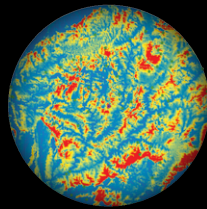


HARVESTING THE BENEFITS OF
10 YEARS OF TRAINING IN THE
IBERIAN PENINSULA (2006-2015)



edited by
Victorino Mayoral Herrera
César Parcero-Oubiña
Pastor Fábrega-Álvarez

Source Reference

Mayoral Herrera, V., C. Parceró-Oubiña & P. Fábrega-Álvarez 2017| ARCHAEOLOGY & GEOMATICS, Harvesting the benefits of 10 years of training in the Iberian Peninsula (2006-2015). Leiden: Sidestone Press.



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Published by Sidestone Press, Leiden
www.sidestone.com

Lay-out & cover design: Sidestone Press
Photograph cover: Visualization of LIDAR data,
by João Fonte and José Manuel Costa.

ISBN 978-90-8890-451-6 (softback)
ISBN 978-90-8890-452-3 (hardcover)
ISBN 978-90-8890-453-0 (PDF e-book)

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The potential of the Geographic Information Techniques for the analysis of the morphology and settlement patterns of the Roman military sites of early imperial era in Iberia

José Manuel Costa-García¹

Roman military archaeology in Iberia

Just a dozen Roman military sites were known to the North of the river Douro by the end of the 1980's (Morillo Cerdán 1991). Although the development of urban archaeology and the improvement of field survey techniques began to change this scenario during the next decade (Morillo Cerdán 2002b), archaeological research was by then mainly focused on the study of Roman permanent settlements, and an important part of the academic world did not pay enough attention to (if not refused to accept) the discovery of the first temporary sites linked with the Cantabrian Wars (29-19 BC) (Peralta Labrador 2002b). Despite these early objections, this little revolution was on at the beginning of the 21st century: not only the number of sites were more than doubled, but also the archaeological evidence begun to diversify. Several marching camps, small fortifications and siege scenarios dating from the Augustan era were found in the northern mountains (Camino Mayor *et al.* 2007; Peralta Labrador 2006). This situation naturally motivated the gradual abandonment of the static visions based on the intensive study of the permanent settlements.

The progressive and increasing use of remote sensing techniques (such as historical and modern aerial photography, satellite imagery, aerial LiDAR or photogrammetry) and geographic information systems (GIS) has boosted this

1 Departamento de Historia, Universidade de Santiago de Compostela. Praza da Universidade, s/n 15703 Santiago de Compostela (Spain) josemanuel.costa@usc.es.

process in the last years.² Furthermore, the development of specific methodologies for the detection and analysis of these temporary sites is now a reality (Costa-García *et al.* 2016; Menéndez Blanco *et al.* 2013). As a result, the number of Roman military sites documented in northern Iberia exceeded the hundred by the end of 2015, and about 90% of them could be defined as temporary (Camino Mayor *et al.* 2015). This impetus also contributed to overflow the traditional areas where the Roman military presence was studied. The discoveries are no longer limited to the Spanish Northern Plateau or to the Cantabrian and Asturian mountainous regions: the Galician and northern Portuguese territories start to show their potential (Costa-García *et al.* 2015; Costa-García *et al.* 2016; Orejas *et al.* 2015).

The existence of fresh archaeological data should encourage the development of new analytical perspectives. However, Roman military archaeology in Iberia lacks a tradition of solid, synthetic studies. Although we can find some catalogues and conference proceedings whose objective was to put together all the archaeological data available (Camino Mayor *et al.* 2015; Morillo Cerdán 2002a; 2006; Morillo Cerdán and Aurrecochea 2006; Morillo Cerdán *et al.* 2009; Serna Gancedo *et al.* 2010), it is difficult to detect a real methodological uniformity in them. To a certain extent, this situation could reveal the youth of Roman military archaeology as an autonomous discipline in Iberia, but it looks like the amending of this historical neglect is not a research priority at the present time. The efforts on documenting and cataloguing the recent discoveries have perhaps relegated this kind of reflexive approaches to a second plane once more. In many aspects, the most basic interpretative archaeological work still needs to be done, and this situation naturally slows down the development of wider studies.

Maybe this is one of the reasons why the analyses focused on the way in which the theoretical principles of the *metatio castrorum* were locally adapted (morphological studies, locational analysis...) are practically unknown in Iberia (Costa-García 2011; 2013; González Fernández and Vidal Encinas 2005). Of course, the main aim of this paper is not to fill all those gaps, but to explore how GIS could help to do it. It should be noted that the reliability of the following analyses might suffer because of the existence of a heterogeneous data base: not only our knowledge of these sites is uneven due to the reasons stated above, but they also show a diversified

2 In recent times, the Spanish government has developed a strong policy of open access to the geographic data. The PNOA program (National Plan of Aerial Orthophotography) of the IGN (National Geographic Institute) has released the majority of the historical and modern aerial photography via WMS services or direct download (<http://pnoa.ign.es/>). The raw LiDAR data of the several flights covering the entire national territory (2009-2014) is also accessible to the common user (<http://pnoa.ign.es/coberturalidar>). This situation has not only provided a powerful tool to the archaeologist but also contributed to the democratisation of the archaeological research as a whole. Unfortunately, the situation in Portugal does not allow us to be that optimistic, since the majority of the aerial photography must be requested to the Geographic Institute of the Portuguese Army (<https://www.igeo.pt/>) and the LiDAR coverage is limited to a narrow strip of the coastal area. Only the iGEO portal (<http://www.igeo.pt/>) offers recent orthophotography through a WMS service.

typology and an irregular distribution. From a total number of 120 individuals,³ 86 sites were temporary camps, 21 could be described as *castella* or small outposts, 8 were “permanent” fortress or forts, 3 have been defined as defensive lines, and only 2 of them could be classified as towers. This implies that some typologies are going to be necessarily underrepresented in the following analyses. In order to explore the potential of the Geographic Information Techniques to answer some questions related with the Roman art of establishing a fortification, these analyses have been grouped under three main topics: morphology, defensive solutions and locational pattern.

