ISAPNEWS

The Newsletter of the International Society for Archaeological Prospection

Issue 66, November 2022

Editorial – Issue 66

Two interesting projects form the core of this issue, demonstrating the variety of problems that can be investigated with geophysical techniques. In 'Littlemore Castle' the layout of the former park, built around a grand Victorian house, was mapped through the combination of earth resistance and fluxgate magnetometer surveys. By contrast, 'The long path to detecting a Roman villa rustica' describes the new measurements that were required to finally map the Roman remains that were known to be at the site, using geophysical methods. This was 20 years after the first attempts and demonstrates how advances in technology and survey practice (e.g. spatial resolution) have made these methods ever more useful.

I am sure you will be delighted that ISAPinacotheca is back with new photos, some showing rather challenging survey conditions, others illustrating the pleasure of being out in the field. I am sure you also have great photos (or text) that could feature here, so don't hesitate to send them.

Armin Schmidt

editor@archprospection.org

The Cover Photograph shows a lunchbreak during magnetometer surveys in Sri Lanka: far too bright for downloading data © A Schmidt

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Littlemoor Castle: helping to save a community park and discovering a lost garden

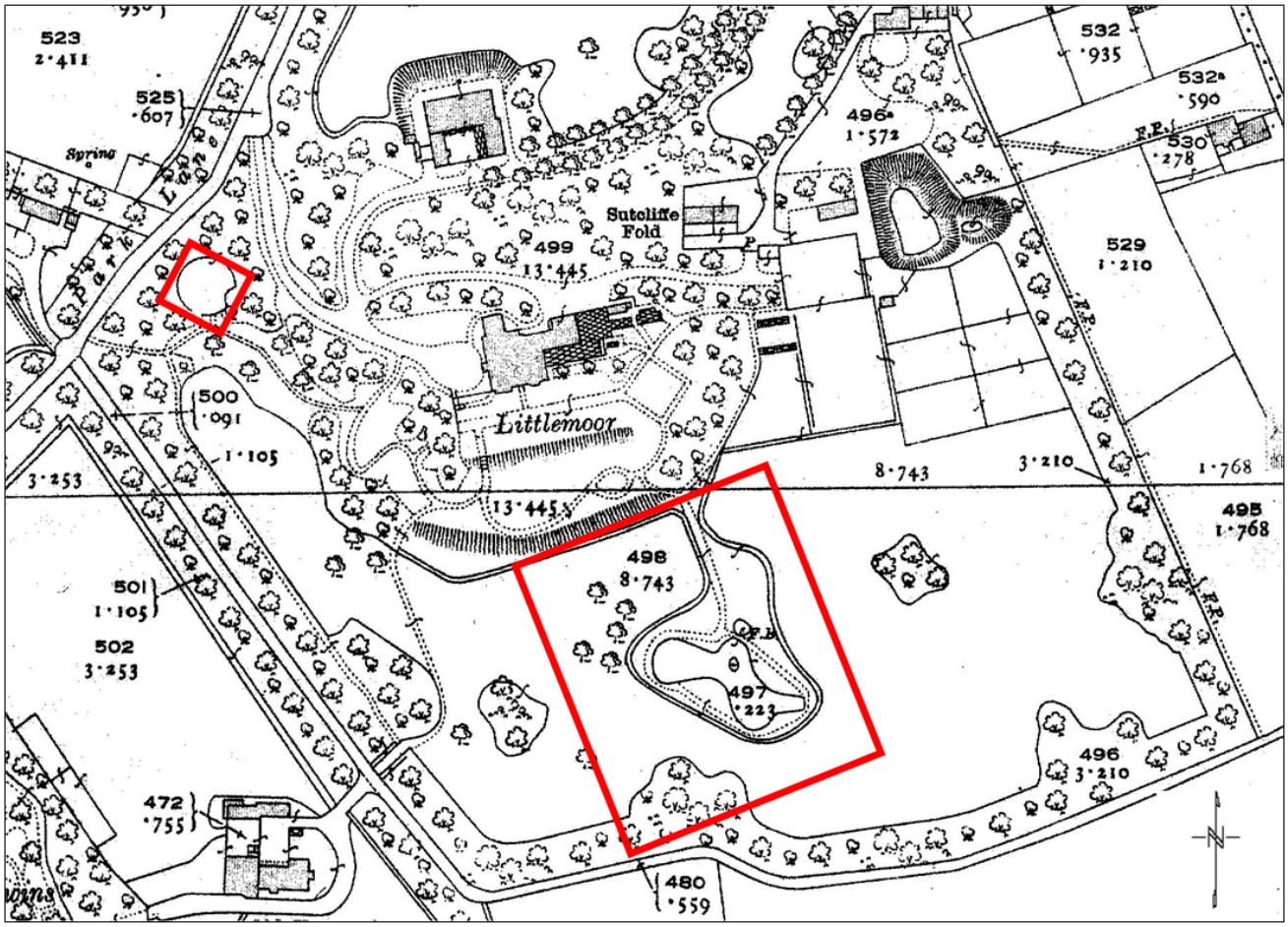
Roger Walker[1]

[1] **Geoscan Research**

roger@geoscan-research.co.uk

Littlemoor Park, once home to Littlemoor Castle, a grand Victorian house built on the wealth of the wool trade, was donated to the people of Queensbury and has been enjoyed for recreation by local people since the mid-20th century. In 2019 we helped 'Friends of Littlemoor' to increase the understanding of what is buried beneath the ground and in doing so provided valuable support in their campaign to save the grounds from development. The 1914 map of Littlemoor is shown below and you can see Littlemoor Castle in the centre, though this was demolished more than 50 years ago.

By using geophysical survey methods, we confirmed the site of the filled-in old ornamental lake and re-discovered the lost layout of a small round garden. Three main geophysical methods were used, earth resistance, magnetometer and ground penetrating radar (GPR) surveys. The areas surveyed are shown in Figure 1. The small red square, 20 m in size, covers the round garden, whilst the larger red rectangle, 100 m x 120 m, covers the lake area.



National Library of Scotland

Figure 1: Survey Areas (1st edition Ordnance Survey map, National Library of Scotland CC-BY-NC-SA)

Lake Area

Earth resistance measurements were made over the lake area using an RM85 Earth Resistance Meter mounted on an MSP25 Mobile Sensor Platform, collecting square array data (alpha, beta and gamma), whilst magnetometer measurements were collected using a Sensys FGM650 Fluxgate Gradiometer mounted on the MSP25, with FAB1 interface to the RM85, Figure 2. Readings were taken every 0.25 m with a traverse interval of 1 m, and GPS readings were logged simultaneously. Figure 3 shows the lake before being filled in – note the iron railings visible in the rear.

