The Making of the Roman Landscape: Conceptual Investigations into the Genesis of Centuriated Field Systems

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Abstract

From a technical perspective, the body of late Roman documents known collectively as the *Corpus Agrimensorum Romanorum* has proved an invaluable source for the study of the development of centuriated and other Roman field systems. However, over-reliance on the Corpus as an analytical source has resulted in the idea of a landscape defined under the Roman land surveyor's technical criteria. Roman surveying text interpretations have also promoted the application of rather rigid parameters in the morphologic analysis of these structures. In this paper we would like to move beyond the practicalities of Roman field surveying applications and explore the concepts and ideas behind the making of a centuriated landscape, of which the city layout was an essential part. Through a combination of GIS-based archaeomorphological research and visual analysis we aim to show the centuriation as a land appropriation process in which cultural and religious factors played an essential role. Particularly, this landscape appropriation draws its basis in a complex cosmogonical conception related with the foundation rite of Roman colonies.

This paper will finally try to demonstrate the flexibility and adaptability of the Roman land surveying techniques illustrating how their application, rather than being rigid, allowed the constraints of the physical environment to be overcome in order to create a truly Roman landscape. All these considerations will be central to the discussion about the study of the centuriations associated with the ancient city of *Tarraco* (modern Tarragona, Spain). This area will be employed as a case study given the appropriateness of its archaeological data.

Keywords

Landscape, Roman, centuriation, viewshed, conceptual

1. Introduction

Roman centuriated landscapes have been the object of multiple studies over the last 40 years. The introduction of geographic information systems (GIS) into studies of this particular type of past cultural landscapes can significantly improve only their identification and recording, while can also offer new means of analysing their genesis and conceptualisation.

The advantages of employing GIS can be briefly summarised in their capacity to handle multiple and multiscale sources of geographically referenced information and their accuracy in measuring areas and distances (Romano and Tolba 1996; Slapšak and Stančič 1998; Romano 1998 and 2002; Clavel-Lévêque and Orejas 2002). Both are essential aspects when applying metrological techniques to modulated landscapes. Ultimately, it has to be considered that the analytical capabilities which are exclusive to most GIS allow the generation of archaeological hypotheses.

This article deals with the centuriated system or *limitatio* associated with the Roman city of *Tarraco*, *Colonia Urbs Triumphalis Tarraco*, capital of the *Tarraconensis* province (*Fig. 1*). This study started in 1999 as a part of a wider landscape project aimed at the study of the *cossetania* territory settlement (Guitart *et al.* 2003). The archaeomorphological study undertaken by one of the authors documented four orthogonal systems (*Tarraco* I, II, III, and IV) around the city of *Tarraco* (Palet 2003, 2005 and 2007; Ariño *et al.* 2004, 49).

In 2006, as a part of the *Ager tarraconensis* project directed by the Catalan Institute of Classical Archaeology, a revision of *Tarraco*'s centuriated field systems started incorporating new technologies and means of analysis. This revision intended not only to thoroughly document all possible centuriation traces but also to move beyond the practicalities of Roman land division works towards the conceptualisation

