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THE URBMINARQ PROJECT: AN ARCHAEOLOGICAL APPROACH TO THE PROTOHISTORIC URBANISM OF THE IBERIAN PENINSULA BASED ON THE INTEGRATED USE OF NON-INVASIVE METHODS

1. Introduction

One of the most significant expressions of the socio-economic changes that occurred in the interior of the Iberian peninsula during the beginning of the Second Iron Age is the widespread use of easily defensible positions for the establishment of large fortified settlements (Fichtl 2018; Fernandez-Götz 2020; Ruiz Zapatero 2023; Burillo Mozota 2023). Walled enclosures are a common feature among the various peoples who inhabited large areas of the peninsular plateau, despite their significant regional diversity and variations in size, defensive systems, and architectural complexity. These populations encountered Mediterranean powers, first Punic and then Roman, starting in the 3rd century BC. This process culminated in the first half of the 1st century BC with a period of widespread instability caused by the Civil Wars that often followed the campaigns of conquest.

The history of archaeological research on this phenomenon dates to at least the second half of the 19th century, and is impossible to summarise here (Blanco García 2017; Armada Pita, Grau Mira 2018). However, it should be noted that, with some significant exceptions, the study of Second Iron Age fortified enclosures has been hampered by the difficulty of obtaining a quality archaeological record of large areas, which would allow us to analyse the internal morphology of these enclosures. As a result of this severe limitation, we have an extensive record of many settlements in which the only clearly recognisable element is the perimeter of their defensive structures, mainly walls, ditches, and ramparts.

The persistence of this state of the art throughout much of the 20th and early 21st centuries is due to two main factors. On the one hand, archaeological research has primarily focused on spaces where it was considered possible to recover a more representative record of the ideological, cultural and identity systems of protohistoric communities, such as *necropoleis*. Large sites from the Celtiberian region are remarkable (Aguilar de Anguita, Carratiermes) (Jimeno *et al.* 2005), and those corresponding to the Vettonian culture (La Osera, Cogotas, Ulaca) (Álvarez Sanchís 1999) to which the case studies presented in this paper belong. On the other hand, the study of the interior of the settlements depended fundamentally on the ability to carry out large archaeological excavations that would allow us to discover significant areas

of the interior, recognising complete domestic structures and the systems of spatial articulation (Álvarez Sanchís, Ruiz Zapatero 2019). Logically, this was only possible on rare occasions, especially thanks to the large excavation projects that abounded at the beginning of the 20th century in emblematic settlements, such as Azaila, Numancia, Tiermes (Jimeno Martínez 2011; Martínez Caballero *et al.* 2023), or in the Vettonian area, sites such as Las Cogotas or El Raso (Álvarez Sanchís 2011; Fernández Gómez 2011).

The progressive introduction of new methodological tools has provided opportunities to obtain knowledge of large areas inside defensive enclosures without relying exclusively on excavations; non-invasive methods such as surface survey, geophysics, and remote sensing. These recording systems are widely used in archaeological methodology globally. They have been successfully implemented in large protohistoric settlements in countries such as the United Kingdom, France, Germany, and other countries in Central and Eastern Europe (e.g. Bibracte, Mont Lassois, etc.) (Fernández-Götz 2018, 2020). In the case of Spain, these systems are introduced with a delay compared to their earlier use in the study of other types of sites, such as Roman cities (Corsi, Vermeulen 2012; Mateos Cruz *et al.* 2014). In 2016, The Merida Institute of Archaeology initiated a long-term research programme focused on exploring fortified settlements located in the western part of the Plateau, specifically in the mid-Tagus valley. Its aim was to fill one of these gaps and generate a large volume of new knowledge. The goal of this study was twofold: firstly, to examine the significance of these settlements in the protohistory of the region, and secondly, to evaluate the effectiveness of non-invasive methods used to acquire this knowledge (Mayoral Herrera 2021). The roots of the urban phenomenon in the southwest of the Iberian Peninsula. Characterisation through non-invasive research of Iron Age castros and *oppida* (UrbMinarq) funded by the Spanish Ministry of Science have led to the development of a strategy based on intensive exploration using a combination of geophysical and remote sensing methods. This strategy has been applied to a series of case studies that are representative of the period under consideration. This does not exclude, of course, the use of other methods, such as excavation, which are obviously essential to answer questions concerning the chronology, functionality, and many other aspects of the archaeological contexts.