Figure 2: MSP25 System

Figure 3: Lake before being filled in

The earth resistance results are shown in Figure 4, where higher values are shown in black. Data on the right were processed using a high-pass filter to improve the contrast. The data show the outline of the lake and possible paths around the lake and other garden features. The remains of an early field boundary can be seen aligned approximately N-S, whilst drainage pipes and other field drains are visible to the north, and the lake retaining bank can be seen to the south.

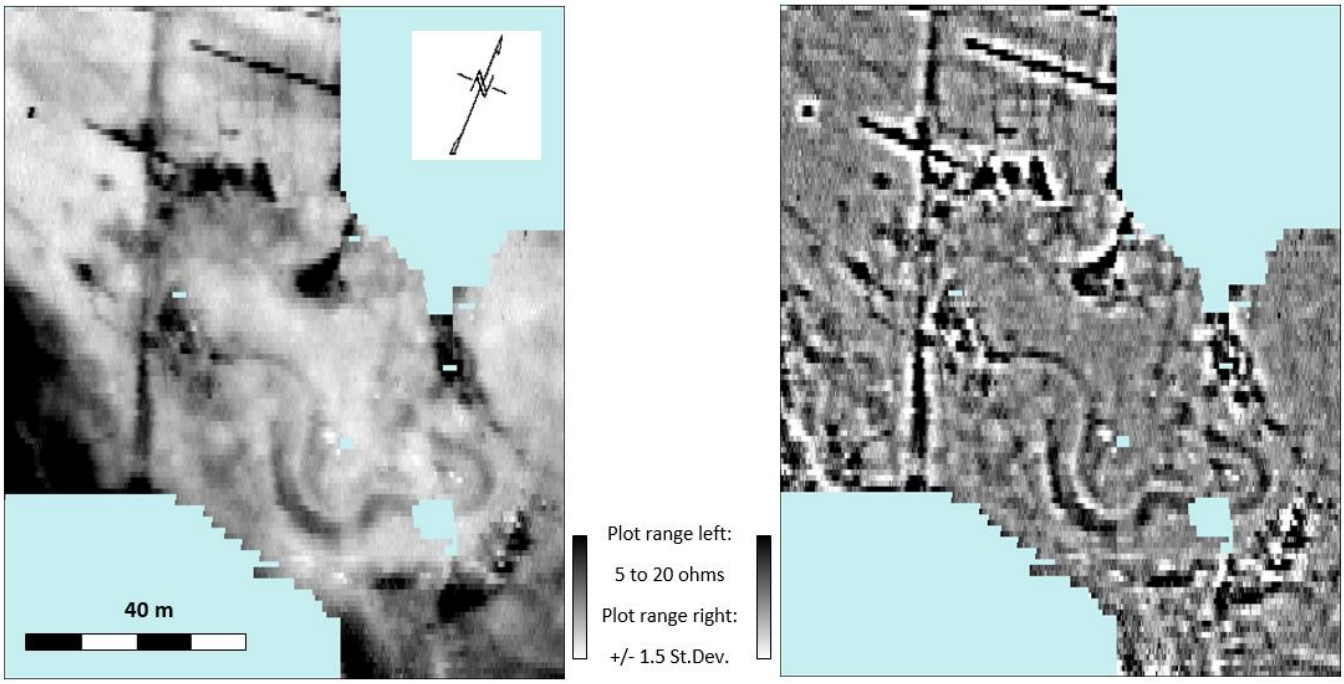


Figure 4: Earth resistance survey results – regular data on the left-hand side, high-pass filtered on the right.

The magnetic results are shown in Figure 5, with positive features showing as black, negative features as white on the left-hand side. The strong magnetic responses clearly show ferrous material in the lake which help define its shape. Also visible are the remains of a ferrous fencing around the lake area, and a pipeline leading into the lake from the NE. Also showing are the more subtle remains of the early field boundary running approximately N-S and once again clear indications of a substantial retaining bank built to the south.

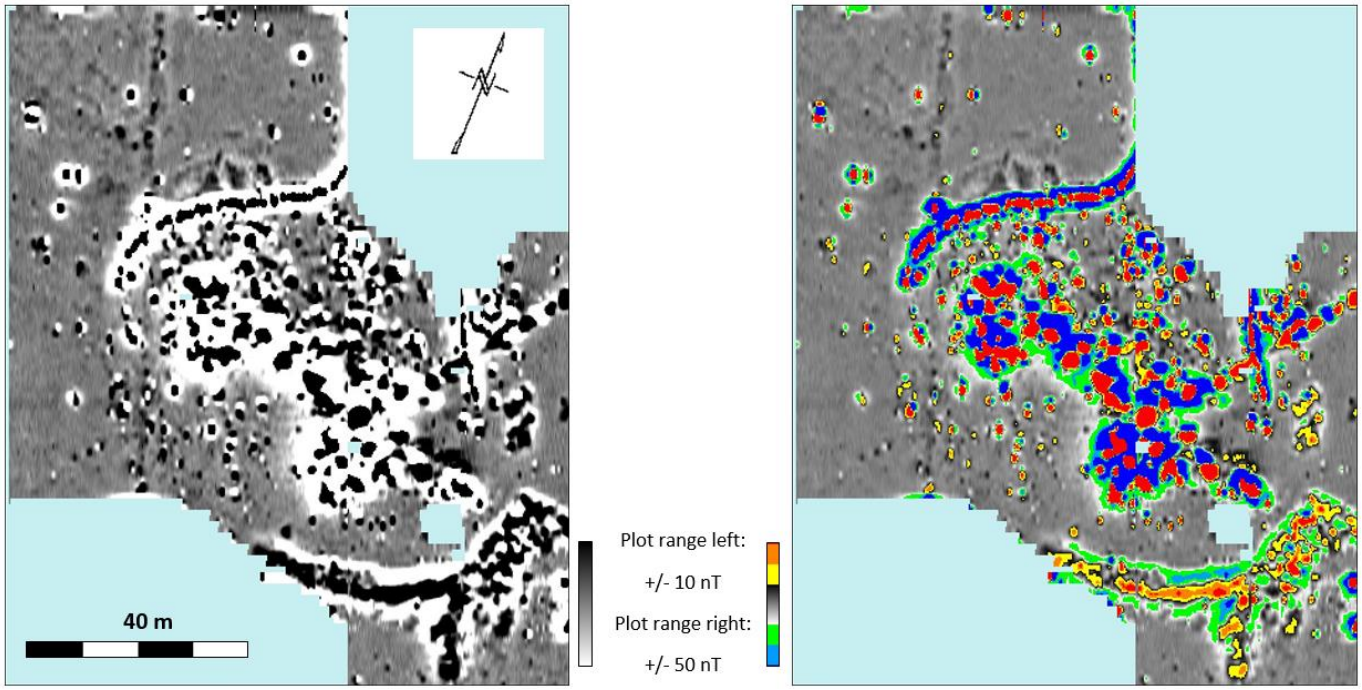


Figure 5. Magnetic survey results.