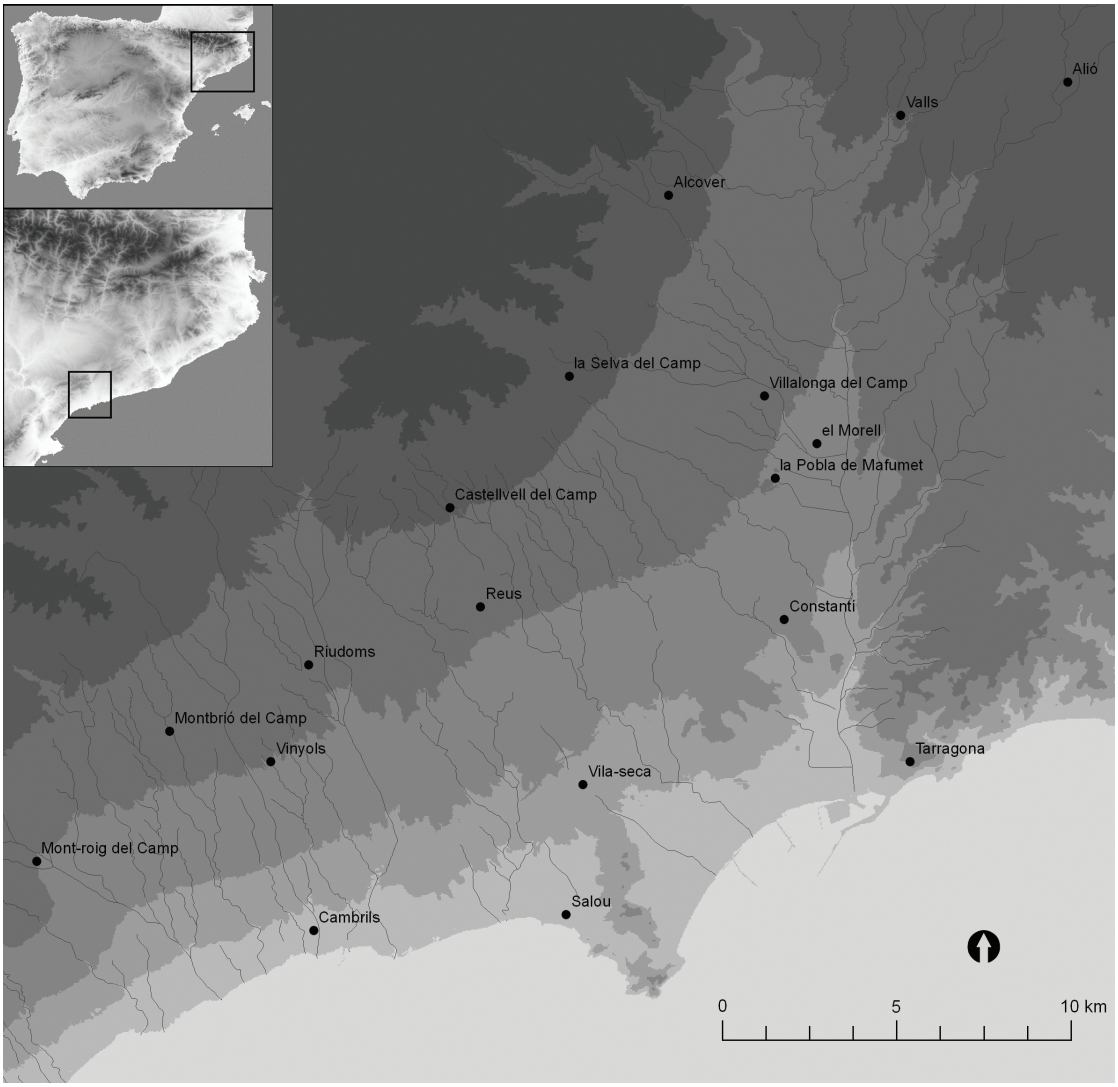

Fig. 1. Location of the study area.

behind the genesis of Roman centuriated landscapes.

Two archaeological elements have played an essential role in the fulfilment of these objectives: the traces documented by the archaeomorphological study, and the discovery of *Tarraco*'s *auguraculum* (Salom 2006). The *auguracula* are temples located in central elevated areas of Roman cities seeking for a good visual dominion of both the city and the territory around it (Gros and Torelli 2007, 25; Mar and Roca 1998, 112–114; Carandini 2007, 13–53). They were square or rectangular in their shape, oriented to the cardinal points and had nine *cippi* dividing their inner spaces regularly. The temples had an augural function, whereby in them public auspices were taken, but most importantly, these were the places where the *inauguratio* rituals were performed. These rituals were associated with the foundation of a Roman Colony. From the *auguracula* both the city layout and the territory were conceived and planned. Even when a city layout already existed, it was usually re-designed in accordance with the Roman standards when the colony status was acquired (Sommella 1988). The *augur* was the priest conducting the foundation ritual; from the centre of the augural temple he directed his sight to the landscape, naming its limits and landmarks and defining the future territory of the new colony. The land surveyor state officer was present during this ritual, being the one in charge of adapting the augur's ritualised instructions into the physical landscape.

The importance of both the archaeomorphological study and the location of the *auguraculum* in the study of centuriated field systems is their significant role in the Roman land appropriation process. The foundation ritual marks the beginning of the process, its conceptual and religious basis, whilst the centuriation traces are, together with the urban layout, the final results of this process; its physical adjustment.

It is believed that those elements can afford data enough to explore some aspects related to the genesis and conceptualisation of Roman centuriated landscapes by means of the application of GIS-based analyses.