Morphological diversity

A close reading of the ancient theoretical treatises on *metatio castrorum* reveals that the election of a morphological solution was a matter of secondary importance when building a marching camp. Indeed, the final decision was determined by two main rules: to guarantee enough inner space for comfortably pitching the tents; and to extend the outer perimeter of the fortification only inasmuch as the garrison could ensure its defence (Veg. *Mil.* 1.22-23, 3.8). However, these very same treaties state that the square or rectangular modules were preferred by the Roman army for practical reasons, since the organisation and distribution of the inner space was quite easier this way (Polyb. 6.32-33; Ps.-Hyg. 21; Joseph. *BJ* 3.5.1-4).

In the last years the joint use of aerial photography, LiDAR data and GIS has allowed us to review and re-catalogue many Roman military sites in northern Iberia. Thanks to these tools it was possible to document the perimeter defences more precisely, so the reconstruction of the original layouts and modules is easier now (Figure 1). Further analyses on these data seem to confirm the suggestion of the classical treatises: the majority (29.2%) of the non-permanent Roman military sites located to the North of the river Douro showed a rectangular plan (Figure 2). In fact, this percentage could be increased with the addition of the quadrangular exemplars (3.8%), and the irregular (6.6%) or partially destroyed sites (12.3%) which seem to follow an original square/rectangular pattern. Even trapezoidal figures (6.6%) could be considered a deviation of this general model.

The oval-circular fortifications follow in number (12.3%). This shape was indeed the best suited for the two theoretical rules given above (Richardson 2004), so it is not surprising to find that this solution was the preferred for small *castella* or fortlets (28.6%): the space needed to be optimised due to the limited number of soldiers garrisoned here. On the contrary, other polygonal solutions, such as triangular (1.9%) or pentagonal (1%) figures, were in general far less representative.

Finally, several cases coexist under the label of irregular sites (15.1%). The irregularity of some of them could be the result of the expansion and/or reoccupation of an existing enclosure, as the impressive exemplars of Cildá (Peralta

3 For this study were only selected those sites in which the existence of archaeological structures related with the Roman army was rigorously attested. The different phases of each site were counted separately as individuals. Due to the strict space restrictions of this paper, the citations regarding these sites have been limited to the minimum, but they can be found in the most recent monographic studies on the subject (Camino Mayor *et al.* 2015; Costa García 2013; Morillo Cerdán 2014).

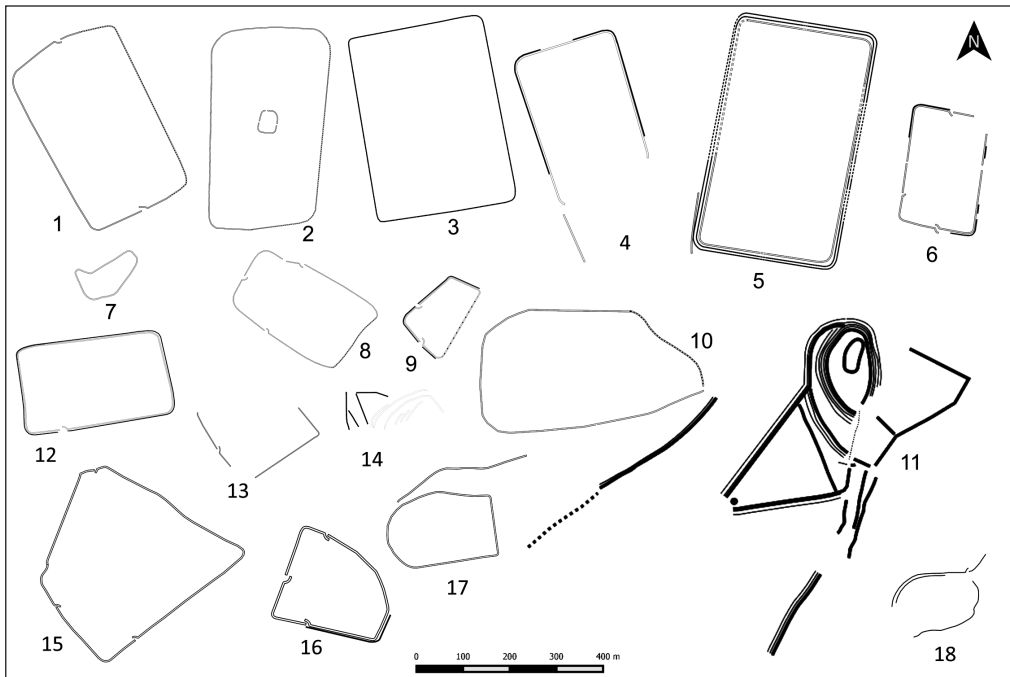


Figure 1: A sample of the morphological diversity: A Penaparda (1), El Pico el Outeiro (2), Villalazán (3), Monte dos Trollos (4), Los Llanos (5), Valdemeda (6), A Recacha (7), El Chao de Carrubeiro (8), Moyapán (9), A Pedra Dereta (10), Monte Currieños (11), Ganda das Xarras (12), El Chao (13), Picu Viyao (14), El Xuegu la Bola (15), A Cortiña dos Mouros (16), Llagüezos (17), and La Garita (18).

