Joan Tort-Donada–Joan Carles Membrado-Tena

*Urban toponymy as a tool for interpreting the physical environment. A case study: Barcelona's mediaeval old town**

1. Introduction

Our purpose in this study is to analyse the urban structure (or, more specifically, *urban morphology*) of mediaeval Barcelona (that is, the part of the city known generically as *Ciutat Vella*) from the perspective of its correlation with the variation in the city's topography and taking into consideration also its correlation with the city's toponymy – in both cases at the local scale. In using this approach, we seek to determine what underpins the process of social differentiation that has historically been recorded in the original nucleus of the city.

Our point of departure is the frequent observation that the micro-shifts in gradient in the physical environment of Barcelona often go unnoticed by scholars because of the pre-eminence of the "built city", which has given rise to what might be considered a mistaken interpretation of the urban evolution of the city. Barcelona's mediaeval old town is predominantly flat in appearance. However, a more detailed inspection reveals it to stand on a physical base of very uneven altitude, with numerous changes of gradient between high- and low-lying areas. In fact, the original core of the city, on which the Roman settlement of *Barcino* was built, is a small hill *(Mons Taber)* that rises above the rest of the old town.

There are many urban toponyms in *Ciutat Vella* that indicate that the streets "descend" from the top of the hill in all directions (from what would have been the Roman core down into the mediaeval quarters), and which usually receive the name *baixada* (*Baixada de la Presó, Baixada de Santa Anna,* etc.; the equivalent word in English could be *slope,* considered in a urban context). Although this is the most significant of the toponyms, it is not the only one. Other names serve as 'indicators of the landscape': *Pla de la Boqueria* and *Pla de Palau* refer to flat urban spaces (the equivalent English word could be *plain*);

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Jonqueres (name alluding to a marsh plant, *reedbed*) and *les Arenes* (literally, "the *sands*") to low-lying depressions; and *la Rambla* (name of Arab origin, pretty frequent in the Mediterranean hidronymy of Iberian Peninsula, alluding to a *creek* or little *stream*) that refers the idea of, to the ancient hydrographic network. A toponym indicating a rise in altitude or a depression, as irrelevant as it may seem today, may historically have been significant, as it would have indicated whether the land was susceptible to flooding and, therefore, whether or not it was suitable for given activities – ultimately, this has been the starting point for the urban differentiation of the "built city".

The study combines the qualitative approach characteristic of classical toponymic analyses with quantitative methodologies (specifically, LIDAR technology applied to Barcelona's physical environment), which we have employed before in other Mediterranean cities, such as València (Membrado 2016, 2017). Regarding the toponymic data, which mainly concern the old town of Barcelona, we use two sources of information: Balaguer (1865–1866), for the old toponymy, and Portavella (2010) for the modern one.

2. Theoretical and methodological considerations

Relief features and other natural factors, including the quality of the soil, the presence of water, the climate, exposure to the sun or winds, condition the original siting of any urban settlement and determine the subsequent shape taken by that site (Oliveira 2016: 11, Capel 2006: 85, Mérida 1995: 465). These determinants, however, are not necessarily absolute: for while every city develops within a natural context, it also develops within its own historical context. Often, the strategic interests of the city's founders determine which location is deemed most suitable (Capel 2006: 104). In general, in periods marked by peace and stability, efforts are made to find comfortable, accessible sites – normally on plains close to the sea or alongside a river, or at the meeting of crossroads – to facilitate movement and trade, while in times of political instability, sites that are difficult to access and easy to defend are often preferred.

The initial location adopted by a settlement tends to determine the subsequent shape taken by the site, and is a key determinant of its evolution (Oliveira 2016: 11). Following its foundation, a city's growth usually occurs – provided this is permitted by the orography – in a compact and successive manner, in a series of 'waves' or 'circles' of homogenous growth centred on the original nucleus. In the case of Barcelona and other Roman cities founded on an alluvial plain, the expansion of the city in Mediaeval times took place on the low-lying, floodable areas that the initial settlers had deliberately avoided. This process ends up generating what is known as urban segregation, with the high ground – safe from flooding – normally being occupied by the elite and the ruling

classes, and the surrounding low-lying areas being occupied by artisans and merchants and, in general, the more disadvantaged classes. In Barcelona, the high area where the Roman forum used to stand is still occupied today, two millennia later, by two of the city's most emblematic buildings: the City Hall *(Casa de la Ciutat)* and the home to the offices of the Presidency *(Palau de la Generalitat)* (CAPEL 2006: 21).