Viewshed, intervisibility, prominence and analysis of surface visible areas are methods to analyse the sense of sight. One of the first visibility studies was made by Fraser (Fraser 1983), who analysed the intervisibility between two locations using Line of sigth (*LOS*). A cumulative viewsheed was computed by David Wheatley (Wheatley 1995) ,who applied it to the study of the visual relationships among the Salisbury Plain Neolithic barrows. Another of its applications can define sacred landscapes and highlight the possible relevance of certain monuments or prehistoric sanctuaries (Garcia Sanjuan and Wheatley 2008). Wheatley and Gillings (2002) provided examples on how to correct the visual quality in function of the distance using of the second index of Higouchi (1988). Other calculations compared visual affordance and topographical preponderance among settlements, monuments and places with a strong symbolic importance (Llobera 2001; Gillings 2009). We only used simple viewshed in our work because this function is strongly related to the *augur*'s sacred *inauguratio* ritual and his sense of sight.

2. Materials and methods

2.1. The project's geodatabase

The development of a geodatabase was the first step in order to update the results and improve the precision of the previous archaeomorphological analysis. It was also intended to locate previously omitted centuriation traces, which became possible thanks to the addition of a wide array of sources. The most remarkable of these were nine old aerial photographs at a 1:5000 scale dating back to 1949, but also a set of thirty-two USAF aerial photographs at a 1:33000, from 1956, covering the whole study area. The photographic sources were orthorectified and georeferenced achieving a maximum RMSE of 4.8m. Historic cartography included twelve municipal maps at a 1:25000 scale handmade between 1914 and 1923. Old maps dating back to the eighteenth and nineteenth century were also added due to the importance of the information they can provide. However, their georectification was problematic, therefore they were not employed in metrologic analyses. Modern reference cartography, aerial photography and multispectral imagery were also included in the geodatabase of the project.

Finally, a 5m/cell DTM was developed from 117 digital topographic maps at a 1:5000 scale with more than 3 million spot heights covering the whole study area, using the Natural Neighbours interpolation method. This DTM was analysed to locate nonexistent sinks and fill them obtaining a depressionless DTM. A stereo analysis of the 1956 stereopairs was also performed in certain areas to avoid the important landscape modifications made in the 1960s.

2.2. GIS-based analyses

However useful the integration of different geographically located sources into a GIS environment can be, GIS also offers a wide range of tools of great relevance to the study of ancient landscapes. Some of these have been integrated into this project as an aid to archaeological landscape interpretation.

The generation of least cost routes (LCR) has been widely treated in the relevant archaeological literature (De Silva and Pizziolo 2001; Van Leusen 2002; Batten 2007; Zakšek *et al.* 2008). In this project framework LCR were employed to restitute the trace of the ancient *Tarraco-Ilerda* route. The methodologies followed to develop a cost surface model adapted to the special environment of the study area can be consulted in Fiz and Orengo (2008).

The analysis of aerial and satellite multispectral imagery can also be done in a GIS environment. In this case, a wide range of multispectral images, including ASTER, Landsat MSS, TM, ETM and ETM+, and aerial SWIR photographs were employed. Each band was filtered using both Laplace and High Pass edge enhancing filters to locate previously unknown ancient landscape lines.

Viewsheds were generated from the centre of the auguraculum in order to recreate the augur's landscape perception in the moment in which the colony foundation rite was performed and the city territory defined. The ancient topography of Tarragona city presented at this spot a small hill removed at the end of the 19th century (Salom 2006, 72–73). This elevation allowed a privileged view of both the city and its territory which bad earlier been impossible to achieve from higher spots in the city. The methodology followed in the restitution of the

ancient city topography can be consulted in Orengo and Fiz (2008).

3. Results

The project's geodatabase allowed the results of the 1999 archaeomorphological study to be brought up to date, obtaining a much higher precision in identifying traces of the ancient landscape. It was also possible to locate new traces, providing a better representation of the centuriated land divisions around the city of *Tarraco*. Three modulated grids around *Tarraco* were documented, each of them following a different orientation and perfectly adapted to the topography and hydrography of the area (*Fig. 2*).

The first grid, *Tarraco* I, is located to the north-west of Tarragona in the area of Constantí. It is oriented 50 centesimal degrees west to grid north, therefore, its axis forms a diagonal to the cardinal axes. The grid units are modulated at 20x20 *actus* and extend over an area of around 6,500 ha.

