveld (NL)

Lena Lambers [a], Walter Laan [b], Philippe De Smedt [c], Burkart Ullrich [d], Sandra Kniess [d], Henning Zoellner [d], Rudolf Kniess [d] and Ivo van Wijk [b]

Highlights:

- *Large scale geophysical prospection of an archaeological landscape in the Netherland.*
- *Integrated and multimethodological approach for archaeological interpretation.*
- *Challenges for the prospecting and interpretation of multiperiod archaeological sites.*

Keywords: multi-method, magnetic prospection, EMI, palimpsest, multiphase site.

Introduction

Lanakerveld is one of the prehistoric and historical key sites within the southern part of the Netherlands. Nowadays, the Lanakerveld area is an open farmland with fertile loess soils, located in the far north-west corner of the municipality of Maastricht. The Lanakerveld project pursues several main objectives. On the one hand, geophysical prospection techniques have been used on a limited scale for archaeological surveys in the Netherlands. The project aims to use different geophysical methods and evaluate their suitability under the specific condition. On the other hand, the results of the investigations should help to assess the archaeological potential on the Lanakerveld region and to put the separately available information into a spatial context.

The area of Lanakerveld seems to have been almost continuously inhabited from the Early Neolithic onwards. During the archaeological research at Lanakerveld a large variety of archaeological remains from Early Neolithic Linear Band Ware culture (LBK), the Late Bronze and Early Iron age, Roman age to the Merovingian period were revealed due to fieldwalking, trial trenching and excavation (Meurkens & Van Wijk, 2009; Roymans & Van Waveren, 2002; Vanderbeken & Van den Hove, 2008). According to Meurkens & Van Wijk (2009, p. 201), the sedentary occupation of Lanakerveld by both the LBK-culture as well as the later Middle Neolithic and Iron Age cultures consisted of clusters of houses spread over the area, with possibly one or two grave fields adjacent to the settlements. A Roman villa was located on the rolling slopes as well as Merovingian pottery kilns. One primary goal of the research was to determine the size of the LBK burial field. In the presentation the data obtained in the first phase of the research project will be presented.

Multi-method approach

To investigate the complex archaeological landscape of Lanakerveld, we used three methods:

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– EMI, electromagnetic induction (12,3 ha),
– fluxgate gradiometer magnetometry (44 ha),
– caesium total field magnetometry (2,1 ha).

EMI was carried out by the ORBit research group of Ghent university with a multi-receiver electromagnetic induction sensor (Dualem 21HS, Dualem, Ontario, CA) with six apparent electrical conductivity (ECa) and six in-phase magnetic susceptibility (IP_MS) signals being measured simultaneously with different depth sensitivity. For the six ECa measurements the depths of dominant response range from 0.25 m (0.6 m PRP), 0.5 m (1.1 m PRP), about 1.0 m (2.1 m PRP) and 0.75 m (0.5 m HCP), 1.5 m (1 m HCP), up to 3.2 m (2 m HCP) below the sensor.

For the gradiometer magnetic prospection work at Lanakerveld, the convertible LEA system designed by Eastern Atlas was used. This includes an array of Foerster fluxgate gradiometer probes mounted on a foldable cart, the data recording device LEA-D2 and independently working positioning systems, GNSS and Odometer. For the magnetometer surveys at Lanakerveld the system was used as 10 sensor LEA-MAX with a sensor separation of 0.5 m in the southwestern and southern areas. At the north-eastern part of Lanakerveld, including the area of the LBK grave field, the 19 sensor LEA-MAXIX system with sensors separation of 0.25 m was used.

Due to positive experiences with using the highly sensitive caesium magnetometer on the magnetically low-contrast archaeology in the Netherlands, GAIA prospection and Archol adapted the Geomatrix G-864 for the first time. It was attached to a frame that allowed to carry it at a height of 30 ±5 cm above the ground in a handheld duo-sensor configuration with sampling resolution of 25 × 50 cm, interpolated to 25 × 25 cm. To have the highest possible sensitivity for the survey the GPS antenna was detached, and the readout tablet was carried separately at a 10 m distance, connected via Bluetooth.

Interpretative Results

The most apparent structures in the EMI data are large, linear ramparts crossing the area that contrast primarily electrically (Fig. 1). While these partly relate to topographical variations observed in LIDAR data, in the western part of the study area these remain hidden topographically. In this part of the area, these large-scale structures are equally characterized by an enhanced magnetization which could relate to a different origin than their non-magnetic counterparts.