The project aims to provide an overview of the urban layout, 'anatomy' of these settlements. Understanding the morphology of the internal structures, we can gain further insight into functionality, space usage, planning, dwelling typologies, the presence of unique buildings, and the spatial organisation in streets, blocks, public spaces, as well as the presence of voids and other spaces. The aim of this study is to define the urban models of settlements, revealing the social logic behind their spatial organisation.

Fig. 1 – Location of Villasviejas del Tamuja and El Raso.

More specifically, these objectives have been achieved through ongoing research in case studies that offered favourable conditions. This includes the topography and characteristics of the landscape, the existence of previous scientific research, and the collaboration of the local administration. The local administration is an essential ally in successfully concluding this type of project. We mainly refer to two of these sites, the Castro de Villasviejas del Tamuja, in Botija (Cáceres), and El Freíllo-El Raso, in Candeleda (Ávila) (Fig. 1). We have been working in many other sites such as Castillejo de Madrigalejo, Castejón de Valdecañas, Castillejo de la Orden de Alcántara, La Torrecilla de Talaván, or Cerro de la Breña. However, Villasviejas and El Raso have produced the most significant results and have been the focus of our most recent work, of which we will present a brief report in this paper.

Villasviejas del Tamuja (Botija, Cáceres) is a settlement consisting of two walled enclosures, covering approximately 7 hectares in size. It is situated on the banks of the Tamuja River and was occupied between the beginning of the 4th century and the beginning of the 1st century BC. The hillfort has a rich scientific production due to excavations and surveys conducted since the late 1960s, making it one of the most extensively studied hillforts in Upper

Extremadura (Hernández *et al.* 1989; Hernández, Martín Bravo 2017). In the last 7 years, our team has carried out an intensive survey with non-invasive methods, which has resulted in a complete reconstruction of its urban fabric (Mayoral 2021). Furthermore, new excavation campaigns have been conducted, organised to verify the results of these surveys.

The site of El Raso (Candeleda, Ávila) is a much larger settlement (around 25 ha), and one of the best known in the historiography of Vettonian hillfort phenomenon. Its occupation spanned from the end of the 3rd century to the middle of the 1st century BC, and it is located on the southern slopes of the Sierra de Gredos. Similar to Villasviejas, it has been extensively studied by various researchers since the 1970s. The excavations carried out by Fernández Gómez in the area are noteworthy. They have uncovered the most extensive group of dwellings of a Vettonian culture settlement known (Fernández Gómez 2008). During the development of our project, extensive survey and remote sensing work was conducted in the area, allowing the urban structure of the entire settlement to be defined for the first time.

V.M.H., S.D.N., M.E.B., C.C.P., C.M.M., P.D.M.

2. From questions to results: methodological processes

Regardless of their logic and convenience, and despite their lack of popularity in our peninsular contexts, the use of non-destructive methods in large protohistoric settlements is not in itself a methodological novelty. It is important to note, however, that in this project we have chosen a multiproxy approach, rather than on isolated procedures to define the layout of buried structures. This multiproxy approach integrates both visual and quantitative data from different sensors. This ensures a more comprehensive and accurate analysis.

Considering the large amount of work completed in various sites over the last few years, it would be impossible to even attempt to summarise either the development of the survey campaigns, or the different methods that we have used. Instead, we have chosen to provide a brief overview of the most recent work, which, although still in the analysis phase, offers the most novelty in relation to these case studies.

2.1 *Villasviejas: defining a militarised enclave from the Sertorian Wars*

Recent research has focused on gaining a better understanding of the physiognomy of the southern enclosure in Villasviejas del Tamuja. In this section of the settlement, previous studies have combined remote sensing, LiDAR, geomagnetic survey and GPR to define the urban layout as a whole. This has identified a series of building typologies which, when combined with the results of the 2019-20 excavations, strongly suggest the military character of the enclosure, dating it to the beginning of the 1st century BC (Delgado

Molina *et al.* 2021; Mayoral Herrera *et al.* 2021). However, there are still some important unanswered questions. It remains unclear how the wall was laid out and how it possibly connected to the northern enclosure. Moreover, there are uncertainties regarding the location of possible entrances to the enclosure on its western and eastern flanks. Furthermore, there are several undefined areas in the northern part of the enclosure despite the abundance of data. To answer these questions, it was proposed to conduct further geophysical (GPR) surveys, followed by test pits (Fig. 2).