The second grid, *Tarraco* II, is located along the Camp de Tarragona to the west of *Tarraco*. It covers an area of approximately 13,000 ha and is oriented 31 centesimal degrees west to grid north. This *limitatio* is also modulated at 20x20 *actus* per grid unit. This second centuriated system is the best preserved presenting traces running parallel for 8 *centuriae*.

The last system, *Tarraco* III (Palet 2007), is located to the north of the city at both sides of the Francolí River in the areas of the Tarragonés and the Alt Camp. It has been previously documented (Gurt and Marqués 1988; Burés *et al.* 1989; Olesti and Massó 1997; Arrayás 2003, 2004 and 2005; Palet 2003 and 2005). It is oriented 31 centesimal degrees est to grid north, with a grid modulated at 20x15 *actus* units and it covers an area of approximately 18,000 ha. This *limitatio* has been related to the setting of the urban layout, since its orientation is closely related to that of the Roman colony with a difference of only 3 degrees. This relationship between the city layout and *Tarraco* III suggests a common planning (Palet 2007). This conception is further reinforced by the

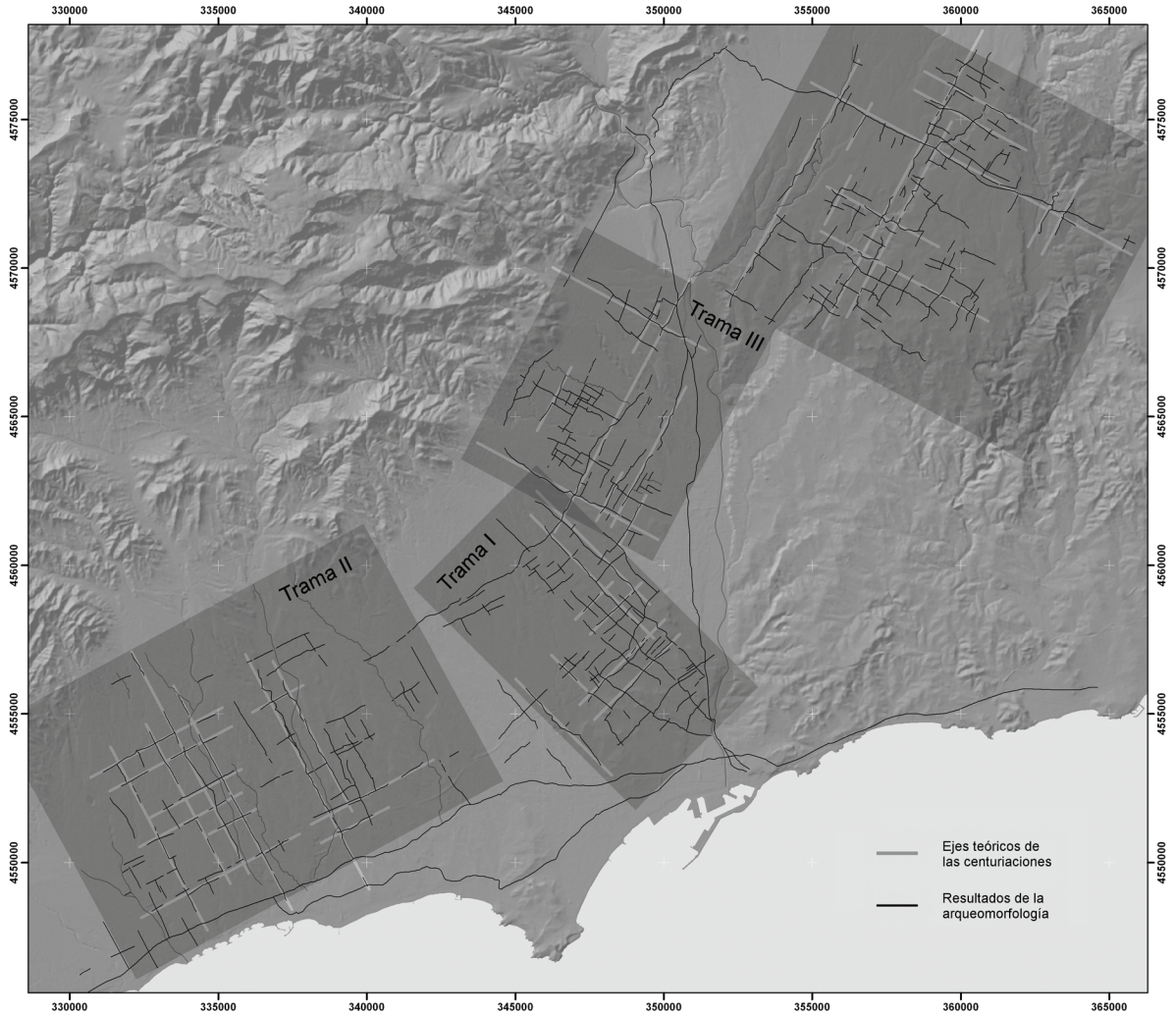

Fig. 2. Archaeomorphologically restituted centuriated systems.

fact that the angular deviation between the grids is constant: 19 centesimal degrees between *kardines* and 181 centesimal degrees between *decumani*.

The whole system is strongly reminiscent of that which was documented at the city of Corinth (Romano 2006).