Here, we base our analysis on a dual methodology: *deductive,* on the one hand, insofar as we employ a high-resolution digital elevation model (created using LIDAR technology)[1] in seeking to establish, in the greatest detail possible, the micro-scale topography of the city's old town; and, *inductive,* on the other, based on the identification of the toponyms that in our study area allude to relief features (and, in particular those of microrelief) prior to its urbanisation. This multi-method methodology allows us to address what is, finally, the objective of our study: gaining an understanding of the influence of topography on a city's social and spatial patterns. In short, we consider that our analysis – centred on mediaeval Barcelona but applicable, in principle, to many other European and Mediterranean cities founded on an alluvial plain – can be framed within a line of research using mixed methods that allows us to address the following question: *As imperceptible as the relief might be, what impact does it have on the segregation of inhabitants and on the differentiation of land uses within a city?*

3. Case study: Barcelona's *Ciutat Vella*

3.1. The city's original structure

Barcelona's *Ciutat Vella* is the sum of its three historic walled enclosures: the Roman (3rd century), the first Christian mediaeval enclosure (built under King Jaume I in the 13th century), and the second Christian mediaeval enclosure (built under King Pere III, known as the Ceremonious, in the 14th century) [Figure 1]. Administratively, the district of *Ciutat Vella* is composed of the *barris* (quarters) of the Raval, Gòtic and Sant Pere, Santa Caterina and the Ribera. The *barri* of Barceloneta is also part of the Ciutat Vella district, although it lies outside the mediaeval walled enclosure of the 14th century.

[1] LIDAR (acronym for Light Detection and Ranging or for Laser Imaging Detection and Ranging) is a remote sensing system aimed at obtaining data about the terrain, both in terms of *position* and *elevation.* Compared to traditional techniques, LIDAR remote sensing has important advantages, as it allows different models (or 'x-rays') of the same terrain (with and without buildings, with and without vegetation, etc.) to be obtained by applying laser technologies. In this way, LIDAR remote sensing avoids the limitations inherent to traditional cartography and allows us to improve technically the accuracy of our mapping.