For the geophysical survey, it was decided to work with a multichannel ground penetrating radar (IDS Stream-C, https://www.idsgeoradar.com/). This equipment has an antenna that can operate with frequencies ranging from 200 to 600 MHz and is equipped with a set of 34 dual-channel polarisation antennas (Fig. 5). This system enables the survey of large areas in a short time. The raw data were processed using the GRED HD software. Unlike previous campaigns that required marking reference grids, continuous data recording was made possible with the assistance of a Trimble R10 GNSS (Fig. 5). The work was conducted in April and June of 2023. The survey method employed in this campaign involved a series of sweeps using a zig-zag method and parallel profiles that covered the entire length of each survey area. During the acquisition phase, efforts were made to obtain regular profiles that could be placed side by side without leaving gaps, in order to achieve a uniform image format. Approximately 2.16ha, including parts of enclosures A and B, were surveyed using this system. For the purposes of the investigation, eight different areas of interest were identified that met the requirements for the investigation and application of the system, which allowed the identification of anomalies inherent to linear structures at a depth of between 0.50 m and 1 m belonging to the old circuit of walls and associated defensive structures.

S.D.N.

Test pits were conducted to contrast and interpret the results of the GPR survey (Fig. 2). The work plan was as follows:

– Test pits 1 and 1Bis were located at the NE end of the site to check where the wall runs along this flank.
– Test pit 2 was located on the west flank of the enclosure to determine the possible closure of the wall on that side.
– Test pit 3 was opened in the northern part of the interior of the enclosure to better define the type of structures existing in this sector.
– Test pits 1, 1Bis and 2 have confirmed the presence of the wall. The parapet documented in test pit 1 has provided new information about its construction. It has been determined that the wall does not have external walls containing the core, but that the external faces are more or less regularly squared on the