Figure 6 shows magnetics to the left, GPR in the centre, and magnetics overlaying the earth resistance data to the right. The image on the left emphasises the ferrous responses superimposed on the 1914 map of Littlemoor Park. The solid double lines show the route, in 1914, of the metal fencing circling the lake and there is a close correspondence with the magnetic response, though the southern part appears to have been lost. There are also many ferrous responses in the lake area – anecdotal stories tell of ornamental cannons being thrown into the lake (!), though it is probably just the locations of missing iron fence sections. The line of alternating red and blue coming in from the right indicates a pipeline and is probably the water feed for the lake. The centre image shows the GPR results (Mala single channel 500 MHz, 0.25 m line spacing), provided by Chris Gaffney of the University of Bradford, which give a clear indication of the edge of the lake, remains of the earlier field boundary and possible garden structures. The

image on the right superimposes the earth resistance and magnetic plots onto the 1914 map. The earth resistance data agree with the GPR positioning and also show possible pathways around the lake. The earth resistance and magnetic responses both indicate a substantial retaining bank built to the south.

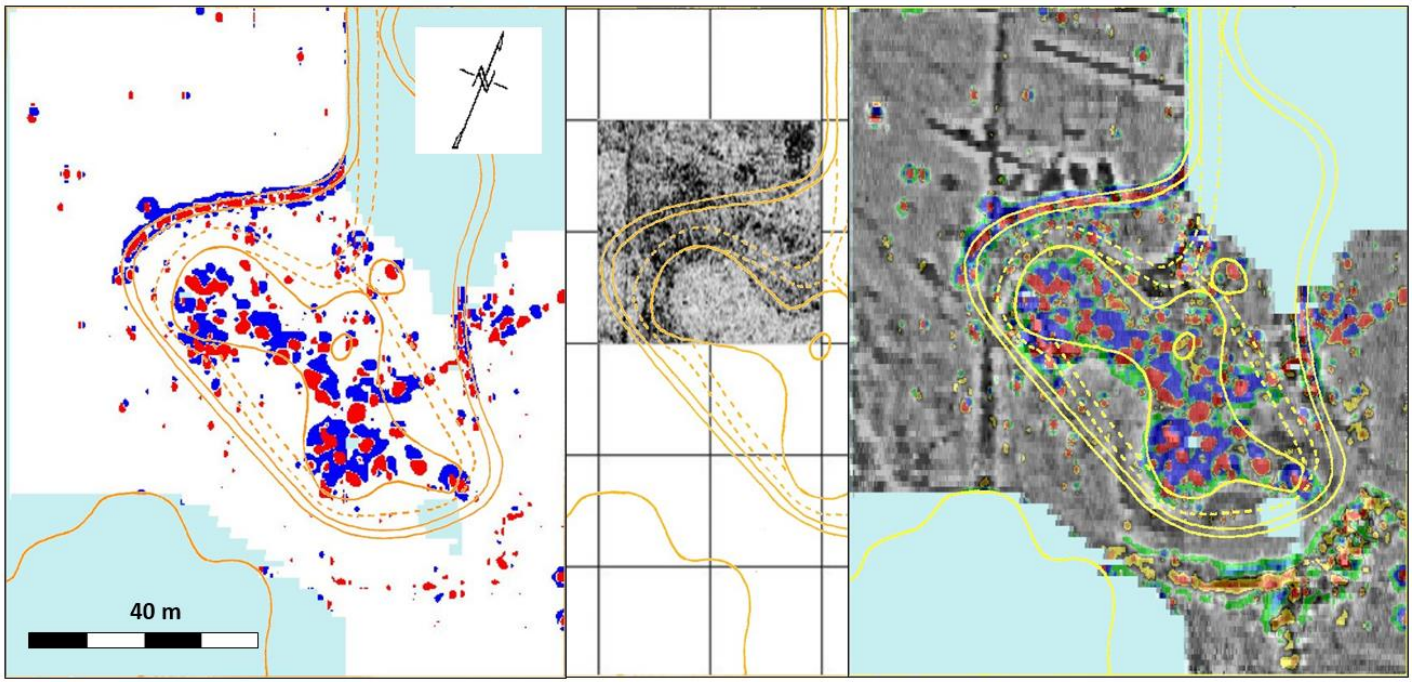


Figure 6: Magnetic, radar and magnetic overlaying earth resistance data.

Lost Garden

Before the lost garden survey could be undertaken, Friends of Littlemoor kindly cleared numerous fallen trees, shrubs and brambles from the garden area. The round garden area, which is 20 m in diameter, was surveyed using earth resistance and magnetic techniques, as shown in the right part of figure 7. Because of the small area and circular layout, more conventional hand-held techniques were used. Earth resistance measurements were made using a 0.5 m Twin Probe array with an RM85 Earth Resistance Meter, whilst magnetic measurements were collected using an RM85 / FAB1 / Sensys FGM650 system, with spot readings being taken rather than using the timer mode. Readings were taken every 0.5 m with a traverse interval of 0.5 m.

The striking main image on the left shows the earth resistance measurements and clearly indicates a central circular structure with radiating arms. These probably represent different garden compartments, possibly for roses; there are indications of small ‘cells’ to the east and west as well. The main image further right shows the magnetic measurements, with emphasis on the

ferrous responses; further plots to the right represent the magnetic responses with different colour palettes. Again, we see a central circular feature which represents a ferrous response, possibly from iron railings; there appear to be more ferrous features around the outer edge of the garden area. In addition, there appears to be a curved region to the right-hand side of the magnetic plot which is probably not ferrous in origin and may be a path. At the bottom, left, are two overlay plots which show the relative positions of the earth resistance and magnetic responses.

