ISAPNEWS

The Newsletter of the International Society for Archaeological Prospection

Issue 70, December 2023

Editorial – Issue 70

Welcome to Issue 70 of ISAPNews!

We have a distinct (though unintentional) Roman theme in this issue, with three case studies covering various facets of life in the empire. The front cover shows survey underway at a site in (a very summery) southern Germany - turn to page 3 for more on this.

This time we have details of not one, but two ISAP-funded projects. The first of these used magnetic and GPR survey to investigate Roman remains in southeast Romania, while the second focused on coastal defences in southern Britain, as well as public outreach work. Not only are these pieces interesting in their own right, but we also hope they will serve as a reminder and provide some inspiration for future ISAP Fund applications...

And, of course, we have details of articles in the latest issue of *Archaeological Prospection* and a reminder about ISAP merchandise - we can't guarantee it will arrive in time for this Christmas, but nevertheless, it's the perfect gift solution for the geophysicists in your life!

To everybody who's celebrating, we hope you have a very enjoyable and restful Christmas. Here's to a happy, healthy and peaceful 2024 that's full of excellent and intriguing geophysical data!

Hannah Brown & Michal Pisz

editor@archprospection.org

Cover: GPR survey at the Tegelberg, Bavaria. (Photo: Florian Becker, BLfD)

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Modelling the Roman floor level? Analysis of a strong GPR anomaly

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Site and research question

A Roman villa rustica is located at the foot of the northwestern slope of the Tegelberg (Swabia, Southwestern Bavaria). It was discovered at the beginning of the 20th century, when H. Popp undertook excavations in 1934/35 and uncovered a subsidiary building containing several drying kilns (Popp 1936/37). In 1966-68, due to the construction of the funicular up the Tegelberg, two further buildings were detected through excavations by Günther Krahe of the Bavarian State Department of Monuments and Sites (BLfD). These two buildings can be interpreted as a main living building and a Roman bath (Krahe & Zahlhaas 1984). Further small-scale archaeological surveys date to the year 2005 and correspond to the construction of a new parking lot further to the northwest.

The Roman settlement can be dated to the 2nd and 3rd century AD and is located near to the *via Claudia*, one of the main roads from Italy to the Rhaetian capital Augsburg - *Augusta Vindelicum* (Krahe & Zahlhaas 1984). The villa rustica was presumably associated with stock farming or ore mining, as the geographical and climatological location does not favour arable agriculture. Because of the Alemannic raids in the middle of the 3rd century AD, the settlement was abandoned (Krahe & Zahlhaas 1984). The archaeological surveys also revealed that a massive landslide down the Tegelberg slope later destroyed the Roman remains, covering the site with a 0.5 m - 1.5 m thick layer of mud and debris.

Based on the current state of research, the site could have been a smaller villa rustica or even a bigger settlement, as the remains were detected across a 300m radius (Krahe & Zahlhaas 1984). To get a better understanding of the Roman site, a geophysical survey was executed in summer 2023. The area between the three excavated buildings was chosen as a first test site, based on the current lack of knowledge related to that area (Figure 1).