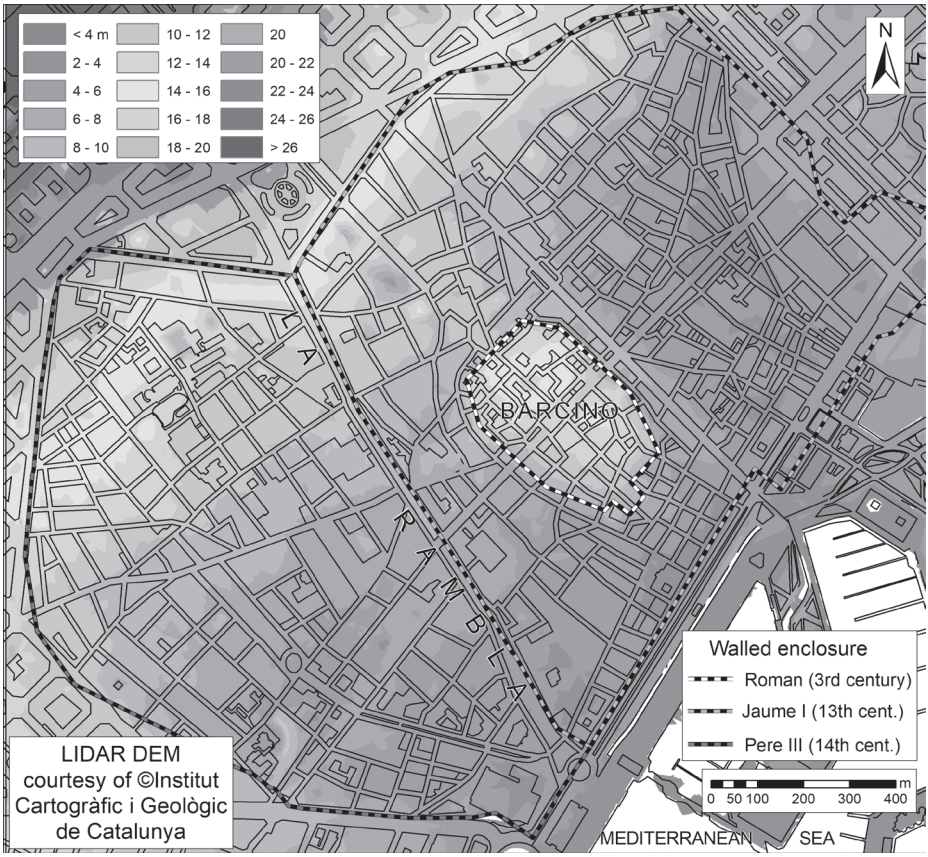

Figure 1: The "global perimeter" of Barcelona's *Ciutat Vella,* with its three historic walled enclosures: the Roman, at the centre, and the two halves of the Mediaeval city, separated by the bed of an ancient stream, *La Rambla,* urbanized from XVIII century (Own work.)

Founded probably in the decades preceding the change of era, in the reign of Augustus, the full name of *Barcino* was the *Colonia Julia Augusta Paterna Faventia Barcino* (Granados–Rodà 1993: 11, Mar et al. 2012: 64). The settlement was founded in relatively peaceful times and, therefore, the initial settlement (which had the status of a colony; that is, a lower rank than that of a city) could be sited on an alluvial plain by the sea and without any natural defences. The small rise on which the primitive *urbs* was located stood barely 5-10 m above the surrounding area. This hill received the mediaeval name of *Mons Taber* in honour of Mount Tabor in Palestine – since, at that time, it was customary to use biblical names in creating local toponyms (Coromines 1989–1997/7: 252). Barcelona's *Mons Taber,* although it reached a maximum height of just 16 metres, facilitated two important functions: first, it ensured the

settlement was safe from flooding and from the inconveniences of the marshy, unhealthy terrain of its immediate surroundings; second, it provided strategic visual control over this area and the adjacent coastline.

The siting of the settlement on the alluvial plain can be linked to its Roman origins. In fact, it is significant that Iberian settlements located in the vicinity of the city (on the perimeter of the plain known as the *Pla de Barcelona*), and chronologically pre-dating the Roman *Barcino,* are situated on top of high hills and, in general, in steep sites – which facilitated their defence in times of instability and protected them from potential attacks. However, the Romans did not feel this same necessity, because, as a rule, the military superiority of Rome in the territories they conquered was self-evident (García-Delgado 2000). In practice, the establishment of the new colonies on areas of flat or slightly sloping topography facilitated the implementation of their gridiron system of urbanisation, a system that they had inherited from the Greeks and which they applied widely in their Hispanic colonies – including that of *Barcino.*

3.2. The name *Barkeno* or *Barcino*. Etymological note

Although, in its present location, the city of Barcelona can be interpreted as being of Roman foundation, the toponym *Barcino* has an older origin. Specifically, the antecedent of this name is considered to be the Iberian form *Barkeno* – a name documented from coins struck at the end of the 3rd century BC, and considered to refer to a pre-Roman settlement located on the slopes of Montjuïc. However, the original site of *Barkeno* has not yet been accurately established. It is believed to have stood roughly three kilometres from the Roman colony, at the foot of the western slope of the mountain of Montjuïc. It is known that a village occupied this site, from at least the 7th century BC, reaching its maximum growth in the so-called Full Iberian period (5th to 4th centuries BC) (Mar et al. 2012: 69). Montjuïc enjoyed a strategic position that allowed it to closely monitor access, from the sea, up the estuary of the Llobregat; we are referring to a time when the current delta had not yet been formed, and in which the final stretch of the river would have played the role of a natural route of penetration and exchange with the lands of the interior. According to Sanmartí–Santacana (2005), this *oppidum* or Iberian settlement would have had access to fresh water, was easily defended thanks to the steep relief of Montjuïc and would have had port facilities for storing cereals. It is likely that during the period of *Pax Romana*, the Romans decided to move this primitive settlement to a more accessible site (*Mons Taber,* on the coastal plain of Barcelona), and, at the same time, to transfer its toponym (Figure 2). Such processes of shifting Iberian cities from their defensive hill sites to flatter areas were especially frequent in Iberia during the Pax Romana (27 BC to AD 180) (Capel 2006: 108).

