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A diachronic study of the Roman skyscapes of Tarraco (Tarragona, Spain)

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Abstract

The role of astronomy in the urban plan and configuration of the territories under Roman control is a subject of study with a long trajectory. In the last decades, archaeoastronomical research into the astronomical aspects in regions of the Roman Empire in the East and West indicated that, despite avoiding environmental constraints, the sky in specific configurations was a fundamental factor in the layout of landscape and skyscape during the territorial expansion of Rome. Archaeoastronomy is an interdisciplinary field that employs tools and methods from astronomy and landscape archaeology to examine astronomical evidence and elucidate the relationship between those with diverse manifestations of Roman culture in specific contexts and the reasons behind. This paper presents a diachronic archaeoastronomical study in a prominent capital of the Roman Empire, Tarraco, with the objective of discerning whether particular astronomical features influenced urban and land design in the various projects of land appropriation and division, which ones were those, and why. This would enable the determination of whether Roman surveying was sufficiently flexible and adaptable to surmount the environmental constrains while accounting for other, more symbolic, considerations through the creation of special skyscapes.

1 Introduction

Archaeoastronomy is a sub-discipline of cultural astronomy, that studies the human perceptions of the sky and its role in various aspects of the social life [1]. By combining the tools and theoretical frameworks of astronomy, landscape archaeology or anthropology, archaeoastronomical research allows the identification of organizing principles, beliefs and other symbolic elements within a society by transforming physical space into a cultural one full of meaning [2]. That is by considering that land and sky are understood in different ways depending on the cosmologies of a cultural group. In recent years, and especially in the last decade, research in archaeoastronomy of the Roman world has sought to understand the influence of the sky in the creation of new landscapes for the establishment of a new order in the territories incorporated to the Roman Empire, both in the East and in the West. In particular,

many of these works present statistical analysis of the orientations of towns and centuriations (see e.g. [3] and [4]). These were public lands delimited and divided in regular lots by the Roman state as a result of the conquest which, like the cities, had two main axes: cardo and decumanus. In most cases, the decumani (axis running roughly east-west) show patterns that coincide with solar rises and sets in important days in the Roman calendar. Some of them coincide with relevant events in particular periods, such as the Early Empire, and elements of the indigenous cultures of each region do frequently arise [5].

This work presents a diachronic approach for the study of the evolution of the urban design of Tarraco (present-day Tarragona), one of the most relevant capitals in the Western Roman Empire. Its development started during the Second Punic War (218-206 BCE) , when a castra to host the troops of Cneo Cornelius Scipio (Polibio (3.76)) was erected and in less than 200 years Tarraco became the capital of the largest province of the Empire (Hispania Citerior Tarraconensis), and a key strategic port. Since the consolidation of the Roman power in the Iberian Peninsula in the 2nd century BCE, both the town and adjacent land experienced various processes of intense building activity and transformations that modified both the rural and urban landscapes. One of the most relevant was the monumentalization plan carried out by Augustus, who resided in the town for a short period in which was one of the most important Roman capitals. Previous landscape research on the centuriated system of Tarraco suggested that here there was a connection between a sacred conception of the space and the layout of the land, originated during the foundational rite [6]. In a similar line, in the present paper the main aim is to explore potential relations between the structures built in different phases of the Roman town with the surrounding sky to observe if astronomical patterns are present.

To do so, a wide range of methodologies have been employed, including an analysis of data obtained in situ in the main urban structures, complemented with GIS-based archaeomorphological research of the centuriated systems developed around the city in different phases. This would help to deepen into aspects of the Roman society embedded in the space and determine whether Roman surveying was sufficiently flexible to surmount the environmental constrains while encompassing more symbolic considerations in the creation of particular land- and skyscapes. In addition, considering structures from different chronologies will favour the observation of patterns that may have dominated at each period, check if those agree with others previously found in different provinces and to unveil the meaning or motivations behind particular spatial configurations.