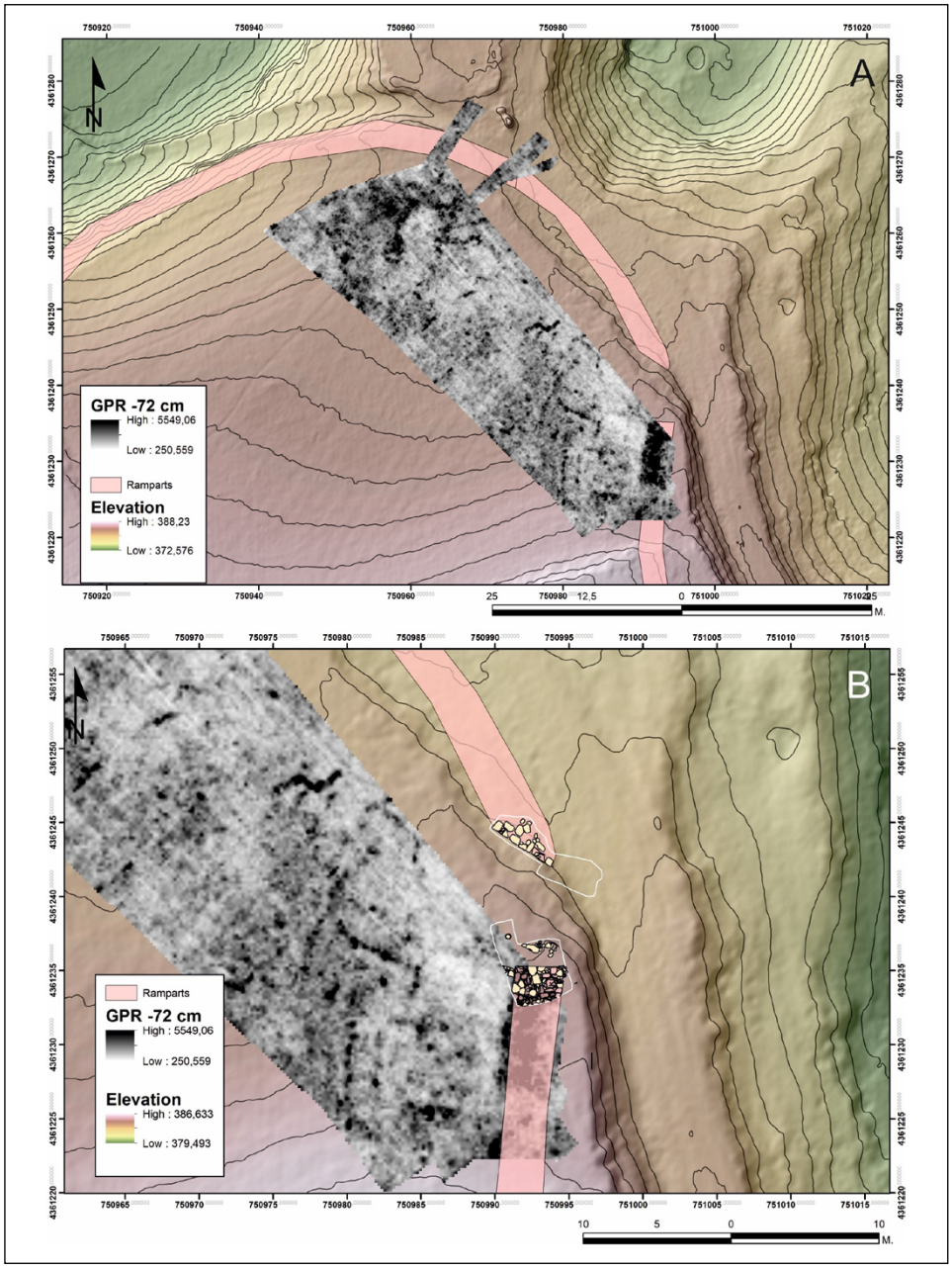

Fig. 2 – GPR geophysics in Villasviejas: a) results obtained at a depth of 72 cm in the north-eastern end of the southern enclosure; b) comparing the geophysical data with the archaeological test pits.

exposed portion and irregular on the inside, thus facilitating their assembly with the boulders that make up the core of the structure. It has been established that the construction method used for this structure involved building the entire structure, likely in sections, without any distinct phases for constructing the external faces. As a result, the defensive parapet has a sloped profile.

Similarly, test pit 1's defensive parapet has provided further information. The enclosure now has a new access gate, which has resulted in a change of direction in the wall's layout, as observed when trenches 1 and 1Bis were put together. Another dynamic documented during the last campaign, confirming earlier observations, was the reutilisation of the defensive structures by the domestic environment. There is evidence of the presence of hearths and pavements that were attached to the documented defensive parapets.

Test pit 2 revealed that the excavated section of wall is directly related to the section documented in the 2019 campaign. Additionally, it was confirmed that the upper part of the defensive parapet had been cleared to provide an effective passageway over the parapet. The construction of the bulwark during the 2019 campaign suggests the need to strengthen the defences during a period of instability. The bulwark is located at a distance of 35 metres from the wall, in one of the enclaves with the least natural defences of the southern enclosure and is integrated into it by the construction of a wall discovered during the geophysical prospection campaigns, thus creating a space between the original wall and the rampart, which had to be connected to the walled enclosure (Fig. 2). As a result, the original wall had to be made permeable to facilitate transit between the two spaces. The results are inconclusive as the outer face of the wall requires confirmation in future interventions. It is also necessary to determine the relationship between the space gained and the original ditch with which the defensive system was equipped.

Regarding test pit 3, no conclusive results could be obtained due to the lack of time available to complete the excavation. It was only possible to confirm the location of one of the slate walls detected by the GPR. This wall is associated with domestic use, as indicated by the ceramic kitchen material found. It may be related to the later stage of occupation of the settlement, as is the case with the domestic structures found in Test pit 1.

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2.2 *El Raso: completing the puzzle of the urban layout*

The recent works aimed to map the entire *oppidum* gradually, using a combination of geomagnetic survey (Fig. 3), tomography, LiDAR (Fig. 4) and remote sensing using thermal infrared and multispectral images. One question left unanswered by these surveys is defining the urban layout of the western half of the settlement and its relationship to Fernández Gómez's excavations.