Subsequent to the survey work, a grant was obtained to re-create the garden, Figure 8. Although not a faithful reproduction of the layout of structures identified, the garden has gained a second life and has now been planted up for future generations of people to enjoy.

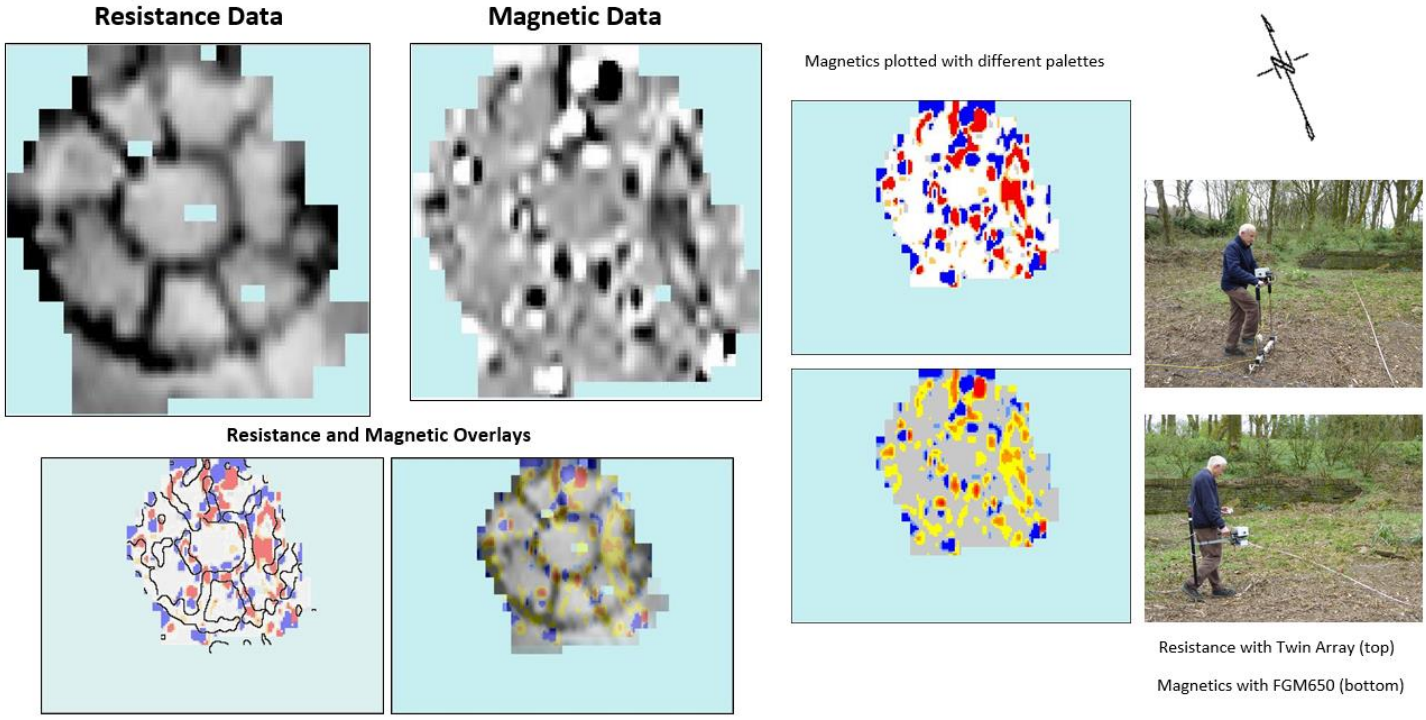


Figure 7: Earth resistance and magnetic data over the lost garden.

Figure 8: Reinstated garden.

The long path to detecting a Roman *villa rustica*

Roland Linck[1]

[1] **Bavarian State Department of Monuments and Sites, Archaeological Prospection, Munich, Germany**

roland.linck@blfd.bayern.de

Location of the site and previous research

Sometimes, it takes decades until an archaeological site can be classified and dated in detail. Furthermore, often several methods are necessary for a definite answer ranging from aerial archaeology over geophysical prospection up to archaeological field surveys. This paper presents such a site in Southern Bavaria. Near the small village of Bertoldshofen (Lkr. Ostallgäu), located ca. 65 km southwest of Augsburg in southwestern Bavaria, in the 1980s a Roman *villa rustica* was already suspected on a small rectangular plateau of 130 m × 70 m size. This small hill, elevated approximately 10 m over the surrounding wet valley plain, was formed by the melting glaciers and formerly surrounded by a small river called Geltnach. Due to its exposed location the proposed settlement had a perfect view to the Alpine mountain chain.

In 1983, the first surface finds were documented by Sigulf Guggenmos, who detected several sherds, building stones as well as mortar and adobe remains. In 2001, Walter Keinert noted several iron pieces, for example currycombs and nails. Accordingly, Walter Keinert proposed a Roman *villa rustica* on this hilltop. To gather a better insight into the site, in the same year a geophysical survey with magnetometer and earth resistance prospection was undertaken by Helmut Becker of the Bavarian State Department of Monuments and Sites (BLfD). The corresponding geophysical results show several hints of buried archaeological features, but detailed building layouts can hardly be detected (Figures 1 & 2). Hence, it still was not clear, whether the site really was a Roman *villa rustica*. Some years later, in 2009, Walter Keinert carried out a topographic survey of the settlement area to produce a relief map and to map possible surface remains of former building structures.

Figure 1: Magnetogram of the Roman villa rustica of Bertoldshofen surveyed in 2001. Caesium-Magnetometer Scintrex Smartmag SM4G-Special, Duo-Sensor-configuration, Dynamics ±5 nT in 256 greyscales, sampling rate 50 x 25 cm, interpolated to 25 x 25 cm, 40-m-grids. Archive-Nr. Ber01a (© Helmut Becker, Florian Becker & Roland Linck (BLfD); Digital orthophoto: Bayerische Vermessungsverwaltung).

Figure 2: Resistogram of the Roman villa rustica of Bertoldshofen surveyed in 2001. Geoscan RM15, Dipole-Dipole-configuration, dynamics: ± 3 Δ Ohm m, sample interval 50 x 50 cm, interpolated to 25 x 25 cm, 20m-grids, processing with high pass-filter. Archive-Nr. Ber01r (© Helmut Becker, Florian Becker & Roland Linck (BLfD); Digital orthophoto: Bayerische Vermessungsverwaltung).