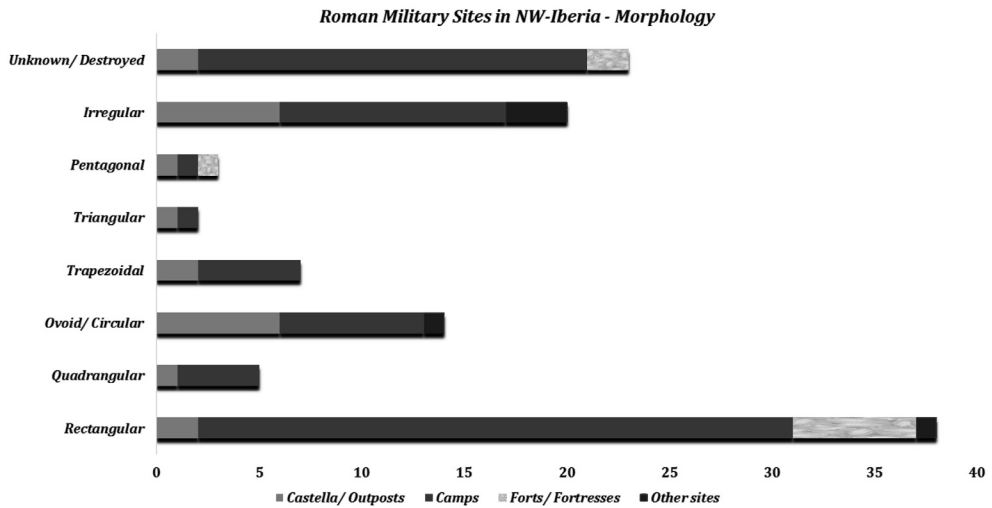


Figure 2: Roman military sites in Iberia: typological and morphological classification.

Labrador 2002a) and Monte Curriellos (Camino Mayor *et al.* 2005) proved years ago. Other settlements were established on uneven locations to control a route or a natural passage, so the regular modules were completely altered if they were not dismissed (Peralta Labrador 2011). The final shape of the defensive lines created to slow the advance of the enemy across the mountain ranges was also very dependent on the local topography, reflecting the fidelity to a very similar strategic principle. Lastly, many little Roman fortifications were also founded over Late Iron Age settlements, and the reuse of some sections of the old defences by the Roman army implied the creation of irregular defensive perimeters (Fernández Vega and Bolado del Castillo 2011; Peralta Labrador 1999; Torres Martínez *et al.* 2011).

The discovery in recent times of more and more irregular sites led us to a last qualitative observation: are these numbers truly representative of a historical reality, or either are they reflecting our tendency to easily detect some (canonical) shapes over other less obvious manifestations of the Roman military presence? Although a strict distribution pattern cannot be detected (Figure 3), data clearly show that the local topography usually determined the election of the morphological solution when establishing a military settlement. That is why a more heterogeneous group can be found in the mountainous areas than in the plains, and it could also explain why the forced adaptation and redrawing of the theoretical modules (that is, the “irregularity factor”) was more frequent in the former zones.

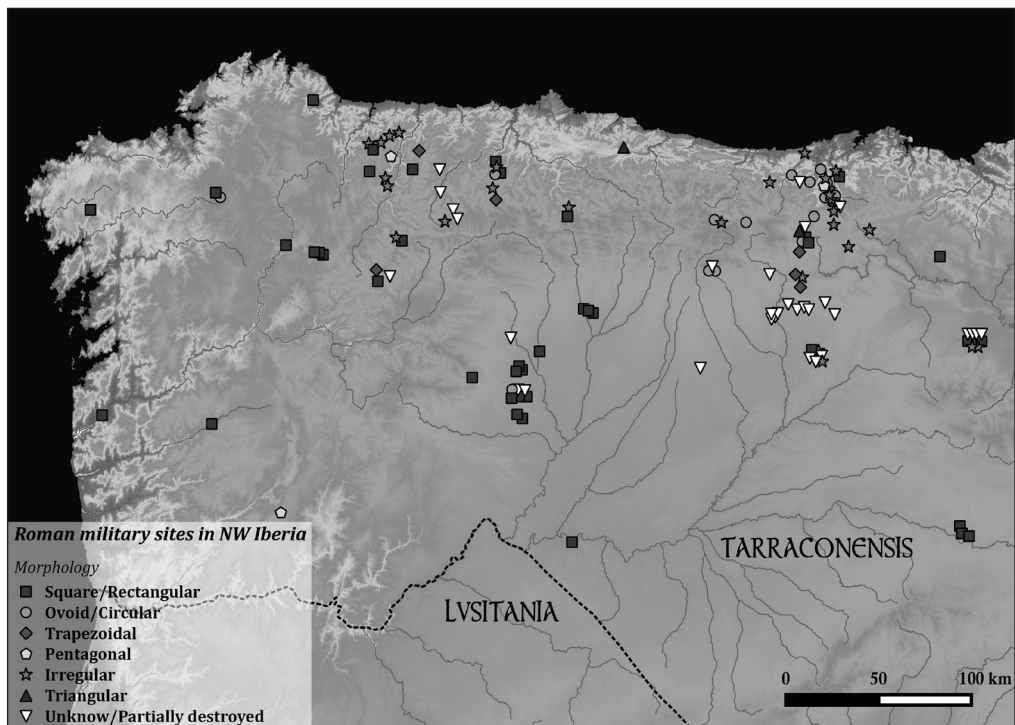


Figure 3: Morphological distribution of the Roman military sites in Iberia north of the river Douro.