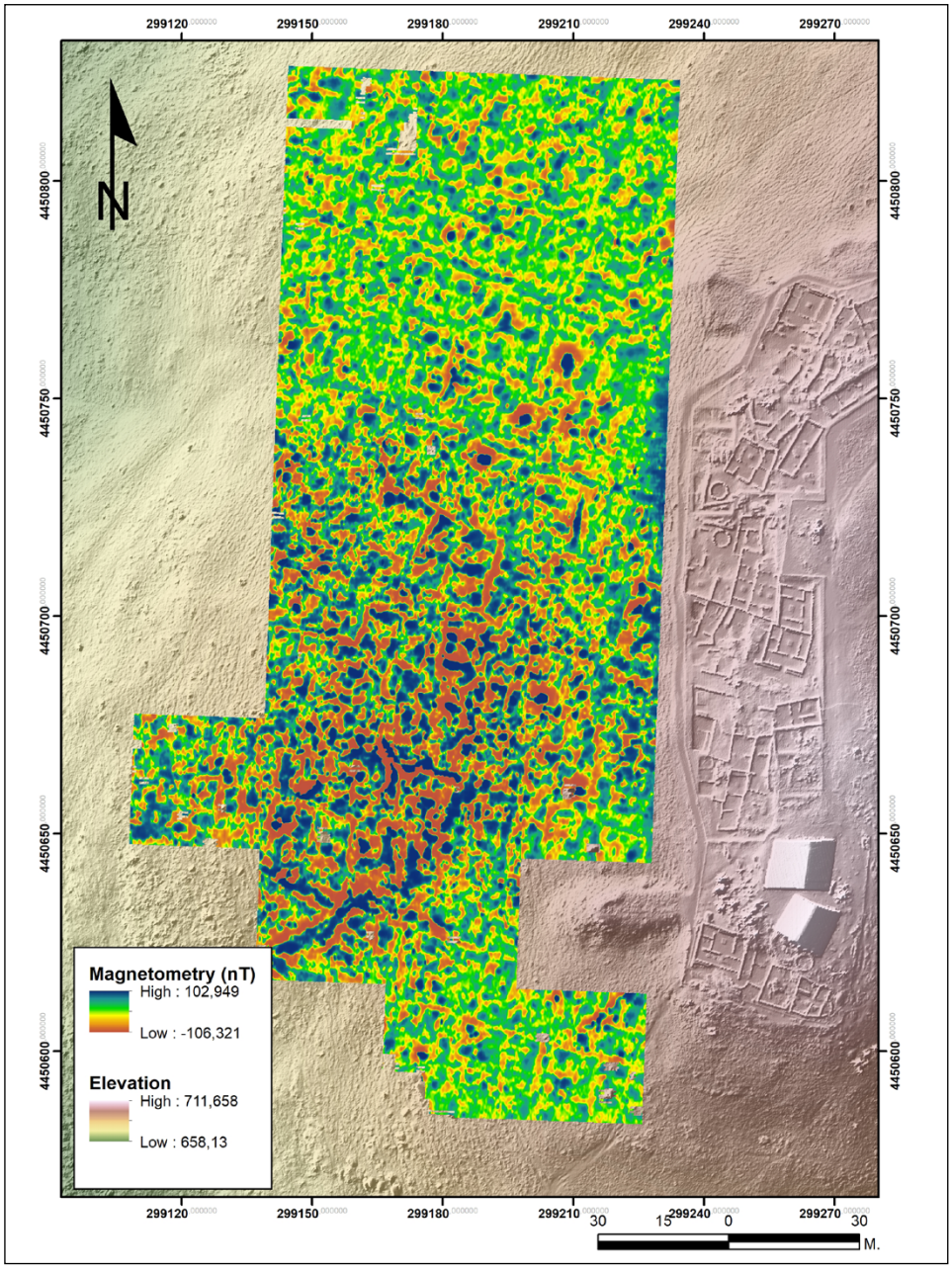

Fig. 3 – Geophysical prospection and remote sensing carried out at the El Raso hillfort in June 2023. Results of the geomagnetic survey on the west side of the hillfort.