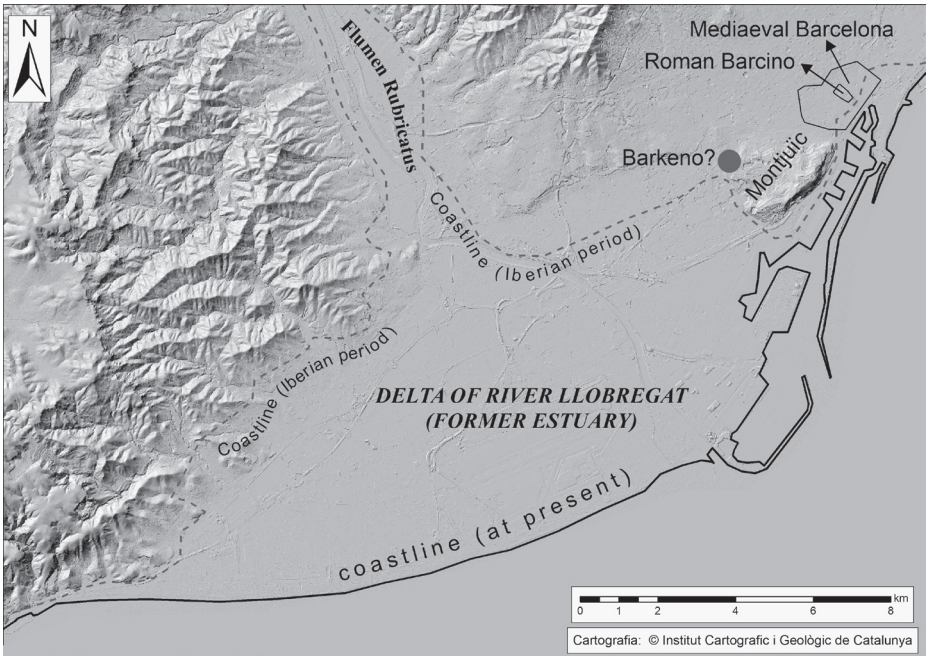

Figure 2: Evolution (hypothetical) of the coast line southwest of Barcelona, in the direction of Montjuïc and the Llobregat river (Own work.)

In common with the majority of Iberian place-names, attempts at deciphering the etymology of the toponym *Barkeno* or *Barcino* must be undertaken with considerable caution, due to our lack of knowledge of this language. The Iberian form *Bar* could be related to the Basque *Ibar,* 'shore, bank (of a river)'. If, indeed, *Bar* was the river shore, the name would refer to the left bank of the Llobregat river whose delta, as we mentioned, had not yet been formed, and therefore the *oppidum* of Barkeno on Montjuïc would have stood next to the river. Although the hypothesis presented here – like any other hypothesis – is somewhat speculative, given the current lack of knowledge of the Iberian language, it at least seems likely that the first part of the place-name *(bar)* is related to the riverbank or shore of the Llobregat, and that it would have been linked to the trade conducted along this waterway. Indeed, this would confirm the city's port vocation from its very foundation. Similar forms, including *Bárcena, Bárzana* and *Barcina,* present in the toponymy of the Iberian Peninsula, possess the same root as *Barcino* and describe a geographically comparable location: a location sited next to a river or in a valley bottom (Urkola 2010, García Arias 2015: 62).

3.3. Results of the analysis: a reconstruction of the original urban morphology of *Ciutat Vella*

The geography of Barcelona's *Ciutat Vella* is characterised above all by its location on a coastal plain site (historically known as the *Pla de Barcelona*) delimited by a number of distinct physical features: the Mediterranean sea, the Montjuïc hill, the Llobregat river, the Collserola mountain range and the Besòs river. Above and beyond its obvious flatness, the coastal plain is characterised by a slight incline (with a sharper shift in gradient in the area of contact with the foothills of Collserola) and, at the micro scale, by many small geomorphological features – which add considerable complexity to the physical landscape of Barcelona as a whole. In short, and from a geological perspective (Riba 1992), the main orographic features of the plain are what is known as the Pleistocene platform, the Barcelona Step, the delta plain (corresponding to the Besòs river) and the small elevation (or palaeorelief) of *Mons Taber.* Similarly, in terms of its hydrography, among the small river courses or streams that cut across the plain perpendicularly, mention should be made of the seasonal torrent of Collserola (better known, in its final stretch, as the *Rambla*).