He stated that the settlement consisted of three parts: a main building at the eastern ridge of the terrace, whose walls he discovered with a search stick, another smaller building ca. 30 m towards the north that showed through tuff debris and tegula sherds and a third settlement area in the south, where the relief is undulating. As aerial archaeology fails in this area due to the use as grassland that does not form any vegetation marks, it needed further 20 years until the next attempt was started to clarify this archaeological site.

Results of the geophysical survey

In 2021, the geophysicists of the BLfD made a new attempt, this time with Ground-Penetrating Radar (GPR). The survey covered an area of 120 x 70 m and hence encompassed the two buildings already proposed by Walter Keinert. In order not to miss any relevant archaeological structures, the survey area was extended into the valley plain in the east and to a noticeable

terrain step in the south (Figure 3, green). Only the third settlement area in the southwest could not be prospected. The soil parameters within the GPR area were surveyed via in-situ Time-Domain-Reflectometry (TDR). Whereas the soil moisture gave a fairly high value of 51 Vol% due to heavy dew in the morning, the conductivity showed a low value of only 1.8 dS/m. Therefore, the soil parameters were promising for a successful GPR survey.

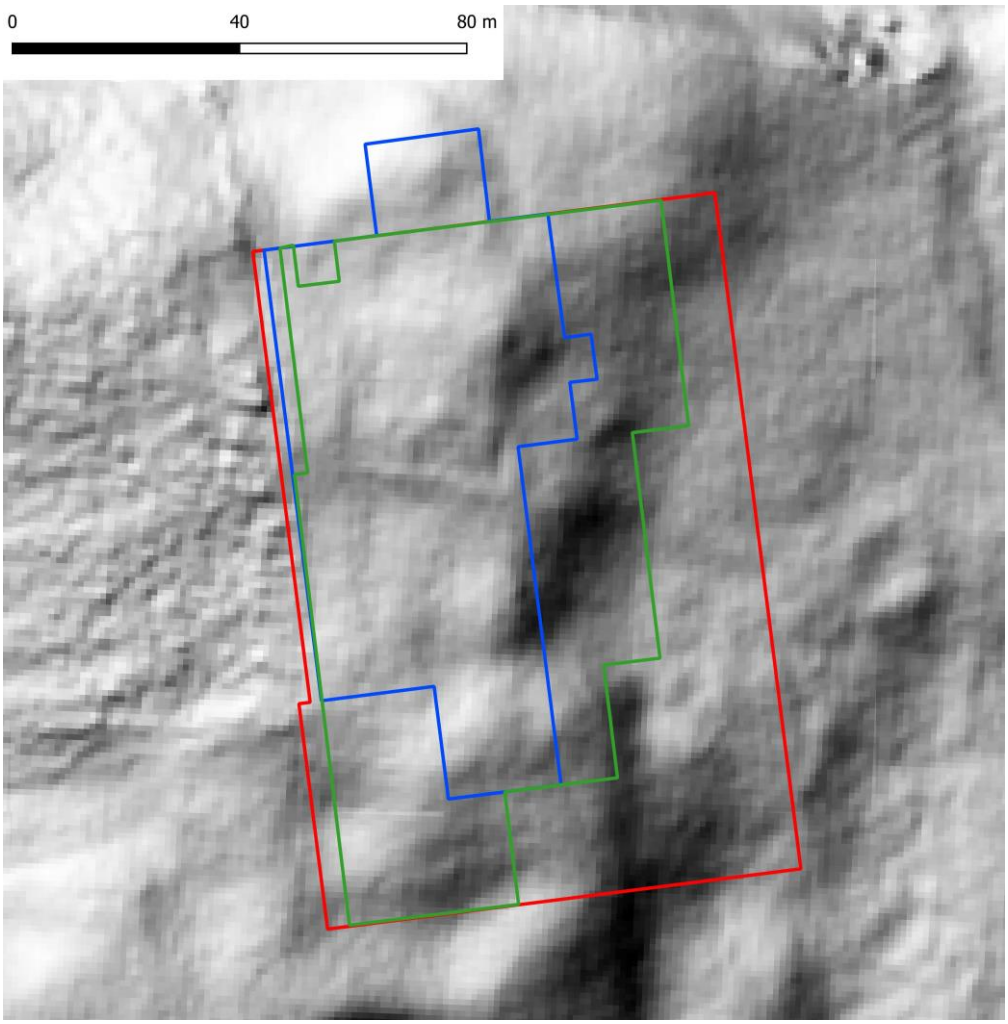


Figure 3: Map of the grid layout of the three different geophysical methods. Colour coding: Red = magnetometer survey, blue = earth resistance survey, green = GPR survey. Shaded relief map as base map to visualize the location of the settlement on a hilltop (© Roland Linck (BLfD); Shaded relief map: Bayerische Vermessungsverwaltung).

This time, the results finally show detailed Roman building structures at a depth of 15 – 70 cm below the surface (Figure 4). The archaeological remains are located quite shallowly, which corresponds with their preservation as small heaps in the terrain. Only the bottom 55 cm of the building foundations are preserved, as the upstanding parts of the walls had been removed over the centuries and the stones had been re-used.