The sites of A Penaparda, El Pico el Outeiro and A Pedra Dereta (Figures 2 and 4) can help to explain this situation. These three marching camps are located over a traditional mountain route which connects the Galician eastern area and the western Asturian territories (Menéndez Blanco *et al.* 2014). They show a similar extension (about 10 ha), but very different shapes (from an almost rectangular layout to an irregular one). Even if we cannot reject a diachronic interpretation for these enclosures, it rather seems that they belonged to a single unit which built its camps adapted to the local topography during its advance across the enemy territory. On the contrary, the impressive concentration of Roman camps close to Herramélluri (La Rioja), reveals how easy was to build up rectilinear defensive perimeters in plain areas (Didierjean *et al.* 2014).

Regarding the permanent settlements, in some cases the actual plan of the sites is not known in detail due to the singularities of urban archaeology, as it happens in Herrera de Pisuerga (Palencia) and Astorga (León) (González Fernández 1997; Illarregui Gómez 2002). The regular playing-card layout seems to have been the rule here (47%), but some slight deviations due to the local topography or to the particular evolution of the fortifications were also attested in León (Morillo Cerdán and García Marcos 2003) and Rosinos de Vidriales 2 (Zamora) (Carretero Vaquero *et al.* 1999). Other precise observations can be stressed in those sites explored at a larger extent. For instance, the size (ca. 2.6 ha), module (6:5) and internal distribution of the forts of Bande and A Cidadela (Galicia) are quite similar, revealing that these fortifications were probably raised following the same plan, if not by the same unit (Costa-García 2011).

Defensive solutions

The use of remote sensing techniques has allowed us to better document the defences of many sites. The combined use of this information and the evidence coming from traditional surface surveys and/or archaeological excavations, provides an interesting amount of contrasted data. After reviewing all these pieces of evidence, it could be stated that the Roman military sites of the early imperial times in Iberia do not generally show complex defensive systems (Figures 3 and 4). For instance, the temporary fortifications with more than a single ditch are quite unusual and these are mainly located in the Spanish Northern Plateau. Considering that it was in the mountainous zones of Asturias and Cantabria where the Augustan campaigns took place, this is a surprising fact. It has been noted that the hardness of the soils often hindered the digging of a proper ditch in these mountainous regions, so the camps and small outposts were frequently defended by nothing more than a rudimentary rampart made of earth and stones (Serna Gancedo *et al.* 2010). Regarding other defensive features, the gates protected by *clauiculae* have been documented in almost one quarter (24%) of the marching camps and small fortifications related with the Asturian-Cantabrian wars: the simplest variation of inner *clauicula* was by far the preferred solution. On the contrary, the use of *titula* has been barely attested in those sites so far.

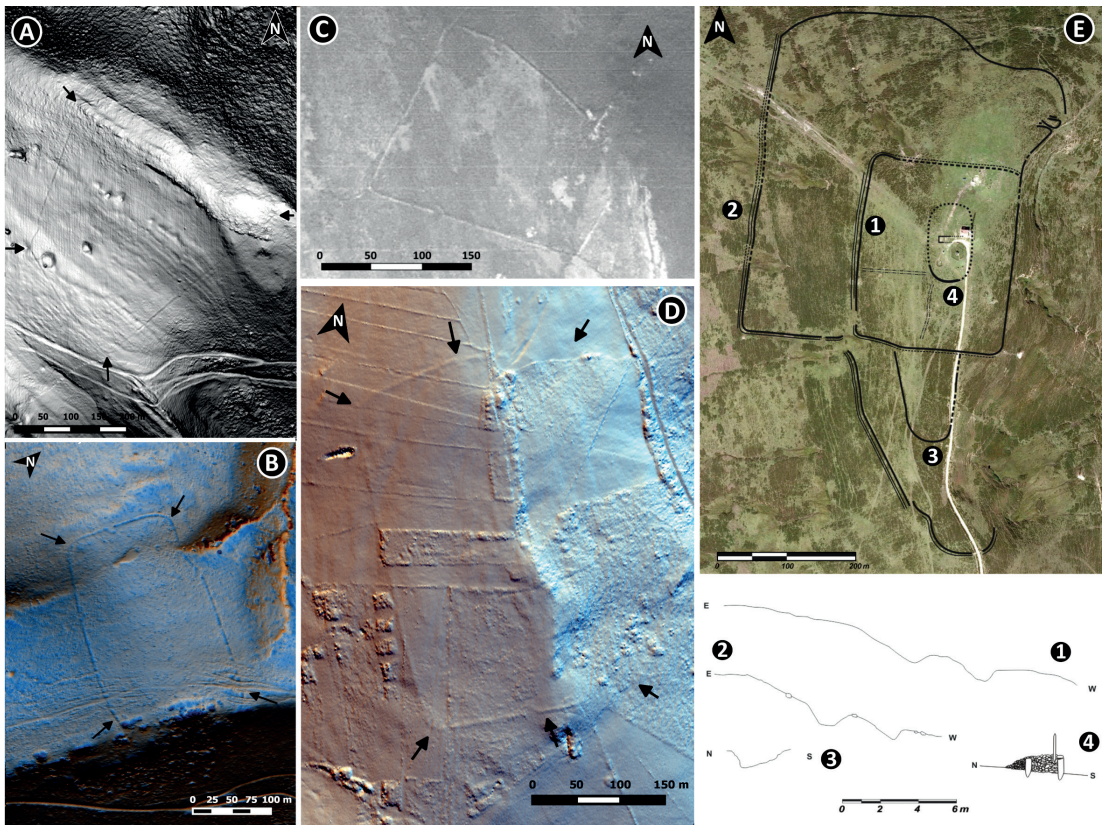


Figure 4: The potential of aerial photography and the aerial LiDAR for the study of Roman military sites. Some morphological and defensive solutions detected at El Xuegu La Bola (Asturias) (A), El Chao de Carrubeiro (Asturias) (B), A Cortiña dos Mouros (Galicia-León) (C), A Penaparda (Galicia) (D), and Cildá (Cantabria) (D).