The results of the LCR analysis were satisfactory since the predicted route avoided the seasonal floods of the Francolí River adapting its trace to the setting of some of the most important *villae* of the area. It also closely resembled the trace of the old path of Constantí, which it is believed to preserve the ancient *De Italia in Hispanias* Roman route. The setting of this route was strongly determined by environmental and social constraints, and it does not seem directly related to the setting of *Tarraco* I or *Tarraco* II *limitatios*.

The application of multispectral imagery only yielded positive results in the case of a band 5 (mid-infrared) Landsat 5 TM image taken in 15-05-1992. In this image, a series of lines were identified as representing buried traces of the centuriated system (Orengo and Palet 2008). The distances between the lines and their orientation were consistent with the traces documented by archaeomorphological analysis. The traces were only visible in this image band 5 due to the rain fallen the previous day. The Landsat TM band 5 is specially indicated for soil moisture discrimination (Shih and Jordan 1992). Besides, the physical features of the traces, i.e. ditched pathways of compacted soil, favoured moisture retention and made them visible by absorbing more energy in the mid-infrared wavelength range.

Viewshed analysis provided the most interesting results for the analysis of the development of *Tarraco*'s centuriation. From the centre of the *auguraculum* as the point from which the *augur* recreated the new Roman territory, a viewshed developed forming visual corridors (*Fig. 3*). Three of those corridors are associated with the three different modulated grid systems present around *Tarraco*. The visual corridors mark the only parts of the landscape visible to the *augur*. When these are superimposed on the results of the archaeomorphological study it becomes clear that their axis passes through the diagonal of the grid units.