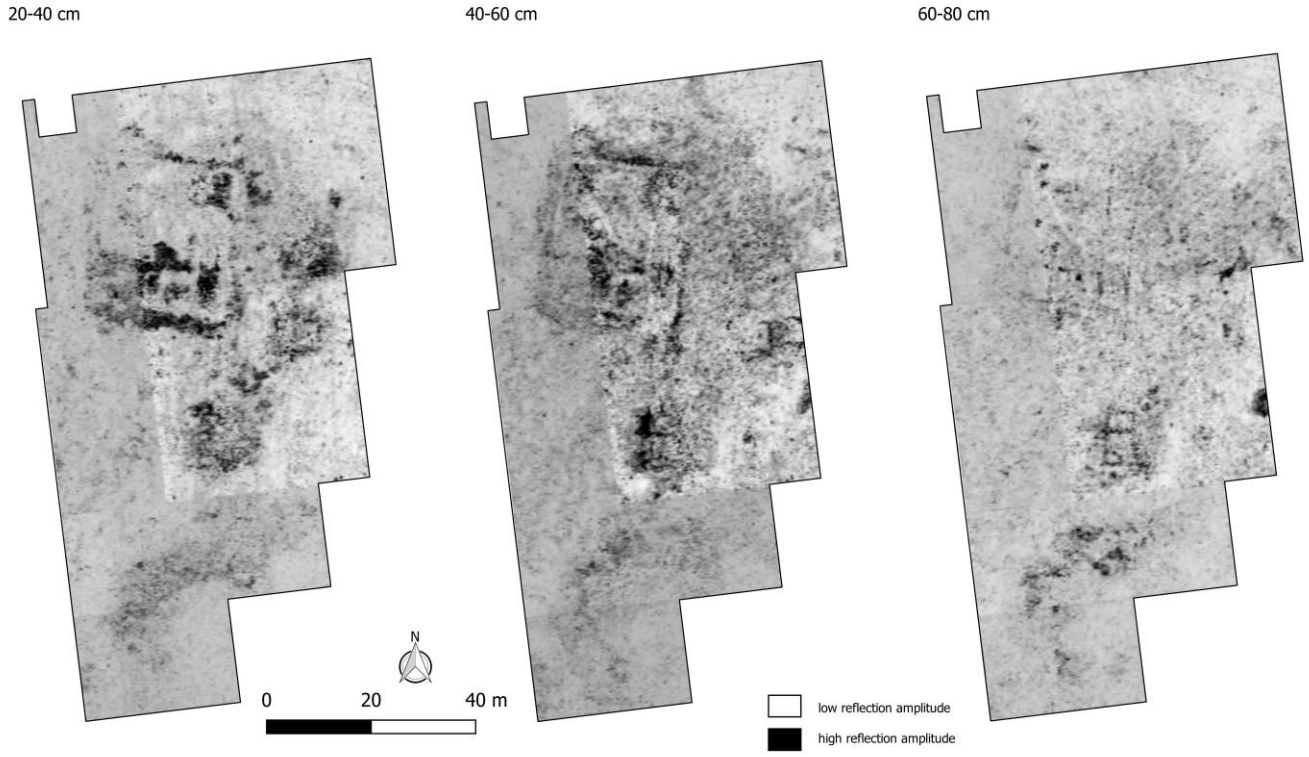


Figure 4: Selection of GPR depth slices between 20 and 80 cm below the surface of the Roman villa rustica *of Bertoldshofen surveyed in 2021. GSSI SIR-4000 with 400 MHz antenna, sample interval: 6 x 50 cm, interpolated to 25 x 25 cm. Archive-Nr. Ber21rad (© Roland Linck (BLfD)).*

Contrary to the initial assumptions, the main building of the *villa rustica* (Figure 6, [1]) is located in the centre of the plateau, where Walter Keinert supposed a subsidiary building (Figures 4 & 5).

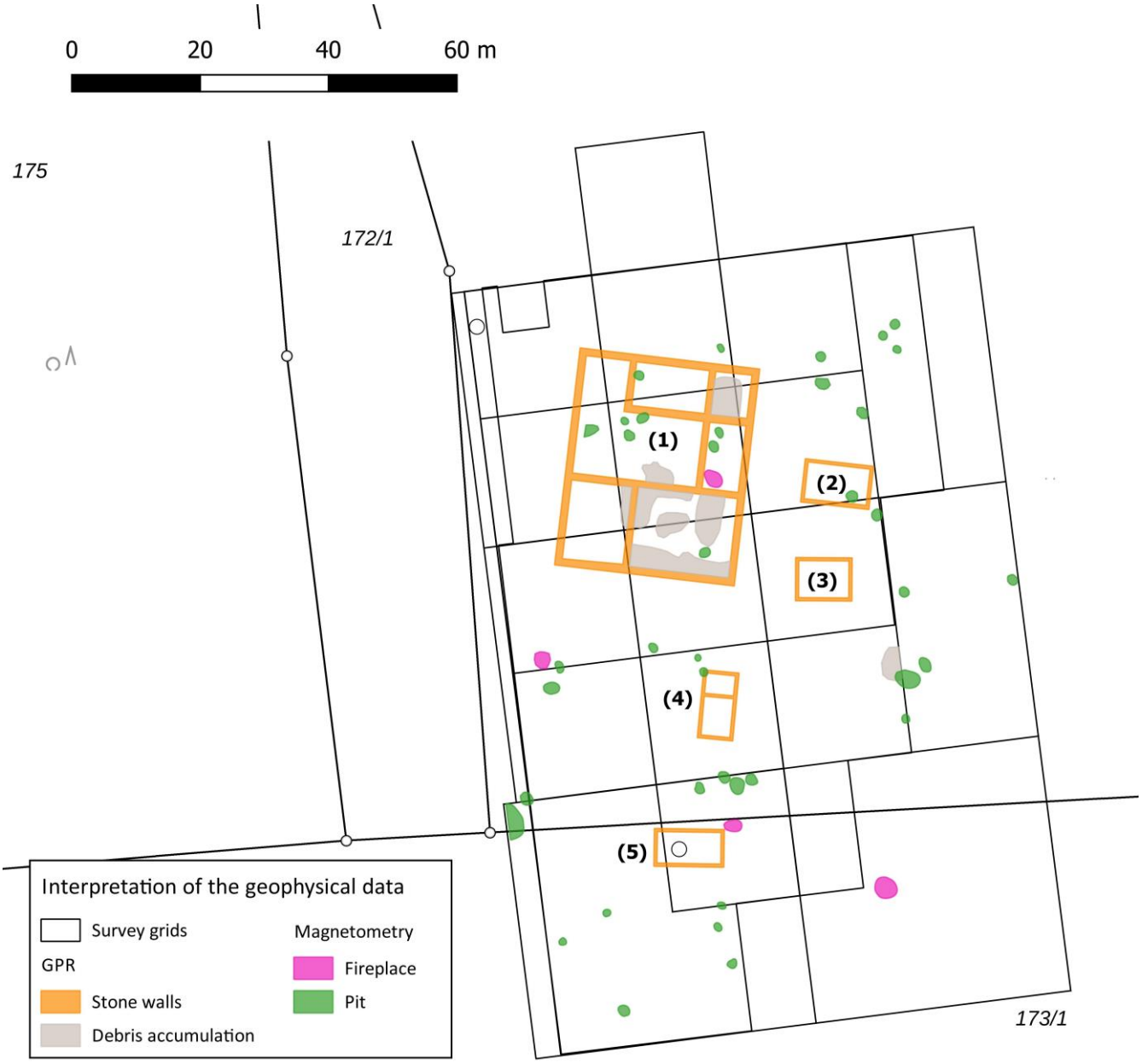


Figure 5: Interpretation map of the archaeological remains detected by geophysical prospection. The numbers refer to those mentioned in the text (© Roland Linck (BLfD); Digital map: Bayerische Vermessungsverwaltung).