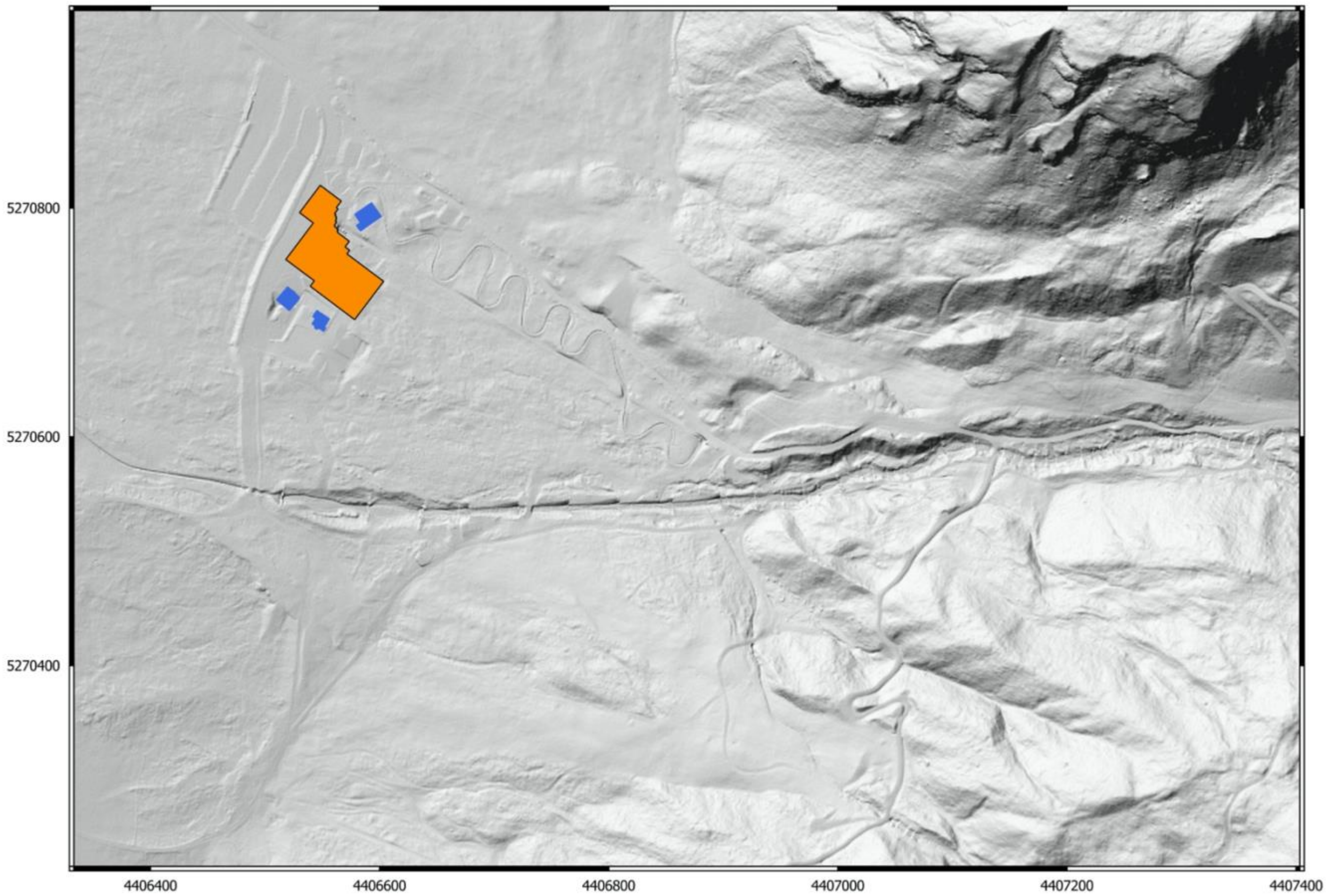

Figure 1: Location of the survey area (orange) between the three excavated Roman buildings (blue). The background hillshade plot shows the topographical location at the foot of the Tegelberg (map creation: Roland Linck; topographical data: Bavarian Topographical Survey, www.geodaten.bayern.de, CC BY 4.0 license).

Survey results

The test area nowadays serves as a paved parking lot for the funicular. Hence, together with the fact that mainly stone constructions were expected in the ground, a GPR survey promised the best results. In total, we surveyed a 95 m x 76 m area covering the whole space between the funicular's valley station (to the south of the survey area) and the nearby summer toboggan run (to the northeast) (Figure 1) with a GSSI SIR-4000 equipped with a 400 MHz antenna (Figure 2).

Figure 2: GSSI SIR-4000 radar system at the Roman site near the Tegelberg (Photo: Florian Becker, BLfD).

Unfortunately, the depth slices (not illustrated here) do not show any archaeological structure at all and only several modern utility pipes and the parking lot markings are visible. Looking at single GPR profiles, however, reveals that there is a very distinct layer boundary apparent in each profile, which occurs at varying depth (Figure 3). The different reflection characteristics of the material above and below the layer boundary is striking. Whereas above the boundary, a quite homogeneous material with few reflection hyperbolas is visible, below it, many small reflectors and inhomogeneity appear. Hence, this anomaly could relate to the distinction between the solid bedrock and the mentioned landslide deposits, which the excavations have shown to mainly consist of coarse- and fine-grained loose material. This might be the reason that the boundary is very visible in the GPR data. Now, the question arises, whether this boundary could indicate the former Roman floor level. To solve this problem, we modelled the interface.

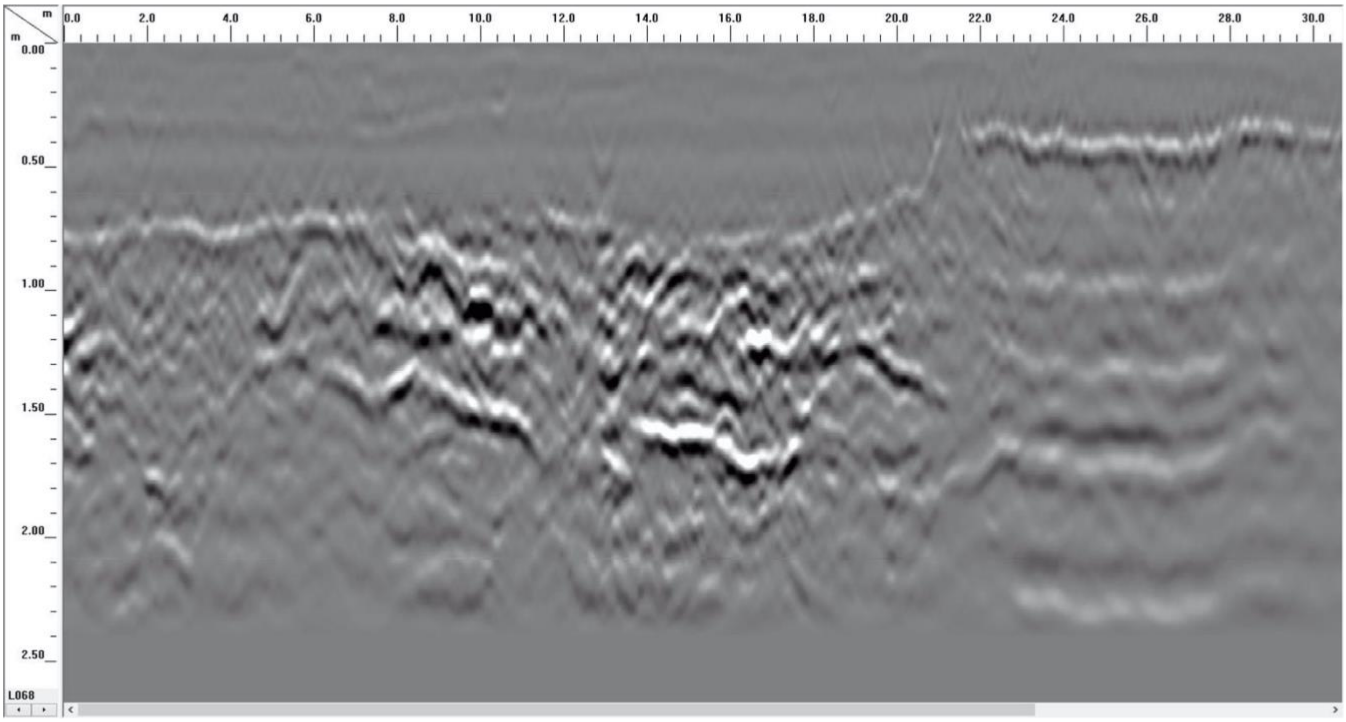

Figure 3: Single GPR profile showing the strong layer boundary at a depth of 0.3m - 0.8m below the modern surface in this location.