3.3.1. Interpretation of the physical environment of Barcelona based on remote sensing data

First, we present the two maps that show the altimetry of *Ciutat Vella* of Barcelona based on LIDAR data. They show that the area occupied by the original Roman site *(Mons Taber)* is located at an altitude of between 8 and 15 m, while the area immediately surrounding lies below 8 metres. The small hill chosen by the Roman founders has, over the intervening centuries, served as a natural protection against the flooding of the torrents and has historically been the site chosen for the city's most emblematic buildings: the Roman city, with its temple and forum; the Visigothic cathedral; the See (the cathedral), the Episcopal Palace, the *Palau de la Generalitat* (home to the offices of the Presidency) and the City Hall. The line drawn by the Rambla marked the perimeter of the wall in the 13th century, a perimeter that was extended west in the following century. The medieval enclosure of the 14th century occupied an enormous space, in provision of the city's future urban expansion: at that date, *Ciutat Vella* stood on an area of 216 ha, much greater than that of other cities in the crown of Aragon, such as València and Saragossa (both occupying about 150 ha). During the following centuries, there was a progressive increase in the urbanisation of this space, to the detriment of the rural areas that it initially housed. As for its population, a few decades after the construction of the second wall, 40,000 people lived within the walls of Barcelona.

The maps clearly show that the urban pattern of mediaeval Barcelona was determined by the site's irregular topography. Externally, in constructing the walls, use tended to be made of the slight but continuous rise in gradient of the terrain (what geologists refer to as the *graó barceloní* or the "Barcelona Step") that separates the Pleistocene platform from the delta plain (Casassas–Riba 1992). Internally, the role played by the channel occupied by the Rambla in structuring the space proved fundamental: on its right bank, towards the southwest, extends the part of the city known as *Raval* (in which, initially, the churches and buildings linked to the city's religious orders predominated, along with extensive orchards), while on its left bank crops out, like a small 'islet' above the alluvial plain, the area of *Mons Taber*. In other words, the pattern of occupation of the city's original nucleus is clearly reflected in the topography: its higher parts are home to those buildings with some relation to the nobility and the high clergy, while the lower parts are characterised by a network of streets and squares occupied in the main by the houses and workshops of the city's merchants and artisans.

3.3.2. The reflection of the relief features in Barcelona's urban toponymy

In the context described, we can identify numerous toponyms that directly or indirectly allude to elevations or depressions in the terrain. Today, when thanks to the hydraulic engineering works, *Ciutat Vella* is – theoretically – safe from floods, it might appear somewhat excessive to baptise a small change in gradient in its site with a toponym. However, for their creators such names were fully justified: to locate a building on a small rise – even if this stood no more than 2 or 3 meters above the immediate surrounding area – could be sufficient to save it from the effects of any flooding (Membrado 2012).

The greatest concentration of toponyms of this type can be detected in the very heart of *Ciutat Vella,* that is, in the environs of *Mons Taber.* Notable here is the recurrence of words within the street names indicating that the streets slope downhill, i.e. *baixada.* As Figure 3 shows, these are small streets that link the highest part of *Mons Taber* with the flat lands that surround it. In the current city gazetteer[2] (in conjunction with an exhaustive search of the historical bibliography: Balaguer 1865–1866, Carreras Candi 1916), we have identified as many as seven names of this type: *Baixada de Caçador, Baixada de la Canonja, Baixada de la Llibreteria* (also known as *Baixada de la Presó* and *Davallada de la Cort*), *Baixada de Sant Miquel, Baixada de Santa Clara, Baixada de Santa Eulàlia* and *Baixada Viladecols.* To these names we might add others, which have fallen out of use: *Baixada de Regomir* or *de la Palma* (today known as *Carrer de Regomir* or Regomir street), *Baixada dels Lleons*

[2] See Portavella 2010: http://www.bcn.es/nomenclator/catala/content.htm.

(today known as *Carrer d'Ataülf*), *Baixada de l'Ecce Homo* (today occupied by buildings) and *Baixada del Palau* (today known as *Carrer del Palau*).