2 Archaeoastronomical data and analysis

The data in the town were obtained in situ. These are azimuths and altitudes of the horizon of structures from different periods of the urban evolution, for which a precision compass and clinometer were used, respectively. In the town, the values were primarily obtained in the two forae, the main political and administrative centres. These are the colonial forum, whose construction started during the Republic with a later ampliations in the Empire, and the provincial forum in the upper part of the town, with a first phase from the early Empire and until the Flavians rule. Under Tiberius rule, both fora incorporated cult spaced devoted

to Augustus, reinforcing the divine nature attributed to the first emperor of Rome.

In the lower and more ancient part of Tarraco, the orientations of the colonial forum and the main streets were measured. The urban grid was parallel to the sides of the forum, and this area underwent notable refurbishment probably with the granting of the colonial status by Julius Cesar in 49 BCE. Interestingly, in this forum there is an auguraculum, something exceptional in Roman cities in Hispania. It is an open-space and sacred rectangular structure designaed to perform auspices, some of them critical for the foundation of a new town and the configuration of the territory (Figure 1).

Figure 1: Colonial (left) and provincial (right). fora of Tarraco at present state.

According to previous archaeomorphological works, the centuriated system around Tarraco was possibly reorganized in a unitary program from this significant location [7]. In our data, the azimuth of the colonial forum and the decumanus of the first urban plan is 119.5º and, considering the altitudes of the horizon in that direction, the declinations are c.-22.4º and c. 22.6º towards the east and west, respectively. These values agree with sunset in the first days of January and December and sunrise in the first days of June and July, when any important festival took place. The provincial forum has an azimuth of c. 124º, translated into declinations of c. -25.5º to the east and c. 25.7º to the western horizon, which fall out of the solar but within the lunar range. However, the relevance of the moon does not seem obvious in this context so, a priori, an astronomical hypothesis is not clear.

Complementary, a viewshed analysis was carried out from the two fora to check whether interesting inter-visibility patterns that embedded celestial phenomena did arise. The fields of view were calculated with QGIS over Digital Terrain Model of 5 metres for Catalonia. Due to the mountainous local orography, part of the north and northeast horizon, towards the sea, is blocked from both observation points. In addition, the provincial forum is not seen from the colonial one, since the last in located in a lower area (Figure 2, Figure 3).

Figure 2: Field of view calculated from the colonial forum over digital terrain model of 5 metres (IGN/MDT05) of the Spanish National Geopgraphic Institute.

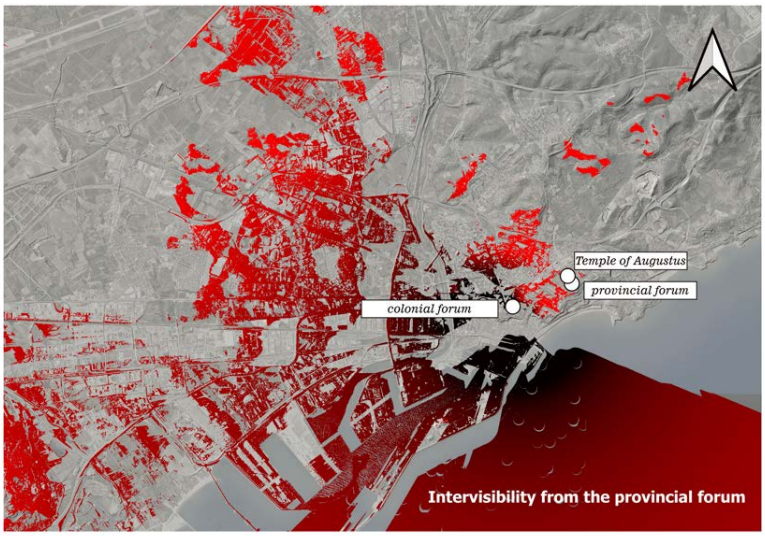

Figure 3: Field of view calculated from the privincial forum over digital terrain model of 5 metres (IGN/MDT05) of the Spanish National Geopgraphic Institute.