Modelling of the layer boundary

The modelling of the layer boundary consisted of several steps. The first was picking the clearly visible stratum in the single profiles in a local coordinate system with a sample spacing of 1 m x 1 m, using RADAN software. The point spacing was chosen according to the corresponding resolution of the digital surface model (DSM) of the area. This local point cloud was then imported and georeferenced to a projected coordinate system in QGIS. Furthermore, points corresponding to modern utility pipes were manually deleted, as they distort the results due to their varying depth that does not correspond to the stratum. The next step was to take into account the modern height above sea level of the LiDAR DSM of the area. This ensured that no small topographical changes of the relatively flat parking lot caused false variation in the thickness of the modelled colluvium. The height above sea level of the stratum could then be calculated as a new attribute of each of the single points. To get the layer boundary as a 3D object, we interpolated the point cloud to a geotiff via inverse distance weighted (IDW) interpolation. As a last step, the modern surface and the stratum were visualised in Golden Software Surfer 13 (Figure 4).

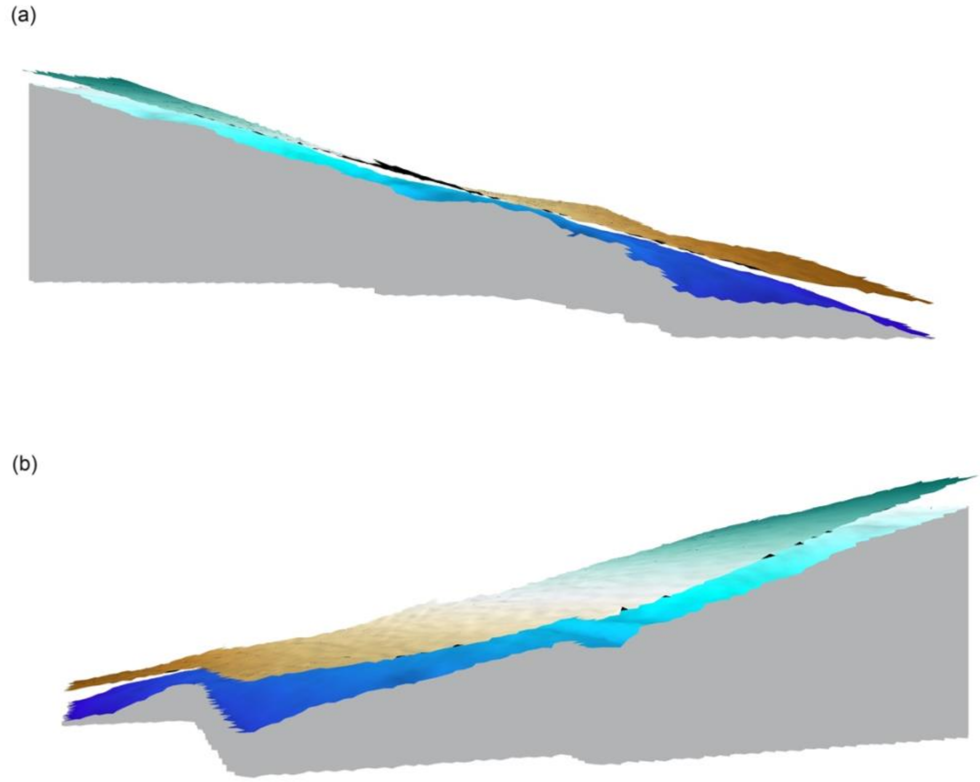

Figure 4: Modelling of the layer boundary (blue colour palette) in relation to the modern surface topography (brown to green palette) and the solid bedrock (grey base). Area clipped to the size of the survey grid. 4a: view from the northeast; 4b: view from the southwest. Exaggeration of vertical scale by factor 4.

The modelled results in Figure 4 reveal that the thickness of the colluvium is increasing in the downhill direction. It ranges from 0.5 m in the southeast up to 1.3 m in the northwest. This change is confirmed by the excavation results of 1935 and 2005: whereas the older excavations of the three buildings (located upslope of the parking lot) showed a layer of debris 0.5 m thick in places, the same layer was only c. 1.5 m thick under the newly built parking lot to the northwest. The only anomaly in this trend in the modelled data appears at the edge towards the summer toboggan run and can be explained by the construction of the latter. The modelling results hence provide strong evidence for the thesis that the stratum could correspond with the Roman floor level and the colluvium relates to the landslide destroying the Roman buildings. This could explain why no remaining walls can be identified in the GPR depth slices. The other possibility that the layer boundary is due to deeper removal of material during the construction of the parking lot in the

1960s cannot be corroborated by the operator of the funicular and is considered not very probable.

Conclusion

The presented results show that GPR is not only capable of detecting archaeological features like, for example, remaining stone walls or refilled ditches, but also gives insights into palaeosurfaces. A such, the method can provide useful information for geoarchaeological questions of a different kind. The only premise is that there are two distinct layers of distinct reflectivity and therefore different material or soil moisture. Otherwise, the reflection coefficient governed by the two dielectric values of the materials would be too small to be resolved by the GPR device (Reynolds 1997; Milsom 2003; Conyers 2004). Coming back to the Tegelberg results, it has to be stated that a definite answer to the question whether the layer boundary really corresponds to the Roman floor level can only be given by an archaeological excavation or drilling directly in this area. However, as this is not practicable due to the paved parking lot, the geophysical survey at least gives strong evidence for this thesis.

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Two gas pipes and a Roman rural settlement (not a love story)

ISAP Fund Completion Report

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The Roman rural site of Ceamurlia is situated in southeastern Romania, in the historical province of Dobruja, roughly 30 km from the Black Sea coastline and 25 km from the ancient Greek colony of Histria (Figure 1).