It has a rectangular layout of 34 m × 28 m and is divided into several rooms. In the north, two rooms with 11 m × 7 m and 5 m × 7 m can be identified. Along the eastern side, another room of 10 m × 5 m is visible. While for the north-western part of the building no subdivision can be detected, the southern part consists of two rooms with sizes of 9 m × 12 m and 16 m × 12, respectively. Inside several rooms high-reflective areas are visible that probably depict accumulations of wall or roof debris. The easternmost room shows a fireplace in the magnetogram (Figure 1) and therefore can possibly be interpreted as a kitchen. In the magnetic data the main building of the *villa*

rustica is only vaguely visible as a slightly more disturbed area in the magnetic anomaly map. Some faint remains can also be found in the resistogram (Figure 2), but no detailed plan can be drawn. Directly east of the main building the GPR depth slices show two stone subsidiary buildings [2] & [3] without a subdivision (Figure 5). They are oriented in east-west direction and have a size of 11 m × 7 m and 9 m × 7 m. As they are located outside the area of the earth resistance survey, they were not detected in 2001. The overlay of the interpretation plan with the digital terrain model (DTM) reveals that the two buildings had been erected at the quite steep eastern slope of the hill (Figure 6).

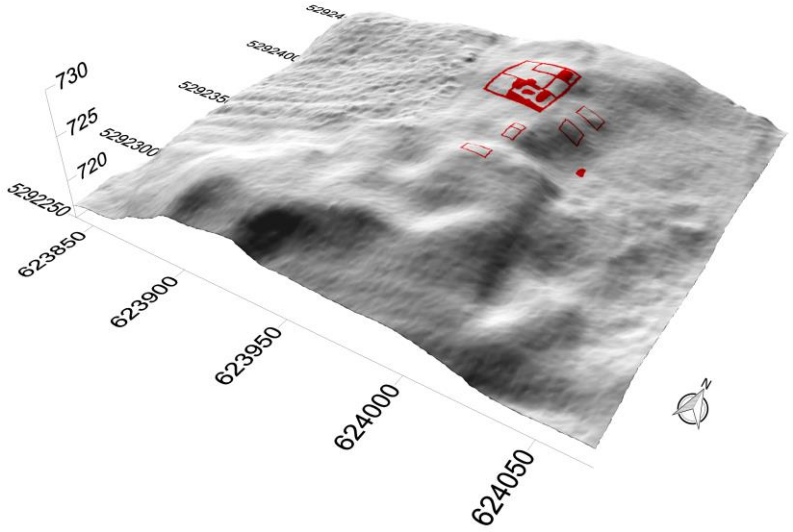


Figure 6: Overlay of the interpretation map with the DTM (1 m resolution) of the area to visualize the location of the different buildings within the terrain (© Roland Linck (BLfD); Airborne laser scanning data: Bayerische Vermessungsverwaltung).

The reason for such a strange position is unknown. South of the main building another north-south oriented stone structure [4] with 11 m × 5 m size is visible. It is divided in two rooms, a bigger one with 6 m × 4 m in the south and a smaller one with 4 m × 3 m in the north. This building is also visible well in the resistogram (Figure 2). In the southern part of the GPR grid another east-west oriented building with 11 m × 6 m size can be identified [5]. Once more, no subdivision into single rooms is apparent. Near the north-eastern corner of the building, the magnetogram shows a strong anomaly that can be assigned to a fireplace. This could be a hint to interpret this building as the bath house and the fireplace as the remains of the Roman heating system.

Again, the resistogram shows no evidence on this structure. The last two buildings [4] & [5] are located on the top of the hill, as the DTM shows (Figure 6). They correspond exactly to those positions that are marked by small heaps in the terrain. Spread over the whole settlement area, a multitude of refilled pits and two further fireplaces can be detected in the magnetogram.

Conclusion

Finally, after nearly 40 years of research, the GPR survey proofed that the site really depicted a Roman *villa rustica*. The reason for the better visibility of the archaeological remains in the GPR depth slices compared with the resistogram, is that the latter is disturbed by the shallow geological structures of the moraine hill. Of course, the geology is also mapped by the GPR, but the depth slices allow distinguishing them from the archaeological remains through the slightly varying depth. Furthermore, due to the higher spatial resolution of the GPR data compared with the earth resistance data, the Roman walls are better visible. The magnetometer results only show vague hints of the stone buildings due to methodological reasons. However, the magnetogram might have revealed, if there are also wooden structures present in the settlement area. As none such features can be observed, the *villa rustica* seems to have consisted solely of stone buildings. The mapped *villa rustica* resembles the dispersed homestead layout that is common for the region Allgaeu. Similar ones were detected by geophysical surveys in the vicinity in Sulzberg (Linck et al., 2014), Kohlhunden (Czysz & Tschocke, 2003) and at the Hopfensee (Linck et al., 2021).