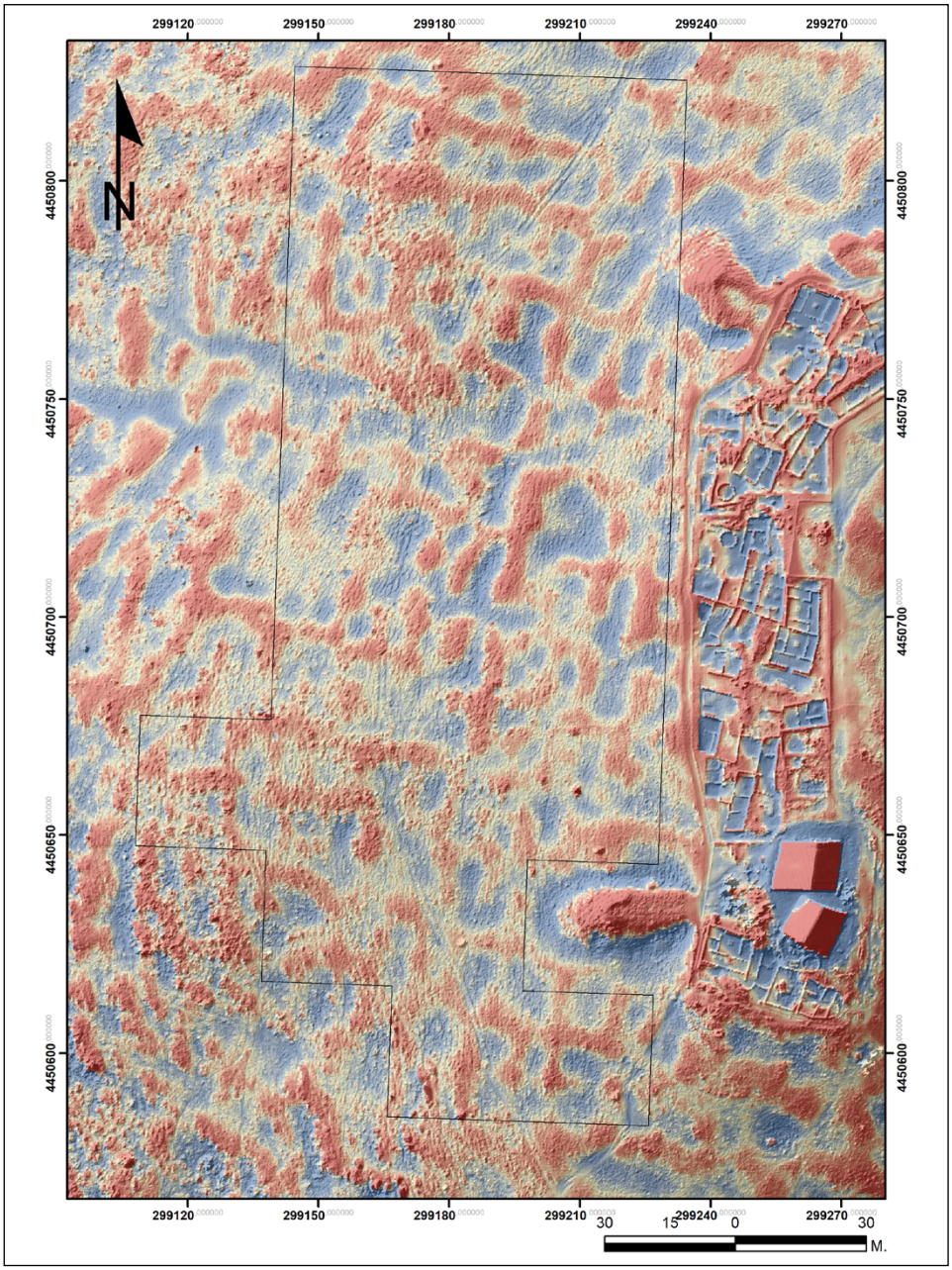

Fig. 4 – Geophysical survey and remote sensing carried out in the Castro de El Raso in June 2023. Micro-topography acquired by the LiDAR sensor.

To address these questions, it was decided to extend the area covered by the magnetic survey and to analyse in more detail the micro-topography revealed by the LiDAR data (Fig. 4) and photogrammetry. The preference for the magnetic method was due to its ability to cover large areas in a short time and the particularly complicated nature of the terrain, which made it impossible to use other sensors such as ground penetrating radar. In order to overcome these challenges, it was decided that magnetic prospecting would be the most appropriate method to use due to its versatility and lower weight. The survey was conducted in June 2023.