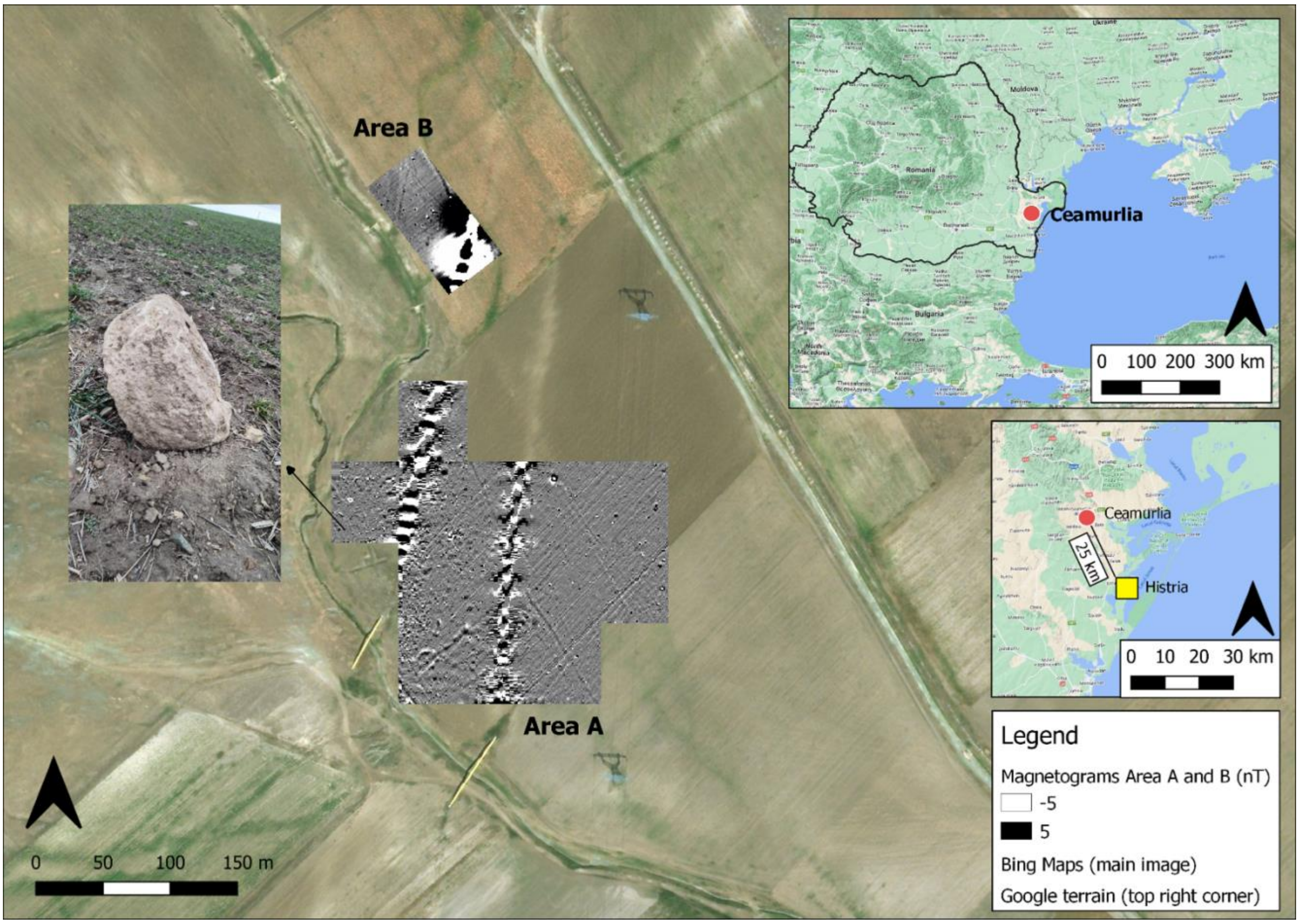

Figure 1: Overview of magnetic survey with the Ceamurlia site and its position in relation to Histria.

It was identified in the late 1980s and a cross section trial trench has been excavated there probably in the early 1990s by the late prof. Alexandru Avram from Le Mans University (France). However, the data has not been published and there is no field notebook available due to the professor's untimely death. Apart from a site visit when the trench was still visible no other information could be obtained.

As part of a larger landscape archaeology study in the hinterland of Histria (*regio Histriae* in Early Roman times), focused on Early Roman rural settlements, this site seemed like a perfect example and we took the challenge of continuing research at this site using geophysics in the first phase. We would like to thank ISAP for funding the campaign of January 2023 with an award from the ISAP Fund.

The region (called Dobruja today) situated between the Black Sea (to the east), Danube Delta (to the north) and the Danube (to the west) was under Roman influence since the 1st century BC and was incorporated into the Roman province Moesia after AD 69 when the civil war ended and Vespasian became emperor. After AD 85, under emperor Domitian, the province was split into two parts and this region became part of *Moesia Inferior* (Suceveanu & Barnea 1991). Information about the territorial administration around Histria comes from a document called Horothesia ('settlement of the borders') of Histria, dated October 25th AD 100, by Manius Laberius Maximus, governor of the province, where the limits of the *regio Histriae* are mentioned and we can place our site within the boundaries of the regio (Olteanu & Amon 2008).

The site is currently arable land, heavily affected by mechanical activities. It is situated between a county road to the east and a small water course to the west. It is also crossed by two large gas pipes (c. 2 m in diameter) coming from the west, that surface over the water stream and return back into the ground in our survey area. Similar to the nearby site at Panduru, where we have carried out magnetometer and GPR surveys since 2020 (unpublished), we assumed that the archaeological layer is very close to the surface, within the first 0.5 m - 0.6 m.