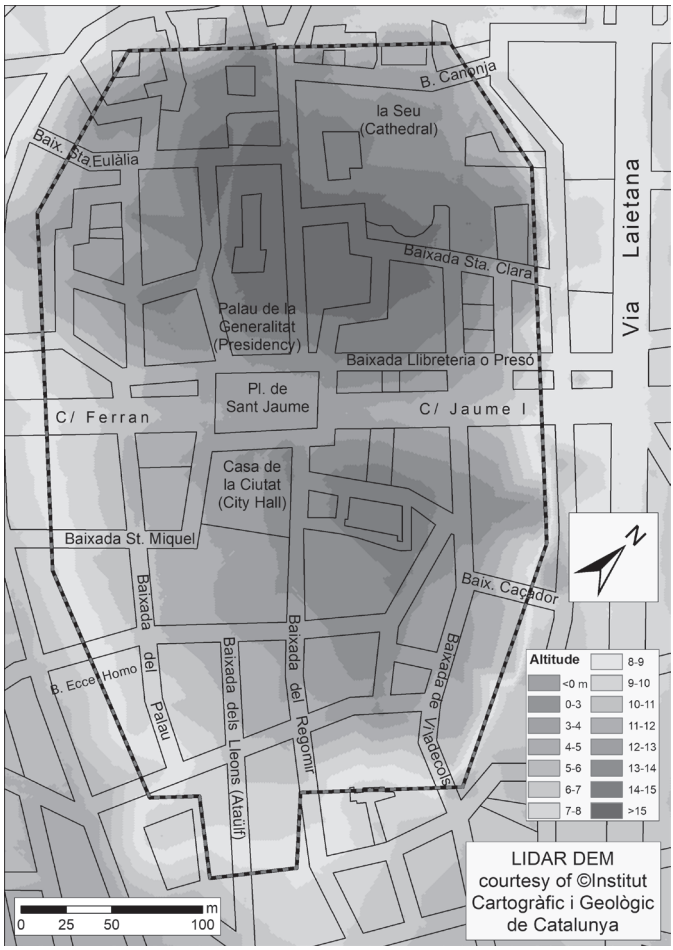

Figure 3: The heart of Barcelona's *Ciutat Vella:* the hill of *Mons Taber,* circled by the Roman walled enclosure (Own work.)

Around the hill of *Mons Taber,* the predominance of depressions in the terrain is, likewise, often underlined by the local toponymy. In addition to the aforementioned hydronym of the *Rambla,* other place-names are highly expressive of the original nature of Barcelona's physical environment. They include *les Arenes* (the sandy site on which the church of *Santa Maria del Mar* was built), *les Jonqueres* (toponym alluding to the bulrush, a typical marsh plant), the flat plains of *Pla de la Boqueria, Pla del Palau, el Born* and the *Ribera* (seashore). In this same part of the city, there is a trilogy of streets whose names clearly point to a gradation in altitude (although barely noticeable at first

sight): Sant Pere *més Baix,* Sant Pere *Mitjà* and Sant Pere *Més Alt* − that is, Lower / Middle / Upper.

Interestingly, practically all the aforementioned place-names correspond to the city's public spaces: primarily streets and squares (regardless of their small dimensions). This correlation between the "traditional toponymy" and the public space observed in *Ciutat Vella* is paralleled, albeit with decreasing intensity, both in the Barcelona of the nineteenth century *(Eixample)* and in the city of the 20th and 21st centuries (Tort-Donada 2013).

4. Final considerations

The case study that we have undertaken, focused on mediaeval Barcelona, is, we believe, indicative of the close interaction that may exist between a city and the physical environment in which it is located. This interaction may not be readily discernible at first glance – especially if the relief of the site is dominated by horizontal forms, and if, over time, there has occurred intense processes of human occupation and urbanisation. But, in such cases, a detailed understanding of the topography (based on remote sensing techniques), on the one hand, and of the city's toponymy, on the other, can be particularly useful analytical tools. The specific case of Barcelona reveals this underlying behaviour: that, no matter how insignificant the change in gradient in the topography, this characteristic can be a key determinant in the configuration of the city's urban plan.