For these very reasons, the complexity of certain fortifications in the mountainous areas should be taken into account when studying the episodes of the Cantabrian-Asturian wars. The famous sites of Monte Currieños (Asturias) or Cildá (Cantabria) are impressive examples of the art of castrametation in northern Iberia (Camino Mayor *et al.* 2005; Peralta Labrador 2002a) (Figures 2 and 4). However, the multiple defensive perimeters, the terraced platforms or the use of *bracchia* are not only found in those massive fortifications. An increasing degree of morphological complexity can be perceived among the sites discovered thanks to the use of remote sensing techniques in the last years. For example, the annex of the camp of Monte dos Trollos (Galicia) (Costa-García *et al.* 2016) resembles that of La Poza 1 (Cantabria) (Cepeda Ocampo 2006); Picu Viyao and perhaps A Pedra Dereta (Asturias) (González Álvarez *et al.* 2011; Menéndez Blanco *et al.* 2014) show triangular *bracchia* similar to those of Monte Currieños; Cueiru, Llagüezos, Llaurienzo (Asturias), Cildad or La Cabaña (Cantabria) (Costa-García *et al.* 2016; Hierro Gárate *et al.* 2015; Martín Hernández 2015) also present multiple defensive lines or enclosures marking out different camping areas. Similarly, the excavations

at Monte Bernorio and Santa Marina (Cantabria) revealed the reoccupation of Late Iron Age hillforts after their conquest, the reinforcement of their old defences, and the construction of new, stone walls (Fernández Vega and Bolado del Castillo 2011; Torres Martínez *et al.* 2011). This behaviour had been previously detected in La Espina del Gallego (Cantabria) at the start of the 20th century (Peralta Labrador 1999).

However, our knowledge about the defences of the Julio-Claudian permanent military bases is very limited. The data mainly comes from archaeological interventions developed during the decades of 1990 and 2000. After that, the lack of economic resources for the systematic excavation of sites placed in rural areas, or either the difficulties inherent to urban archaeology have slowed down the research. *Fossae duplices* and earth ramparts were detected in Astorga (González Fernández 1997) and Rosinos de Vidriales (Carretero Vaquero and Romero Carnicero 1996). The defensive system of the legionary camp of León is better known (Morillo Cerdán 2010): the Augustan defensive system comprised a box rampart and at least one ditch. It was replaced in Tiberian times by a new *agger* built with turf bricks (*caespites*). The oldest archaeological contexts of Herrera de Pisuerga have not been properly clarified (Illarregui Gómez 2002; Morillo Cerdán *et al.* 2006).

From the Flavian era onwards masonry walls began to be the norm. It has been attested the petrification of the old earth ramparts at the legionary fortress of León (Morillo Cerdán and García Marcos 2003) and the auxiliary fort of Rosinos de Vidriales (Carretero Vaquero *et al.* 1999). On the contrary, the forts of Bande (Rodríguez Colmenero and Ferrer Sierra 2006) and A Ciudadela (Caamaño Gesto 1997) were built in stone *ex novo*. Unfortunately, no comparative analyses of these evidences have been developed yet, and only the slight morphological variations showed by towers and gates have been used as dating elements. Some architectural reforms and alterations have been also detected in many of these structures, but they were never studied as a whole. The use of remote sensing techniques such as photogrammetry or laser scanning could help to fill this gap by following the specific methodologies of archaeology of architecture (Mañana-Borrazás *et al.* 2002, 2016).

The majority of the sites in use at the beginning of the 2nd century AD show only one ditch surrounding the walls, and usually not very wide or deep. Considering that the only military emergency in Hispania since the end of the Asturian-Cantabrian Wars was the brief uprising of Galba in 68 AD (Suet. *Galba* 8-10), this is not surprising. Unfortunately, the building of the Tetrarchy walls of León destroyed the remains of the external defences of the only legionary fortress documented in this period (Morillo Cerdán 2010).

Settlement patterns

The ancient writers who dealt with the *castra metatio* stressed the importance of selecting a proper location when establishing a camp (Polyb., 6.32-38; Ps.-Hyg. 57; Veg. *Mil.* 1.22, 3.8). Even if some degree of ambiguity can be detected in those treatises, two main issues were commonly observed: the place needed to be “safe”, and the presence of certain natural resources in the proximities was preferable.

Still, these strict rules could usually be taken as a simple but wise advice. Like many other aspects of the castrametation, the general ideas of a safe and well supplied location relied more on the tight balance of some variables than on the strict observation of each of them. For instance, a location that is strong by nature does not necessarily imply a great altitude, but it should not be overlooked from a higher ground. Similarly, water was an essential resource, but its proximity could be judged as a positive or a negative aspect. The close presence of a water spring or a river guarding the flank of the settlement was always welcome, but the locations prone to flooding should be utterly avoided.