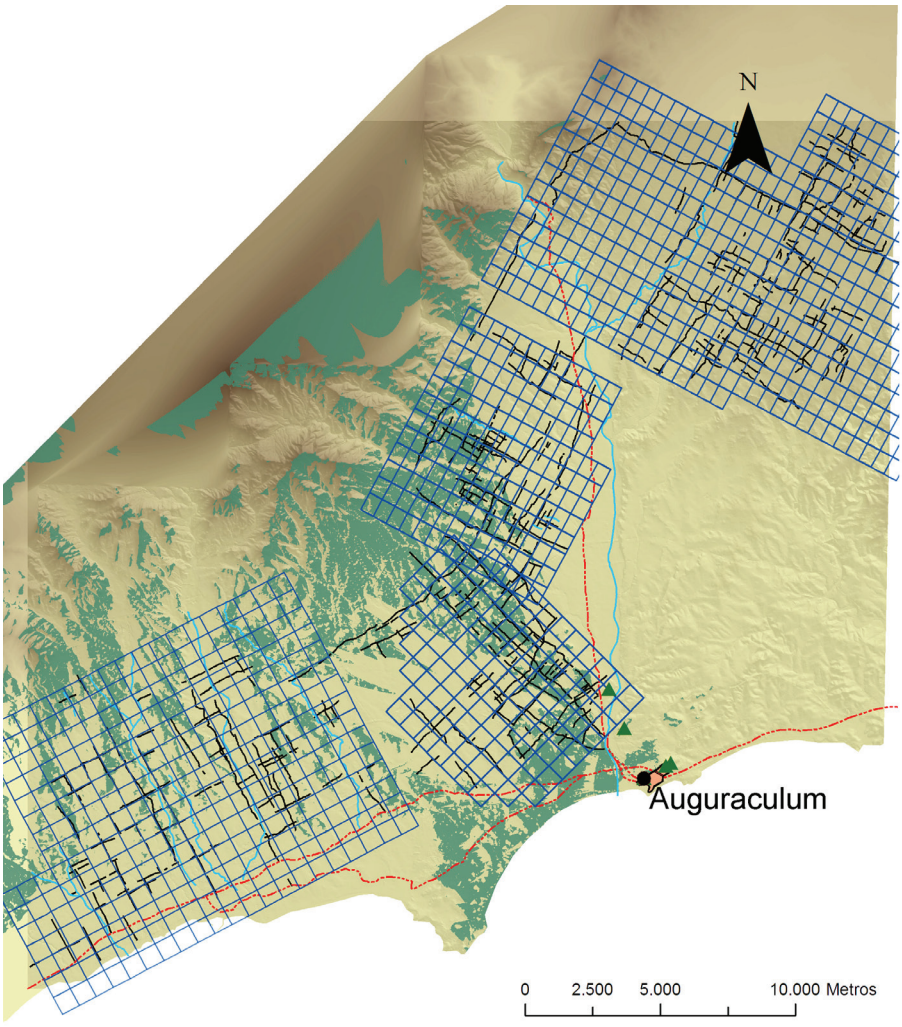

Fig. 3. Viewshed from the auguraculum.

4. Discussion

It has been argued (Roth 1996; Chouquer and Favory 2001, 301–302) that centuriated systems were constructed from straight stretches of roads which would act as an hypotenuse or diagonal of the grid units following the process known as *variatio*.

These diagonals could include one single unit or several of them depending on the angular relationship between the road and both the orientation of the *limitatio* and the size of its grid units.

In the case of *Tarraco*'s centuriations, having a clear idea of their modulations and orientations, the relationship between the viewshed and the hypotenuses of the different grid units strongly suggests a single conception of the three

systems. This conception is further reinforced by the fact that the three grids also keep a constant angular relationship between them. It seems clear, therefore, that they were not only planned together, but also at the same time. It is also important to note that they were developed from visual axes rather than from pre-existent roads (*Figs 4* and *5*). This could have been done following a simple method of landmark identification and alignment. This method was perfectly possible given the techniques employed by the Roman land surveyors (Lewis 2001). This is also strongly related to the foundation ritual in which the *augur* described the territory which he saw from the *auguraculum* noting the landmarks; the land surveyor, who would be present at the rite, could later develop the *limitatio*.

Another factor that should be noted is the adaptation of the grids to the physical environment, in particular, to its hydrography. The visual axes defined from the *auguraculum* allowed multiple orientations for the grids by changing the module of the grid units or, simply the number of grid units involved (*Fig. 6*). In this way an environment adapted centuriated system could be developed.

5. Conclusions

In this article it has been argued that Roman centuriations were not only a land division system but also a true conceptual appropriation of the landscape based on a strong mythical and religious background. By recreating the rituals present in the foundation of Rome, the newly acquired territory