Alongside smaller discrete structures scattered through the area, such as potential extraction pits and ditches, the most striking potential archaeological feature is a rectangular structure in the center of the EMI survey area. Characterized by negative in-phase magnetic contrasts, based on its rectangular shape and adjacent excavated Roman ditches, these likely relate to Roman occupation of the area.

The fluxgate gradiometer magnetic data is interpreted by assigning individual anomalies according to their main causes to archaeologically relevant anomalies, which are further differentiated, as well as non-archaeological anomalies that are generated by recent structures or natural, mostly geological and geomorphological features. More than 4.400 single features are marked by polygons and assigned to the classes according to a specific scheme, developed for the site Lanakerveld (Fig. 2). The distribution of the archaeologically relevant anomalies varies from areas with almost no marked anomalies to areas with a very high concentration of magnetic anomalies. Some of the most interesting results will be presented.

The caesium total-field measurement was carried out in the area of the expected graveyard. Although many dispersed pits have been recorded, it is difficult to classify individual ones as graves. Nevertheless, we were able to detect various anomalies that show anthropogenic structures as well as clusters of anomalies, that highlight the presence of organic material and human activity. Standing out is a row of linear oval shaped anomalies in the southeast of the measurement Area I and in a similar one in Area II (Fig. 3), that have almost the same shape, size and orientation as the clay pit of the partly excavated LBK house in Area II.

Combined prospection results

The multimethod approach provided the opportunity to compare results in detail achieved with the three methods in the same area. This has given new insights on geological phenomena as well as archaeological remains and the superposition of natural and anthropogenic impacts on the Lanakerveld. In the presentation two aspects – remains of a Roman building complex and the signature of Neolithic (LBK) settlement structures will be discussed in detail.

Finally, the huge amount of new data that is obtained by combining the three methods has proven to be very successful. Again, this is an illustration of the importance of using a multi-method approach, especially in regions with a very complex archaeological record and an archaeological landscape overgrown in many ways which is the case in Lanakerveld. Again, also the challenges of the comparison of geophysical datasets obtained by different methods and differing in terms of parameters, depth of investigation, spatial resolution etc., and their significance with respect to specific archaeological remains to become clear.

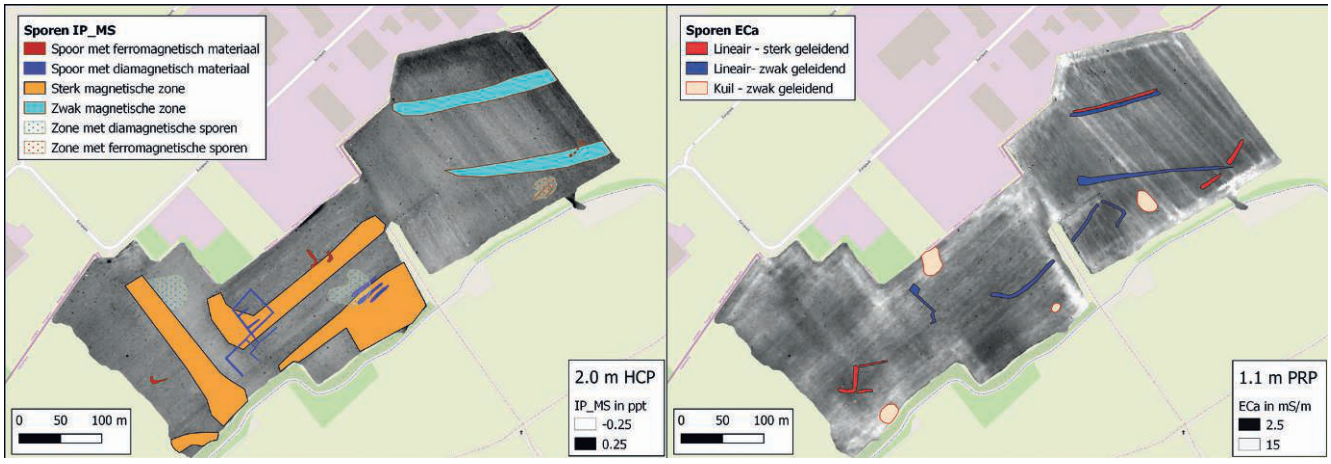

Figure 1. General interpretation of EMI survey data.