To a great extent, those ideas recorded by the ancient writers could be synthesised as variables to be included in a GIS-based location analysis. Issues such as relative height, local relief, slope, nearby presence of water courses or optimal visibility are easily collectable and quantifiable. Unfortunately, other elements cannot be reconstructed *a priori* due to the lack of reliable information about the ancient environment.

Of course these issues are not unsurmountable, but they demand supplementary archaeological work. The distribution of forested areas and pasture lands or the location of water courses and natural springs have changed since ancient times, but new palaeoenvironmental analyses could provide very useful information. Likewise, the exact position of the enemy and the direction of the march could be also inferred from the distribution of the gates in a camp (Ps.-Hyg. 56; Veg. *Mil.* 1.23), so a more accurate knowledge of the defensive perimeters is mandatory. In short, many difficulties could be overcome through specific, micro-level analyses of these sites following the most basic principles of landscape archaeology. Unfortunately, archaeological research on the Roman military in Spain has showed little interest in these approaches up to date.

Considering these limitations and the strict spatial boundaries of this work, only a selective sample of 30 sites (25% of the total individuals) has been analysed through GIS software.⁴ Regarding the variables taken into consideration, they were grouped under two main categories in order to define the locational and visual control patterns of the sites.

The locational study (Parcero Oubiña and Fábrega Álvarez 2006; Stančić *et al.* 2000) comprises four subordinated analyses:

- a. The classification of the position of the settlement bearing in mind some generic situations recorded by the ancient manuscripts, such as the morphology of the land (i. e. plain, hill, mountain, valley...), the location on a hilltop or a slope, and the presence of higher ground in the surroundings.
- b. The calculation of the relative height of the site -topographic prominence. Five buffers based on Roman measures were defined in order to analyse this factor from close to far ranges: $\frac{1}{4}$, $\frac{1}{2}$, 1, 3 and 6 Roman miles (ca. 370,

4 Both ArcGIS 10.3 and QGIS 2.10 software were used for these calculations. The 5m LiDAR-based digital elevation models (DEM) were granted by the Spanish National Plan of Aerial Orthophotography (PNOA). More precise (1m) digital terrain models (DTM) were also built after the interpolation of raw LiDAR data of the PNOA using LAsTools (Repidlasso GmbH) and SAGA GIS software.

740, 1500, 4500 and 9000 m). Relative Height was calculated as follows: $RH = (SH - MA) / STD$, being RC the relative height, SH the height of the site, MA the mean altitude of the analysis area, and STD the standard deviation of the values of the mentioned area. A positive result implies a prominent position of the site, while a negative one indicates that it is under the mean height values.

- c. The study of the local gradient. This issue is important to define two aspects: the natural strength of the position and the water runoff (a basic logistic observance). It can also help to define the orientation of the site, since the most elevated point was commonly reserved to place the tent of the commander and the front door (the one which heads to the enemy) should be located in the farthest wall (Ps.-Hyg. 56; Polyb. 6.32). The gradient was measured from the epicentre of the site following four main axes, and the results are expressed in percentage values. $G = ((H1 - H2) / D) * 100$, being H1 the height at the epicentre of the site, H2 the height at the end of every axis, and D the horizontal distance between H1 and H2.
- d. The proximity of water streams and to what extent they help to reinforce the defensive position.

A second GIS-based approach included both visibility and visual prominence analyses (Llobera 2001; 2003; Wheatley 1995; Zamora-Merchán 2013), in order to understand not only the way in which the sites effectively controlled the surrounding areas but also if they occupied a visual prominent place within those landscapes. Five visual range areas were defined following the Roman-mile buffers previously mentioned. These analyses were executed through the Viewshed algorithm of ArcMap 10.3. For the visibility calculations the OFFSETA was set in 2.8 m (the sight height of a man -1.6 m- plus the height of a regular agger -1.2 m-),

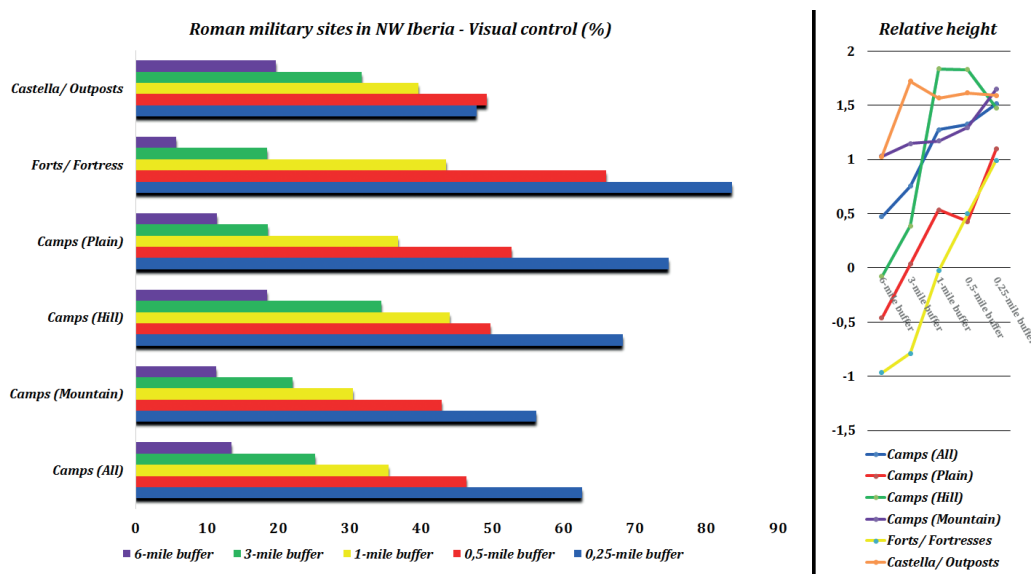


Figure 5: Roman military sites in Iberia: visual control of the surroundings and relative height.

the radius limited to 10000 m and the Z Factor to 1.7 m (the height of a person). For the “visibilization” calculus the OFFSETA was set in 1.7 m and the OFFSETB in 1.2 m (the agger only).