Methodology

After the ground-truthing stage, locating Avram's trial trench and identifying areas with a high density of archaeological material on the ground (mainly pottery sherds, local greenschists from building foundations and roof tiles) we established two areas for magnetometer surveys in the first stage (see Figure 1). The instrument used was a 3-sensor nonmagnetic cart Sensys DLM98 working in a local grid. The first area (A) was split into grids of 50 m x

60 m and a total are of 3.9 ha was covered. The second area (B) was a larger grid of 100 x 50 m. Data density was 1 m x 0.10 m. We aimed at doing a magnetometer survey in case our initial data showed promising results and then augment them with Ground Penetrating Radar (GPR) investigations.

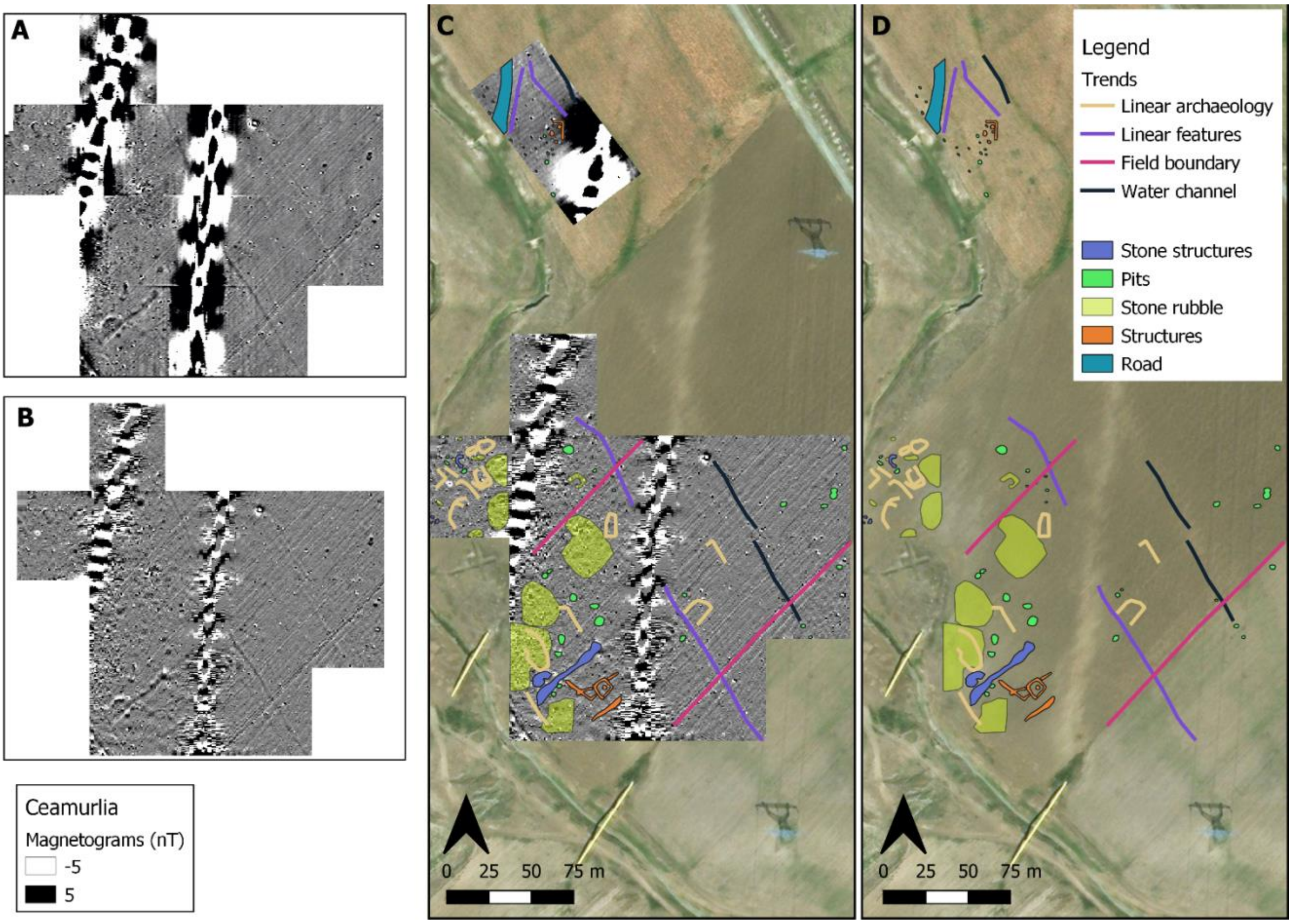

Figure 2: Magnetometer data and interpretation. A: Area A processed with Terrasurveyor; B: Area A applying a rolling median; C: Areas A and B with interpretation overlay; D: Interpretation.

Area B is situated North of Area A and covered two areas with an average concentration of artefacts, mostly pottery sherds in this case. One of the pipes appeared in our survey and occupies the NW part of the data.

For the second stage we investigated one area of 20 x 30 m where we detected magnetic anomalies, and artefacts were present on the ground. A Mala GPR ProEx with a 500 MHz antenna was used and data density was 0.02 m x 0.50 m.

Due to the presence of the two metal pipes, the magnetic data was initially processed in Terrasurveyor (Figure 2A), but the halo they produced was not fully reduced and data was reprocessed by Natalie Pickartz using a rolling median along the traverses and results were vastly improved (Figure 2B), thus structures obscured by the metallic signal became visible in the data set.

Results and Interpretation

Numerous magnetic anomalies were identified in both areas, mostly overlain by artefacts scattered on the ground (Figures 2 and 3). Areas with bipolar anomalies that are related to stone rubble from structures were present, mostly in the southwestern and western parts of Area A. The dispersed and more compact stone areas were marked differently on the interpretation diagrams (Stone Rubble and Stone Structures). Numerous positive magnetic linear anomalies were located. These might be features related to the stone buildings (ditches, fences etc.) or adjacent structures of the household(s).