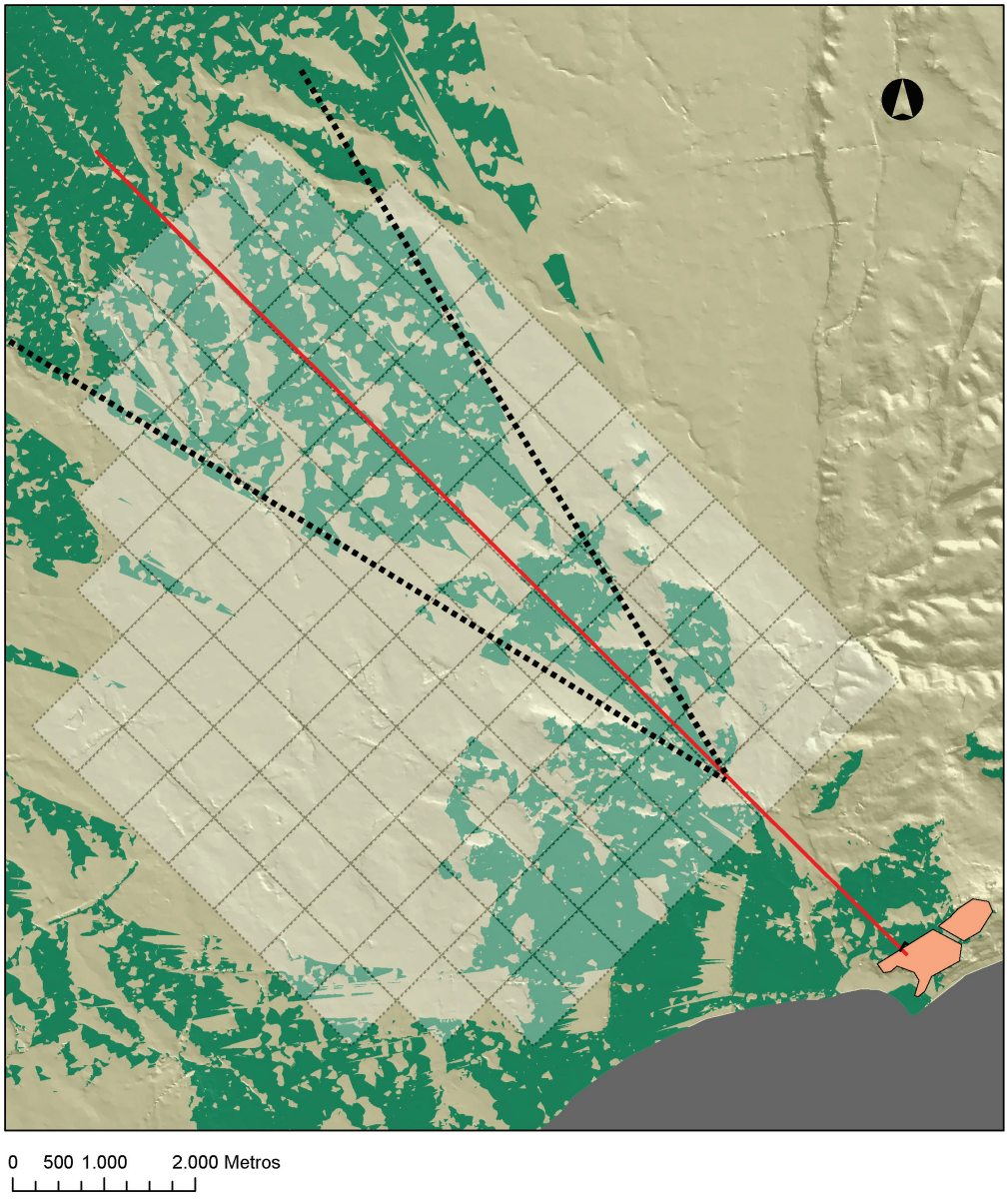

Fig. 4. Detailed view of the Tarraco I grid.