The results show that, to a great extent, the marching camps follow the theoretical principles of “safe location”. Their relative heights are over the mean altitude values of the surrounding areas and that usually guarantees a quite good visual control, at least in the closest ranges (below 1 mile) (Figure 5). Nevertheless, specific patterns can be also detected after grouping the sites in accordance to their generic location.

When compared with the overall, the relative height of marching camps in mountainous areas is far above the average (over +1), but this does not imply a better visual control due to the complex geography of these regions.⁵ Indeed, they could be defined as highly selective: the control of key positions such as mountain passages, mountain ranges, or the very accesses to the camp were prioritised over the complete seizure of the surroundings. The attempts of blocking mountain routes or immediately accessing water springs were issues commonly observed. In short, the final location of the sites was strongly dependent on strategic factors. As one could expect, steep slopes (5-27%) are also frequent, and there is a marked trend to establish the rear part of the camps on the higher terrain, so front gates are usually located on a lower ground. Altogether, these issues are probably reflecting that those settlements belonged to war scenarios.

The mountainous *castella* and lookout posts should be analysed separately. They were placed on the most elevated but less accessible locations, so they were frequently isolated.⁶ The enhancing of visual control in the long distance⁷ was made at the cost of a lower control over the short distance, except over key positions and natural routes through mountain ranges and valleys. Those objectives were probably of certain importance during war and post-war eras.

The Roman camps established in flat lands show less prominent locations, but their visual control is among the largest at the short distance,⁸ where river fords, natural routes and passages are commonly found. A strategic use of watercourses is also attested, and the locations near river confluences granted the protection of more than 50% of the defensive perimeter. Thus, these positions derived from a strongly planned defensive behaviour and a strategic exploitation of the surrounding landscape. Gentle slopes (<1%) allowed a smooth water runoff and the articulation of regular “playing-card” layouts.

Finally, the camps located on hills usually occupied prominent positions over plain or valley areas, which implies a more extended and uniform visual control.⁹ Once again the overlooking of key positions such as natural passages or river fords is frequently recorded. Likewise, meanders and river confluences were commonly selected when placing these sites. The values of terrain gradient were very dependent on the morphology of the specific hill (from <1% to ca. 15%) but these

5 Percentage values from closest to farthest range: 56.1%, 42.8%, 30.4%, 22% and 11.3%.

6 Relative height values are over +1 and they even reach +3.

7 Percentage values from closest to farthest range: 47.7%, 49.2%, 39.6%, 31.5% and 19.6%.

8 Percentage values from closest to farthest range: 74.7%, 52.7%, 36.8%, 18.5% and 11.3%.

9 Percentage values from closest to farthest range: 68.3%, 49.7%, 44%, 34.4% and 18.4%.

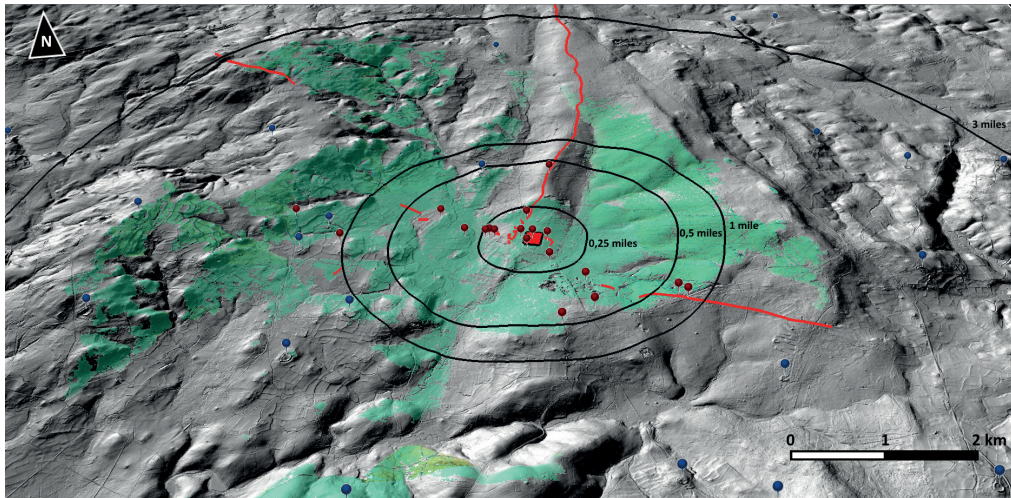


Figure 6: The fort of A Cidada. Visual control in relation with the Roman (red) and Late Iron Age (blue) sites.

only occasionally conditioned the layout of the enclosures to a great extent. The placing of the rear part of the camp on the upper area of the hill was a tendency.

If we look at the so-called permanent sites we will find out that they were usually positioned not in “safe locations”, but in places suitable for daily life. Plains or hills with soft slopes were preferred when establishing a fort or fortress, even if they were overlooked by higher grounds in the nearby, as happened in Rosinos de Vidriales, Bande or A Cidada.¹⁰ However, these locations granted a large visual control over the immediate surroundings as well as a notable prominence in the short and medium distance. For instance, the fort of A Cidada visually controlled more than 50% of the land within a 1 mile distance and the visual prominence of the site was over 80% within the same area.