3 Landscape and Skyscape in Roman Tarraconensis

At first glance, the impression was that the results in all the structures considered do not show any kind of astronomical pattern attributable to the Roman tradition. However, closer

analysis suggests that celestial phenomena was implicit in geometrical aspects of the spatial layout, rather than in direct observation of the sky. A geometrical technique widely used by the Roman surveyors was the varatio, and consists in the use of right-angles triangles whose legs are in ratios of integer numbers. These sides of the triangle would be placed along the cardinal axes to obtain the desired configuration. The orientation of the earlier urban grid and the colonial forum coincide with the application of a varatio 3:5 (31^{o}), the same that Grid III of the centuriation.

In Tarraco, Augustus carried out a refurbishment of the forum and a monumentalization plan in which the theatre was constructed following this same orientation. In addition, once the Imperial cult was consolidated, Tiberius (Augustus' successor) promoted the construction of a basilica in the colonial forum with an annexe altar devoted to Augustus, as well as a temple in the hill where the provincial forum waslater located. A few decades later, with Vespasian, in that same hill the provincial forum was monumentalized coinciding with the promotion of Tarraco to Latin citizenship. The buildings followed the orientation of the great temple and one of the most common patterns in the Augustan towns, the Pythagorean triangle 3:4:5.

The use of both 3:5 and 3:4:5 ratios has been attributed to obtain solstitial orientations in previous studies about the orientation of Roman towns in Hispania and they are commonly found in cities founded or re-founded by Augustus. A few examples of 3:5 in the Iberian Peninsula are the Imperial fora of Corduba and Italica, Petavonium or Carthago Nova and, interestingly, 3:4:5 is also found towns from the same period, such as Barcino, Juliobriga or Cesaraugusta, as well as in many others in the Western Empire [8].

The interest in the application of these ratios, and the possible reason for that, is that they could be useful as standard patterns to obtain solstitial orientations during massive programs of territorial expansion and urban development. Specially in this case, these may be orientations to the winter solstice sunrise or setting. The reason is that this event has been traditionally linked to moments of renewal, and was incorporated to the Augustan Imperial propaganda as a symbol of the beginning of a new era of prosperity, for example, through the use of images of Capricorn and likely, in the orientation of diverse structures [3].

4 Conclusions

Although at first glance, the orientations of the main points of the city do not have clear astronomical values, the comparison of the azimuths with simple geometrical relations, like 3:5 and 3:4:5, offers an alternative perspective that connects to a such a significant event like the winter solstices. This may have played a major role in the construction of the land- and skyscape of Tarraco, especially during the period under Augustus rule and later on, when the cult to the Emperor was consolidated, in spaces devoted to him. Even though the first phase of colonial forum started during the Republic, the fact that Augustus and his closest successors monumentalized and maintained the use of this space as the main political and religious centre, makes sense considering that the layout of the colonial forum follows the architectonic and urban standards according to the Imperial propaganda and in such a

key moment of the Roman history as it was the beginning of an Empire. Furthermore, the later construction of the Temple of Augustus and the provincial forum around it maintained similar patterns, possibly in an attempt to reproduce the winter solstitial standards in the main location of the worship to Divus Augustus.

In general, the layout of the central spaces of Tarraco at the most important moments of its history, evokes symbols that connect to the power of Augustus, the first Roman emperor. And this was done through the use of the winter solstice in the design of the main areas of the city as a metaphor of the return of light and the beginning of the Empire and then, of a new glorious era for Rome. In conclusion, the diachronic archaeoastronomical analysis of the urbanism of Tarraco highlights the potential of the sky to convey an image of power in one of the most important Roman towns of the Empire, both through the use and re-appropriation of previous structures whose orientations followed the Imperial stadards and also by the creation of new ones.

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