Figure 2. General interpretation of fluxgate gradiometer survey data.

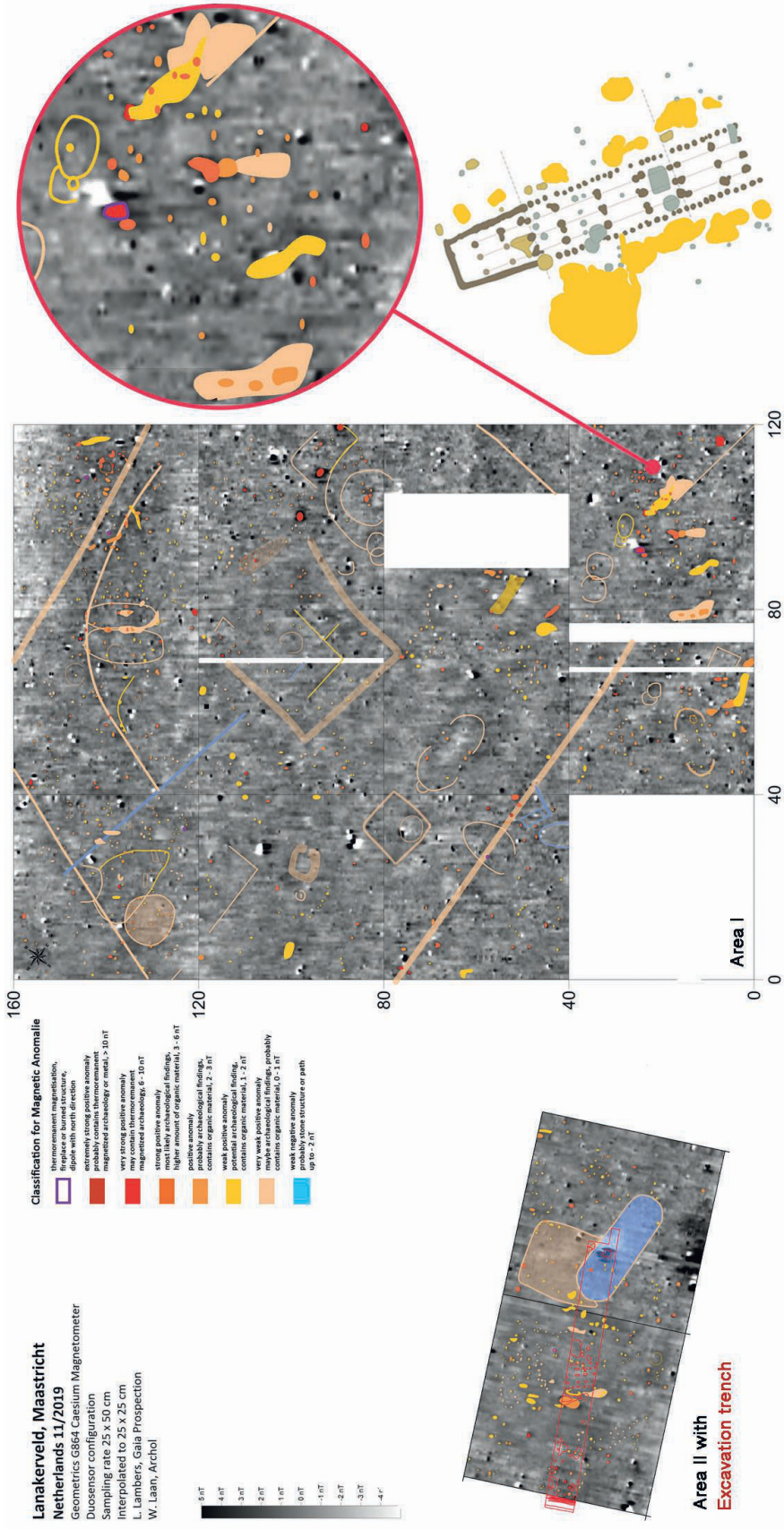

Figure 3. General interpretation of the caesium total-field measurement, zoomed in to the row of oval shaped anomalies and compared to an idealized LBK house ground plan with aligning clay pits.

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