The urban segregation (or separation) that results from changes in the altitude of a site is something that is repeated – in a manner similar to that documented in Barcelona – in the old towns of other major Spanish cities founded on a flat topography. A good example is provided by València, a city where, in common with Barcelona's *Ciutat Vella,* the activities of the traders and the artisans – many of them dangerous to the general health – were located primarily in low-lying areas such as the *Pla de la Boatella* and the neighbourhood of the *Mercat.* The pattern found in València is repeated in other cities located on flat land. These include Seville and Saragossa, whose commercial activities have historically been concentrated in the cities' low-lying areas city (*Calle de la Feria* in Seville; *Avenida César Augusto* in Saragossa, which occupies a former valley floor), while the centres of religious and political power are found on areas with a more pronounced incline, or on those that are at a slightly higher altitude, safe from any floods.

According to the *Diccionario de la Real Academia Española* (Drae), the Spanish expression *bajos fondos* refers to "marginal areas of large cities".[3] Similarly, according to the *Diccionari* de l'Institut d'Estudis Catalans *(Diec),* the Catalan

[3] See *bajos fondos* at: http://dle.rae.es/?id=IBhKM8D|IBiSV3w (Consultation: 29.11.2017.)

expression *baixos fons* refers to the "lower reaches of society, especially those associated with criminal elements".[4] Both expressions *(bajos fondos, baixos fons)* derive from the French *bas-fonds,* which in its literal sense describes a physical feature ('terrain lying lower than that which surrounds it and, in general, marshy"), but which metaphorically alludes to social differences. The metaphorical sense of *bas-fonds,* as employed in the work of Honoré de Balzac in the middle of the 19th century, in all probability derives from this literal meaning, used to describe those Parisian quarters that, orographically, were low-lying and vulnerable to flooding, and in which Paris's marginal population lived. These swampy areas of low-lying terrain in European cities harboured over the centuries their mercantile and recreational activities and the workshops of their artisans, and stood in stark contrast with what were the supposedly more *noble* neighbourhoods built on the higher ground. After the bourgeois and industrial revolution, this pattern of urban segregation began to change, but typically to the greater detriment of the *bas-fonds:* the commercial bourgeoisie that had grown rich were gradually able to abandon these areas and to occupy the new, more spacious areas of the urban expansion plans. The neighbourhoods that occupied the low-lying areas – and which continued to be the *bas-fonds* socially – were exposed, in some cases, to extreme processes of deterioration and neglect throughout the 19th and 20th centuries.

In recent decades, however, Europe's *bas-fonds* have undergone another change. The hydraulic engineering works carried out over the last few decades – which protect these neighbourhoods from potentially catastrophic flooding – have turned these run-down neighbourhoods back into desirable residential areas. Some of them are currently undergoing marked processes of gentrification or reconversion for tourist uses – a process that benefits from their proximity to the city centre, as well from the value of their traditional architecture and the historical nature of their urban fabric.

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[4] See *fons,* meaning 9, at: https://mdlc.iec.cat/results.asp?txtEntrada=fons&operEntrada=0 (Consultation: 29.11.2017.)

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Abstract

Barcelona's mediaeval old town, today known as Ciutat Vella, is predominantly flat in appearance. However, a more detailed inspection reveals it to stand on a physical base of very uneven altitude, with numerous changes of gradient between high- and low-lying areas. In fact, the original core of the city, on which the Roman settlement of Barcino was built, is a small hill (Mons Taber) that rises above the rest of the old town. There are many urban toponyms in Ciutat Vella that indicate that the streets "descend" from the top of the hill in all directions (from what would have been the Roman core down into the mediaeval quarters), and which usually receive the name baixada (Baixada de la Presó, Baixada de Santa Anna, etc.). Although this is the most significant of the toponyms, it is not the only one. Other names serve as 'indicators of the landscape': Pla de la Boqueria and Pla de Palau refer to flat urban spaces; Jonqueres and les Arenes, to low-lying depressions; and la Rambla, to the ancient hydrographic network. A toponym indicating a rise in altitude or a depression, as irrelevant as it may seem today, may historically have been significant, as it would have indicated whether the land was susceptible to flooding and, therefore, whether or not it was suitable for given activities. This study combines the qualitative approach characteristic of classical toponymic analyses with quantitative methodologies (specifically, LIDAR technology applied to Barcelona's physical environment), which we have employed before in other Mediterranean cities, such as Valencia.

Keywords: urban toponymy, Barcelona, mediaeval town, landscape indicators