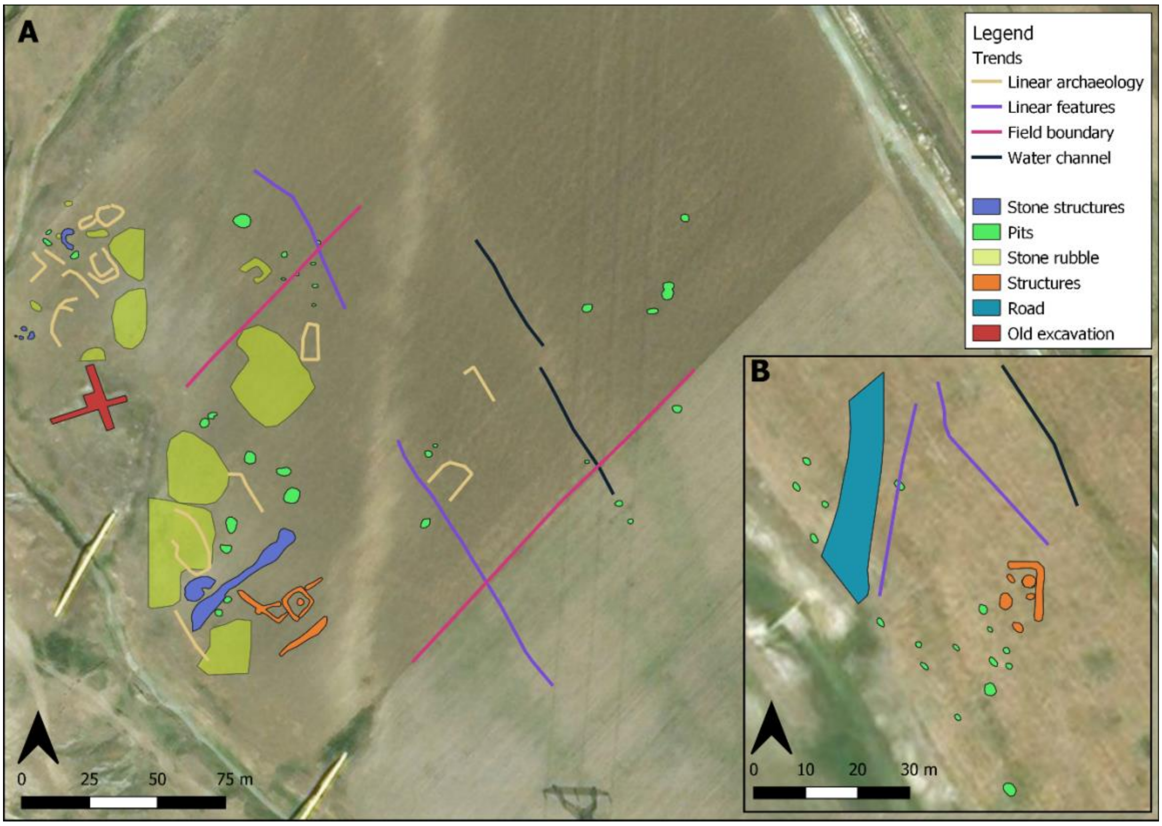

Figure 3: Interpretation of magnetic data. A: Area A; B: Area B.

In Area A, the concentration of anomalies is situated in the western part, closer to the stream, where the magnetic data detected parts of stone structures as well as the dispersed material from them, other features related to the buildings and one possible annex (marked in orange - Structures - in Figures 2 and 3). The rest of Area A was relatively ‘quiet’ magnetically with some well-defined pit-type features, field boundaries, and other linear anomalies that cannot be identified on aerial imagery but are most likely modern.

Both areas are dotted by pit-type features. Larger ones (up to 3.5 m diameter) could be related to dwellings or annexes while smaller ones are probably different types of pits. Very small ones might be the result of moles; such burrows were observed during survey.

In Area B some magnetic anomalies are visible outside the metallic pipe's halo. One of the anomalies that appears also in Area A, oriented N-S is related to a small palaeochannel or a water pipe for irrigation or drainage. There is also part (two sides) of what could be a rectangular structure (with positive magnetic contrast up to 10-13 nT) and several pit-like features near it.