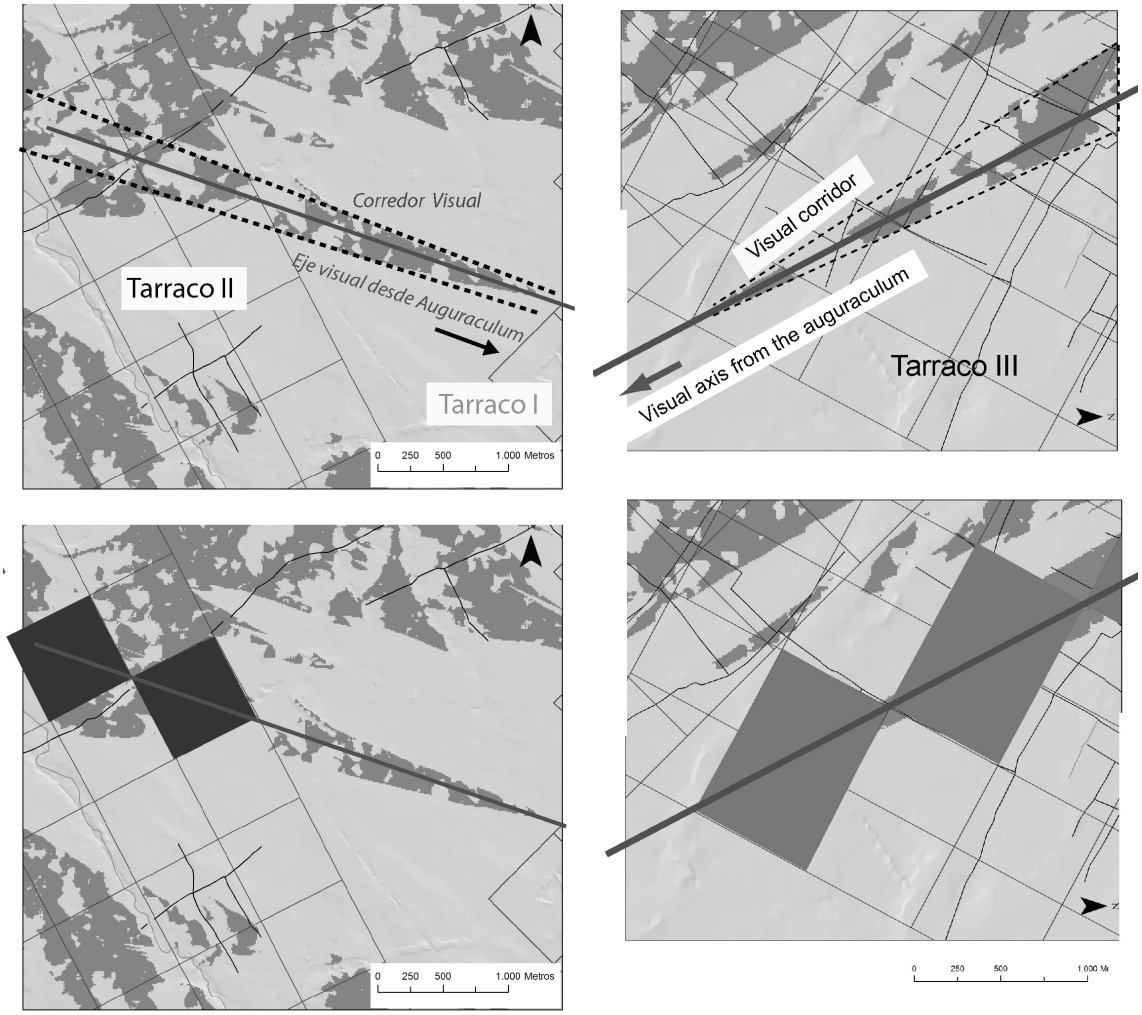

Fig. 5. Detailed views of the Tarraco I and II grids.

became Roman. The *auguraculum* had a central place in this foundation: its plan reflects the Roman idea of the heavens and its cardinal orientation was related to the ordination and orientation of the world. It is therefore reasonable to assume that both the city layout and the land division process were conceived at the *auguraculum*. It is interesting to note the *agrimensores* or Roman land surveyors clearly stated in the *Corpus Agrimensorum Romanorum*, the religious origin of its art, based on the Etruscan *Disciplina*.

It has also been shown how the setting of the centuriated systems was based on those orientations marked by the portions of the territory perceived by the *augur*. Their materialisation was sensitive to the particularities of the environment. Roman land surveying techniques allowed for flexible adaptation to both the visual axis defined by the *augur* and the physical barriers by playing with the modular relationships of the grid units.

These conclusions are aimed to contradict the standardised concept of centuriations as being

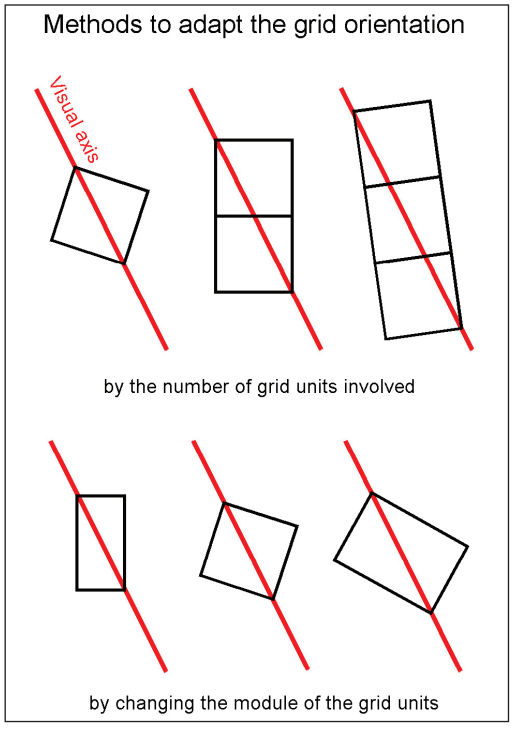

Fig. 6. Scheme showing some methods to adapt the grid orientation.

exclusively a technical and economical process linked to Roman colonialism. They might be better defined as a kind of "transported landscape" in which the home country was conceptually recreated, rather than just politically extended.

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