The preference for watersheds and river confluences can almost be considered a rule in these cases. It might be reflecting an attempt of delimiting a sort of military exclusion zone, since the presence of structures other than those of the camp is very limited in these areas. However, the archaeological landscapes showed a great complexity beyond those natural boundaries (Figure 6), so the question here should be if the logistic principles were stronger than the strategic ones regarding the location of those military sites. But, once again, this kind of diachronic analyses demand the existence of solid studies sensitive to the methodologies of landscape archaeology.

Discussion

Although the gradual introduction of new techniques and methodologies has increased the number of discoveries in the last decades, the archaeological study of the Roman military presence in Spain is still anchored in descriptive approaches. The aim of this paper was to break this inertia by showing that useful information

10 Relative height values usually became negative from less than a mile onwards.

can be extracted from the combined study of these sites, even applying the simplest statistical and locational analyses. Moreover, one way to overcome the heterogeneity and incompleteness of the archaeological data is indeed by asking transversal questions. It is not possible to gather certain datasets if we skip the bigger picture.

Even if the conclusions of this study are preliminary, they do not lack any significance. Precisely in this very moment, when the accumulation of data breaks the traditional uniformity of the archaeological record linked with the Roman Army, the definition of morphological, defensive, locational and behaviour patterns becomes fundamental for a correct characterisation of the Roman military presence in Iberia. Furthermore, this impetus should lead us to the building of predictive models and to the re-examination of the old archaeological catalogues in the search of new data. In this regard, many fortified settlements have been catalogued in the north-western area of Iberia under the label “castro” (hillfort), and even if the majority of them actually are Early or Late Iron Age hillforts, many others could belong to very different historical periods, from the Bronze Age to the Medieval Era. Sites such as A Recacha (Asturias-Galicia) (Menéndez Blanco *et al.* 2011), A Cortiña dos Mouros (León-Galicia) (Vidal Encinas 2015) (Figure 4) or O Cornado (Galicia) (Gago Mariño and Fernández Malde 2015), among others, were initially classified as Late Iron Age “castros”. We know now that they are Roman military settlements. The reoccupation of native settlements pointed above could be another example of the “invisibility” of the Roman military presence in the archaeological record.

The use of GIS-based analyses for the study of Roman military sites in Iberia is far from being ended. A detailed examination of the gradients could help us to determine to what extent the inner space of these fortifications could be used as camping ground, and to carry out some demographic estimations on that basis (Zorn 1994; Porčić 2011). The discrimination of visibilities could also give us some interesting hints about which were the primary surveillance objectives from the perimeter defences or what area of the fortification was actually controlled from the commander’s tent (Wheatley 2004; Bevan and Lake 2013). More complex analyses of accessibility and defensibility of the sites could be also implemented (Llobera *et al.* 2011; Parceró Oubiña 2013). However, these are only little pieces of a bigger process: in order to really understand the impact of the Roman army over the territory, it is necessary to analyse the fortifications within their archaeological landscapes through comprehensive, diachronic, and multidisciplinary studies.

Acknowledgements

I would like to thank César Parceró, Victorino Mayoral and Pastor Fábrega for inviting me to collaborate in this volume and for their advice throughout the courses on GIS and remote sensing techniques. I must also remember the other members of the Romanarmy.eu project (J. Fonte, A. Menéndez Blanco, D. González Álvarez, R. Blanco-Rotea, V. Álvarez Martínez, M. Gago), whose daily work to a great extent contributed to gather the data catalogue here analysed.

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Notes on contributor

José Manuel Costa-García has a PhD in Archaeology (2013) and BA in History (2006) with a honours degree from the University of Santiago de Compostela. He obtained an Advanced Studies Diploma in Archaeology from the same university (2008). He also got a FPU predoctoral grant (2008-12) and a postdoctoral grant of the Galician Regional Government (2016-2019). Active member of the archaeological research team in the Roman fort of A Cidadela (Sobrado dos Monxes, A Coruña) (2007-2010 and 2016). His specialization is the study of Roman military sites combining specific methodologies coming from archaeology, ancient history, epigraphy and new technologies.



Archaeology and Geomatics

Digital technologies have numerous applications in archaeology ranging from the documentation of the archaeological evidence and the analysis of research data to the presentation of results for a wider audience. This volume consists of various studies on the use of methods such as LiDAR (light detection and ranging), archaeological prospection, visibility, mobility and the analysis of the spatial distribution of archaeological objects, applied in various contexts. The case studies vary widely and include the Late Pleistocene in the Northern Iberian Peninsula, the Roman Republican period in Southern Italy, the Formative period in the Andes and the 1936-39 Spanish Civil War.

In 2005 a (then) pioneering postgraduate course on the applicability of digital geospatial technologies for archaeology was launched in Spain. Quite unexpectedly, the course has been alive annually for more than 10 years so far, having trained around 300 young archaeologists from Spain, Portugal, and Latin America in the critical use of nowadays popular tools such as GIS, GPS, remote sensing and LiDAR for the documentation and analysis of the archaeological record.

To commemorate the first 10 years of the course, a conference was organized in Mérida (Spain) in October 2015. Former students were invited to present and discuss their research in which these technologies were used intensively; this edited book is a selection of those contributions. Through a series of widely varying case-studies, both technically sophisticated and theoretically informed applications of such digital technologies are presented.

All the contributors are young researchers, either young doctors or doctorate students, coming from fairly varied archaeological contexts and approaches.

Sidestone Press

ISBN: 978-90-8890-451-6



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