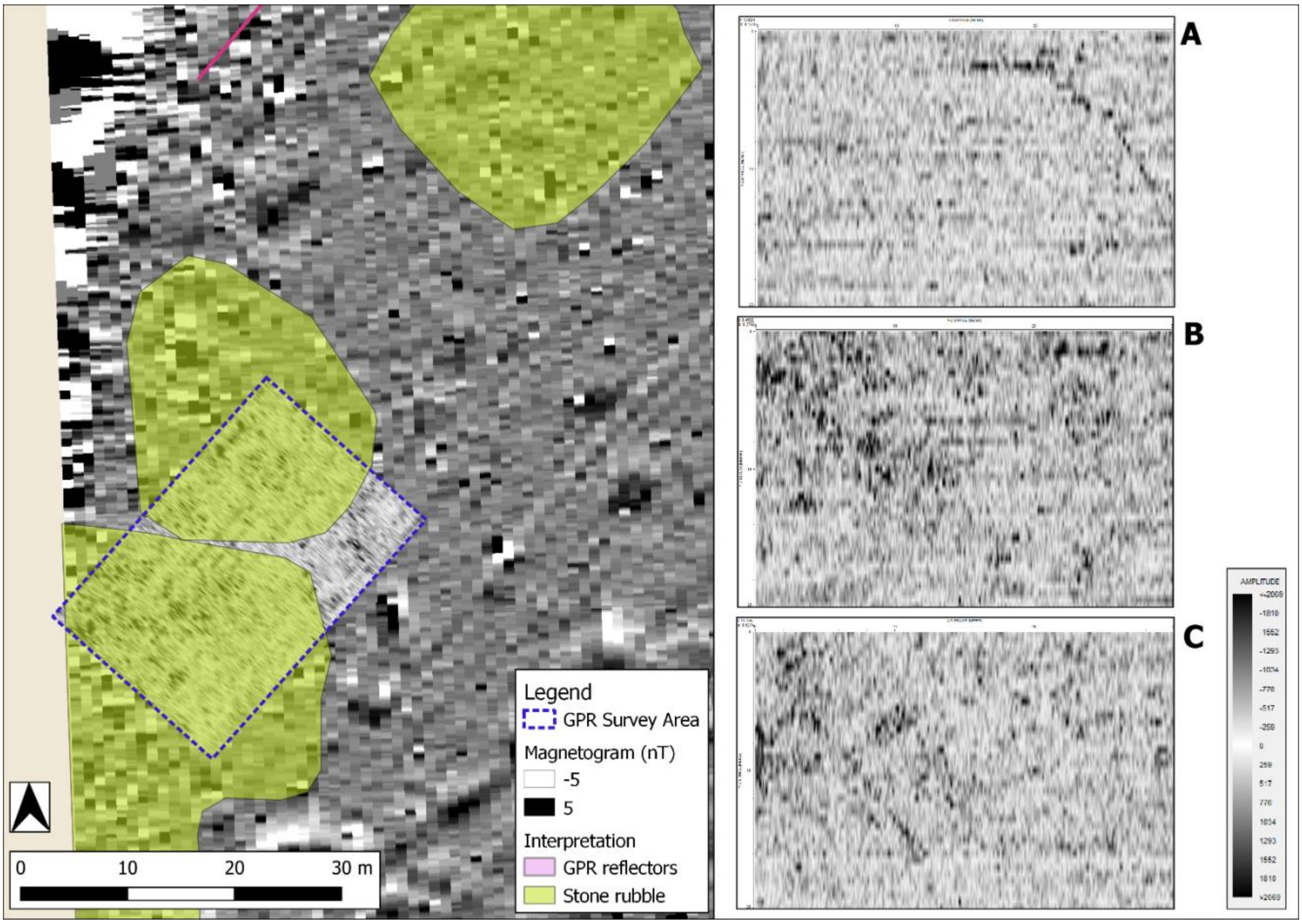

Figure 4: GPR data. Main – Survey area, timeslice at -0.35 m and interpretation. A: timeslice at -0.15 m; B: timeslice at -0.35 m; C: timeslice at -0.50 m.

The GPR survey in the SW of Area A (Figure 4) overlaps an area with a high concentration of artefacts on the ground and stone rubble in the magnetic map. Time slices show that high amplitude reflectors are present in areas with bipolar magnetic anomalies, related to stone walls and rubble from a depth of around -0.25 m to c. -0.60 m, which is consistent with information that can be seen in the eroded, but still open excavation trench. There is also a linear feature present very close to the surface, from -0.15 m to -0.25 m, visible in Figure 4A. It is highly improbable that it is related to the Early Roman layer due to intensive agriculture activities.

Final remarks

Although not a geophysics love story due to the presence of the two pipes and intensive agricultural activity that destroyed part of the shallow archaeological layer, it was possible to detect parts of the settlement. They are concentrated in the western part of survey Area A, close to water, with stone structures, mostly dismantled, annexes and other types of structures.

Two other types of structures were also identified (one in each area), as well as a plethora of pit-type features and, as a bonus - also in the western-most grid - part of a limestone column with a diameter of c. 0.5 m - 0.6 m (Figure 1).

The extent of the site and its functions are not yet clear, but from the first investigations we can assume that we are dealing with a relatively small settlement, with a few stone structures and annexes. The presence of the column part could change the situation and might indicate that this could come from an edifice, or that the site is a Roman villa. Future work that could include ERT and ER surveys might produce more information and possibly clarify the situation with regard to whether it is a villa or a village, as well as to the current conservation state of the site.

Acknowledgements

The author would like to thank ISAP for the award from the ISAP Fund that made this project's fieldwork possible.

Moreover, the author gratefully thanks Natalie Pickartz for reprocessing the data, the discussions and remarks.

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Communities of the Saxon Shore, past and present: Survey and outreach at Pevensey Fort and Castle

ISAP Fund Completion Report

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I am very happy to share with the ISAP community my Ground Penetrating Radar survey at the Saxon Shore fort at Pevensey (Figure 1) and the related outreach efforts. My belief is that archaeology provides value to local communities, but also derives value from wider interest. I chose to concentrate on community outreach because although archaeological geophysics is recognisable, especially for the Time Team generations, it is still somewhat poorly understood by the public. I sought to demystify the techniques and the archaeology by disseminating my results to a wide range of local stakeholders, including talks during the local Pevensey History Festival (a fortnight in August each year) and sessions for Year 4 pupils at Pevensey and Westham Primary School during their units on the Romans and Saxons.

Figure 1: Location of the site in south-eastern England.

The survey itself was situated in two areas of the Scheduled Ancient Monument: the inner bailey of the Norman Castle and a selected area of the outer bailey, which is within the extant circuit of walls enclosing the area of the Roman Shore Fort. I also targeted a third area, 200 m from the west gate of the fort in the grounds of the primary school, on a potential line of the Roman road. The survey areas were georeferenced with a Leica Viva RTK GNSS instrument and the GPR surveys were undertaken with a Malå RAMAC/GPR XV11 with a shielded 250 MHz antenna on a rough terrain cart with a spatial survey resolution of 0.5 m × 0.03 m (Figure 2).

Figure 2: GPR survey inside the inner bailey.