A Bartington fluxgate gradiometer (Grad601) (Bartington, Chapman 2004; Himmler *et al.* 2008; Schmidt 2008; https://www.bartington.com/) was used, covering a total area of 2.16 ha (Fig. 5). The instrument was configured with an interval of 0.5 lines/m and a density of 8 samples/m. This setting allowed more data to be collected over a very large area than other configurations (Mayoral Herrera *et al.* 2019, 307). The gradiometer was set to a range of 100 nT/m, achieving a resolution of 0.03 nT/m. The acquisition of data was based on a georeferenced grid structure. The squares' vertices were plotted in a GIS work environment and then staked out in the field using a GNSS system. We created 23 30×30m grids and 2 15×30m grids, adapted to the working area. The grids were oriented west-east whenever possible to maximise efficiency. We followed a zig-zag pattern of parallel lines and recorded data continuously every 50 cm.

Terrasurveyor software was used to process the data. This allowed the initial correction of inconsistencies caused during data collection, such as banding caused by different readings from the two sensors or staggered zig-zag patterns of passes. The data was then exported to ArcGIS for subsequent georeferencing and digital image processing. The data served as the basis for interpreting the survey results, which identified various types of buried structures. In addition, an orthoimage and elevation model of the surveyed area was generated by a drone flight using an RGB camera.

C.C.P.

3. Conclusions

This contribution aims to demonstrate the usefulness of a non-invasive approach that goes beyond providing a linear and unambiguous result as a preliminary stage to excavation. The proposed method involves a continuous dialogue between survey and excavation, where the results of each inform the other in a cycle of knowledge generation. The system cannot rely on the isolated application of a limited number of methods. Instead, it must integrate and fuse the data provided by a wide range of sensors (Fig. 5).

This strategy is considered the most appropriate for recording complex

Fig. 5 – Development of field work between April and August 2023: A) GPR survey in Villasviejas; B) conducting test pits; C) replanning the geomagnetic survey frames with a GNSS system; D) geomagnetic prospection at El Raso.

data. The complexity arises from the diversity of physical properties recorded by these methods, the heterogeneity of the elements in the archaeological stratification, and the infinite casuistry of terrain conditions during data collection. This approach encourages a multifactorial model for non-invasive exploration, seeking to establish significant correlations between the aforementioned elements.

Regarding the historical process of configuring the castros and *oppida* of the plateau in Iberia, this method has produced a large amount of new information that changes our understanding of the internal anatomy of these settlements. Recent work on Villasviejas has provided valuable new insights into the internal spatial organisation of the southern enclosure of the site. The new GPR data, combined with the test pits, have completely transformed our perception of the design of its defensive system, with the appearance of a new access and the confirmation that the layout of the walls, as previously thought, must be reconsidered. There is evidence of an open space of a public

nature within the enclosure. This is supported by earlier evidence from the documented structures, suggesting a high level of planning and the presence of construction features incompatible with domestic layouts in the indigenous tradition.

Regarding El Raso, the latest work described here expands our knowledge of the urban layout of a large area of the settlement and connects it for the first time with the layout of the dwellings documented in the main excavated sector. These data confirm the very dense, regular, and highly planned character of the settlement's urban planning in its final phase, in the middle of the 1st century BC. In this case, it is evident that the habitat is indigenous. However, the characteristics of the urban landscape deviate from the low-density model proposed for other settlements in the Vettonian culture (Ruiz Zapatero, Álvarez Sanchís 2015; Ruiz Zapatero *et al.* 2020). In contrast, it is similar to systems well documented in other settlements in the mid-Tagus valley, such as Cerro de la Mesa, in Toledo (Pereira Sieso *et al.* 2020) or Cerro de la Horca de Santorcaz in Madrid, which is also within the Carpetanian territory (Azcárraga Cámara 2022), but also within the Celtiberian territory, as in the case of Azaila, Segeda, Valdeherrera or Numancia itself (Liceras Garrido 2022; Burillo Mozota 2023).

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ABSTRACT

The purpose of this paper is to demonstrate the potential of using a combination of non-invasive methods for investigating large and complex archaeological sites. We present a multidisciplinary project, UrbMinarq, developed by the Institute of Archaeology-Mérida (CSIC-Junta de Extremadura) in collaboration with the University of Extremadura as a case study. This paper presents the preliminary results of the latest work carried out at the sites of Villasviejas del Tamuja (Botija, Cáceres) and El Raso (Candeleda, Ávila) in accordance with the general objectives of this project. Our aim is to demonstrate how a methodological design guided by historical questions and supported by a non-invasive approach can generate new knowledge about the internal anatomy of large, fortified settlements from the Second Iron Age and the beginning of Romanisation in the south-western quadrant of the Iberian Peninsula.