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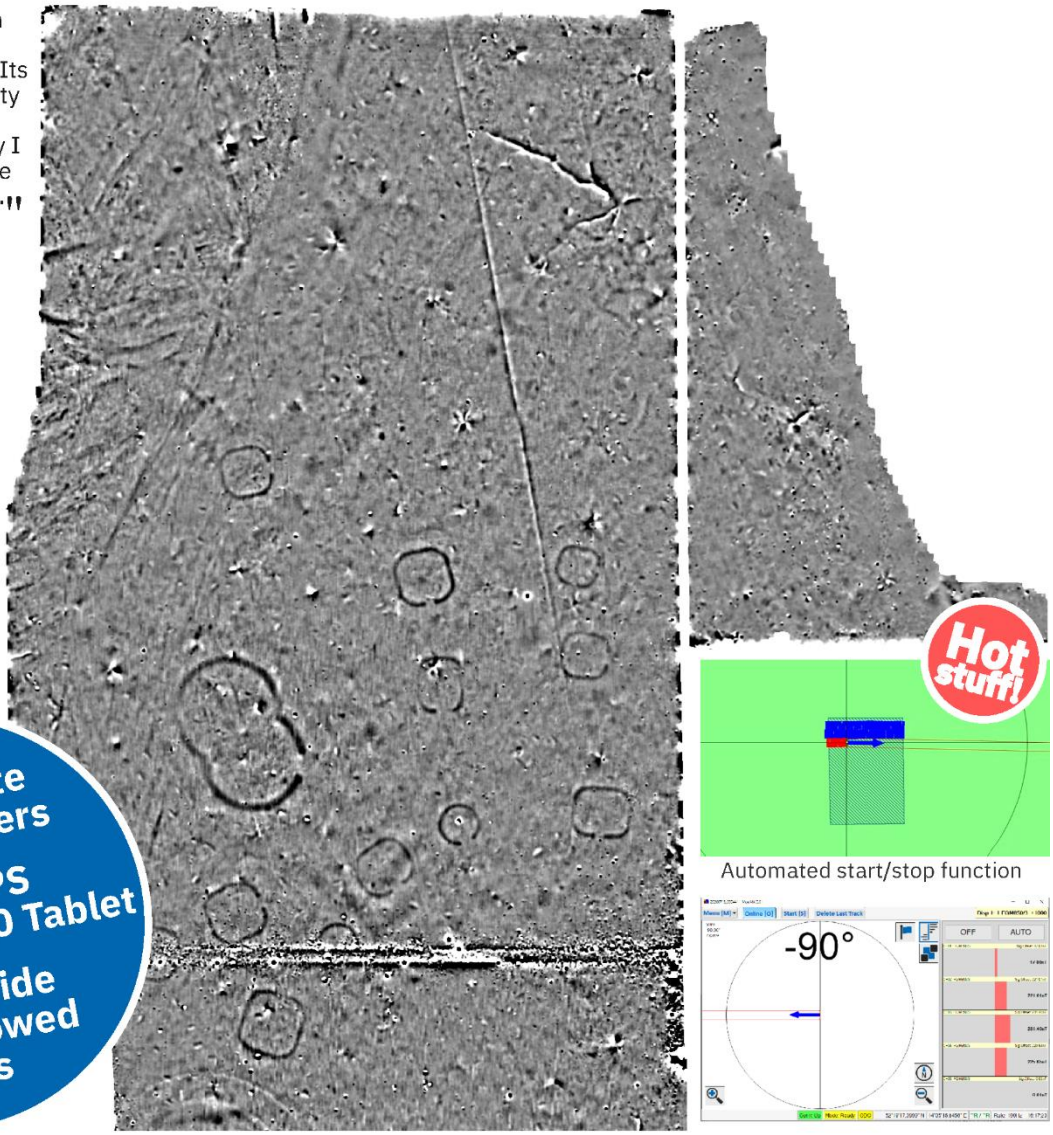

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The ISAP News Gallery

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Introduction

Dear ISAP Members,

After some time of staying in a Covid and post-Covid limbo, most of us eventually managed to get back to more or less normal life and regular professional activities. Many colleagues went out to the field and carried out surveys over the last few months.

Regarding the recent freezing temperatures (at least in the northern part of the northern hemisphere) one may like to warm up with a cup of hot beverage. To enhance this experience, I would like to present you with a couple of nice pictures, taken in a warmer setting or time (also see our frontpage)!

Please remember – the ISAP Gallery needs you! Do not hesitate to feed us with your pictures!

Michał Pisz – ISAP & ISAPinacotheca Editor

1. *Mapping the urban layout of the Gallinazo mounds Viru Culture Peru* - Edward Eastaugh

2. Trisha Voke surveying with a Bartington. I wonder if the monkey helped to move the ropes.

3. Jarrod Burks shared a picture of his multi-channel magnetometer enlighten with a September sun

4. Arne Anderson Stamnes is clearly not afraid of any weather extremes, regardless of whether it is a blizzard or a sandstorm!

5. Philippe De Smedt carrying out a motorized EMI survey in a short sleeve – picture provided by Jeroen Verhegge, authored by Layla Aerts

6. *Ms. Kleyman taking pXRF soil readings as a part of Archaeobiogeochemical survey in the US and Mexico in 2007-2018.* Picture and description by Richard Lundin

7. *A picture of a survey I undertook for Antony Harding at Sobiejuchy, Poland, in the summer of 1987. We were using an RM4. Of course, at the time, we had to wait until we got back to the UK to process the data on the mainframe at Durham (once it had been input by the ladies of the "Data Preparation Service"). The results provided us with an excellent plan of where the hay was lying in the field to dry. Many years later I managed to import the data into TerraSurveyor and reprocess it.* – Kris Lockyear

8. *Ibrahim Haj Hassan describes his resistivity survey to a visitor: Abu Mousa, the landowner and sheikh of the Abu-Orabi family. As everyone knows, it is always a delight to find other people who are curious enough to ask what is going on with a geophysical survey.* – Picture and description of an electrical survey in Jordan are from MASCA 1970s report, shared by Rinita Dalan

9. *Crazy GPR survey at a 45° steep hill in a search of a possible Roman theatre in Southern Bavaria. The standard GPR equipment was modified to fit the special requirements of the survey area. The kit was pulled with a rope and a tackle from above.* – Roland Linck

Journal Notification

Archaeological Prospection 2022: 29(4)

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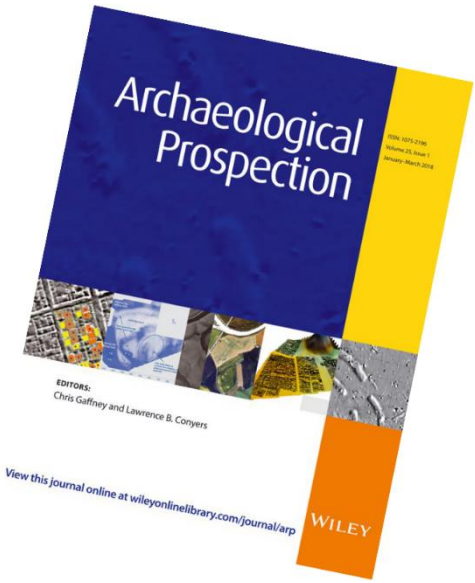

Human-in-the-loop development of spatially adaptive ground point filtering pipelines—An archaeological case study (Open Access).

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Yi Hu, Yipang Liu, Jianxiang Ding, Boran Liu & Zhongxin Chu

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Roland Linck, Andreas Stele & Hans-Martin Schuler

UAV magnetometer survey in low-level flight for archaeology: Case study of a Second World War airfield at Ganacker (Lower Bavaria, Germany).

Andreas Stele, Roland Linck, Markus Schikorra & Jörg W. E. Fassbinder

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