Pevensey was built in the last quarter of the third century AD and excavation evidence indicates it was occupied, often times by individuals or communities with access to high status material goods, in the centuries after the end of the Roman Empire in Britain. An earlier fluxgate gradiometer survey conducted by me in early 2019 suggested that there was potential survival of archaeological features throughout the outer bailey. I also wanted to test the possibility that the Norman Castle possibly allowed the preservation of the Roman layers below it, rather than obliterating them. In the case of the inner bailey I was wrong with this hypothesis, as I was not able to interpret a configuration of buildings that related to the medieval phase of the castle/fort, much less any surviving Roman structures at depth. In the outer bailey I had slightly more success, in that I targeted an area where historical excavations had located the outlines of a robbed-out building dating to the late fourth century AD. My survey on the grounds of the primary school similarly lacked success, but in this case the cause was likely topographic – during the Romano-British and into the Medieval periods Pevensey was coastally situated, making it an ideal base for the Roman and Norman fleets. Although directionally the school looks perfectly in position to observe the routeway from the fort to the chalk uplands westward, the road may have changed direction before reaching the school grounds which, when subsequently examined using LiDAR data, looks too low-lying and may have been intertidal during the periods of interest.

Where this project really excelled was in the outreach elements. The local community from the Historic England staff at the castle itself, to interested villagers, to the primary school pupils were incredibly interested in the archaeology of the castle and the geophysical methods I used to explore it further. The outreach programme with the school began in March 2021. In addition to the presentation of my previous survey and a discussion with the pupils about the Roman and Anglo-Saxon phases of the fort, I partnered with Worthing Museum and Art Gallery (with whom I have an ongoing collaboration) to bring artefacts for the pupils to see and handle. I think the combination of the privileged views – both of the subsurface and of artefacts from 'behind the museum glass' were big hits, and the teachers later mentioned how the classrooms buzzed for days after seeing the objects and meeting a 'real archaeologist'.

A chance meeting in the castle car park led me to be invited to give a talk as part of the Pevensey History Festival, a fortnight of hands-on events and guest lectures. I was able to share the good news of the work first in 2022 in an extremely well-attended talk in the Tudor Pevensey Gaolhouse and Museum and, second, in 2023 in a similarly well-attended talk in the parish church of St Nicholas (Figure 3).

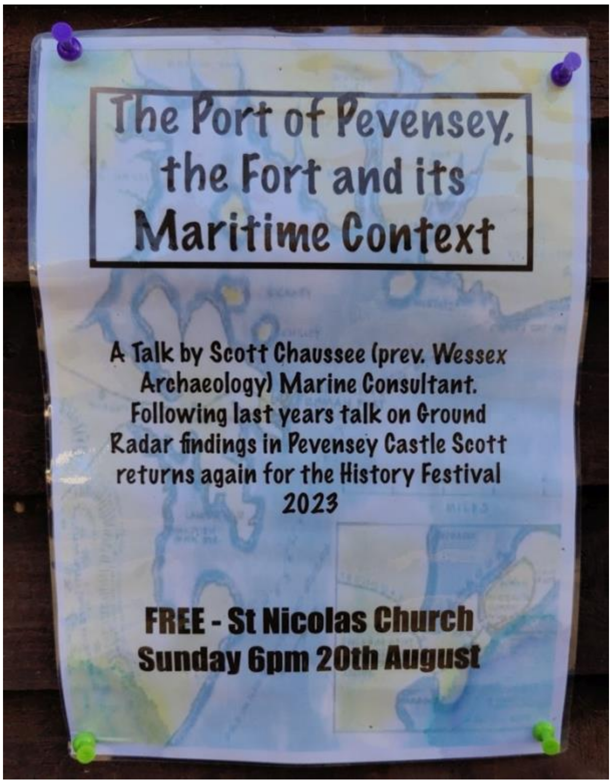

Figure 3: Advert for a talk on the GPR results.

I want to conclude by saying that despite the delays, the support of ISAP through the Fund and thereafter produced an enduring legacy of interest and interaction between the community and myself. In addition to the survey report and this newsletter item, I have been working on a companion website to the survey and my ongoing work at Pevensey, aimed at the Key Stage 2 history and science components of the National Curriculum of England. Though in draft stage now and being reviewed by the Year 4 teachers and subject leads at Pevensey and Westham Primary, I hope to share it with the wider ISAP community when it finally goes live.

Acknowledgements

I want to conclude this contribution for ISAPNews with gratitude, and an apology. My project, 'Surveying the Saxon Shore' was conceived, and funded by ISAP in 2019. With some grace it was extended into the New Year, 2020 (and we all know what the first months of that year were like). Through varied circumstances there were delays to this project which were not all external, but through it all, the ISAP Management Committee ensured that not only would I succeed with the project, but that value for the society's members was maintained. I want to thank Armin, Paul, and the rest of the ISAP Fund and wider team in shepherding this project to a conclusion.

Journal Notification

[Archaeological Prospection 2023: 30(4)]

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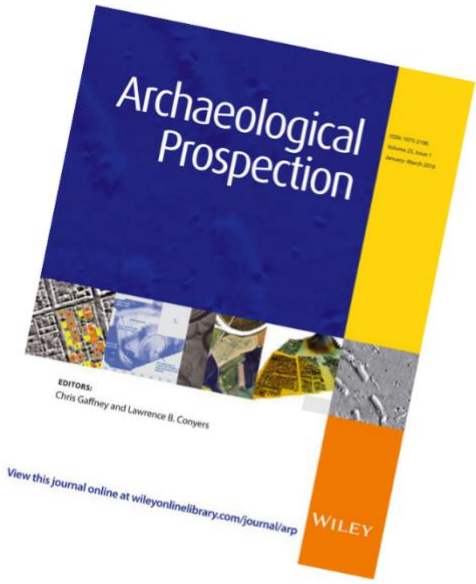

Comprehensive geophysical prospection of the Roman and late antique city of Pollentia (Alcúdia, Mallorca, Spain) (Open Access)

by Miguel A. Cau-Ontiveros, Catalina Mas-Florit, Esther Chávez-Álvarez, Roger Sala, Cornelius Meyer, Helena Ortiz-Quintana & Pedro Rodríguez-Simón

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