





ARTICLE



<https://doi.org/10.1057/s41599-023-02178-9>

OPEN

The Spanish Gough maps: first pre-postal maps of the Iberian Peninsula in its European context

Federico Pablo-Martí¹  [✉] & Jesús López-Requena^{1,2} 

In this paper, we study two singular maps, the *Modern Map of Spain*, attributed to Cardinal Margarit, and *Spagna con le distantie de li loci*; made in northern Italy in the late 15th and early 16th centuries. Like the British Gough map, both already show communication networks with expressed distances. Using formal analysis, statistical methodology, and computer processing, we present the cartographic characteristics of each one and relate them to their historical context, updating the scarce information available until now. We explain their relationship as two milestones of the same cartographic process. At the same time, we study the routes represented, finding out the units of measurement used and the communication networks that both maps show us in the context of the Revolution of Communications that the Renaissance represented in Europe. The research has allowed us to attribute a new dating to them, question the traditional authorship, and advance a theory on the transport networks' functionality, demonstrating that both maps are part of a cartographic and historical process at the European level. All these updates to the vision on the first maps of communications in Western Europe established new contributions to the relationship between maps and itineraries. It contributes to filling a void occupied in solitary, until now, by the map of Gough of Great Britain.

¹Complex Systems in Social Sciences Research Group, Universidad of Alcalá, Plaza de la Victoria 3, Facultad de CC. Económicas, Empresariales y Turismo, Alcalá de Henares, Spain. ²IES Alfonso VIII, Calle Lope de Vega, 1, 16002 Cuenca, Spain. [✉]email: federico.pablo@uah.es

Introduction

If we ask anyone today what use they make of cartography, they would say none or very little. Indeed, paper maps are hardly used anymore by the general public. However, most of us still use cartography intensively in our journeys, even if we are only sometimes aware of it when we use navigation systems or applications that show us the best way to get to our destination using public transport. Travel planning assistance is one of the utilities for which maps were once built.

In the Roman Empire, we find the first known road map, the *Tabula Peutingeriana*, and the first itineraries, the *Itinerary of Antoninus* and the *Vicarellus* vases, for Western Europe. In the High Middle Ages, the *Anonymus* of Ravenna was compiled in the 8th century, and the *Tabula Peutingeriana* continues to be reworked. It greatly influenced other maps and texts, and several similar copies were most probably known (Gautier, 2003, pp. 43–44). It is now accepted that medieval roads were at least as well traveled as those of classical antiquity (Delano-Smith, 2006, pp. 16–17). In the middle of the 12th century, the *Codex Calistinus* of the *Liber Sancti Iacobi* was written, which contains, in its fifth book, a description of the *Iter pro peregrinis ad Compostellam* (Calixtus II, 1538). Other works include the itinerary Matthew Paris compiles in his *Historia Anglorum* from the middle of the 13th century (Paris, 1250–1259). The *Via prima quae est diversorum locorum mundi distantia demonstrativa*, or *Itinerary of Bruges*, written at the end of the 14th century (Le Bouvier, 1908), shows that the flow of travelers continues to be maintained in Christian Europe. The itineraries that Al-Idrisi introduces in his *Nuzhat al Mustaq*, also from the middle of the 12th century, do the same for the Muslim area (Idrisi, ca. 1300). This constant flow is also attested to by the books and travelogues that we know of. The flow of people, goods, and information expanded even further between the end of the Middle Ages and the beginning of the Modern Age, constituting an actual Communications Revolution (Behringer, 2006). This calls for instruments that help in their planning. And now, they will be much more accessible due to the printing press. There has been in traditional historiography a great interest in establishing which was the first road map or where the first itinerary was published after the classical period. We can almost say that, in the latter case, there was for a long time a kind of competition that aroused even some controversy (Fordham, 1926, p. 3; Thebussem, 1895, p. 16; Wolkenhauer, 1908, pp. 151–166). However, as far as road maps, or route maps, are concerned, there has been little discussion.

Generally, the Gough map of Great Britain, produced in the early 15th century, has been widely considered the only European map explicitly depicting routes until the appearance in the 16th century of the first printed maps (Pablo-Martí and López-Requena, 2022).

Gough's map is a manuscript, but the printing press will quickly popularize route maps to aid travelers. Thus, in 1500 Erhard Etzlaub published the *Rom Weg* (Etzlaub, 1500). Eleven years later Martin Waldseemüller's *Carta Itineraria Evropae* (Waldseemüller, 1511), and in 1524 Erlinger's *Lage der deutschen und aller angrenzenden Lander* (Lang, 1950). However, for practical purposes, the itinerary is the best option for planning a voyage (Delano-Smith, 2006, pp. 34–35). The example of the merchant Thomas Butler who copied Gough's map in the mid-sixteenth century but without routes and added them separately as an itinerary, ratifies the previous statement (Birkholz, 2006). When we speak of an itinerary, we refer to a guide written to help plan a future journey, with useful indications such as stages, distances, and essential points such as bridges, fords, sales, etc. We do not consider the travel book or account, which, although it can be helpful for the traveler who wishes to prepare a specific

route, has an anecdotal character since it is defined by the circumstances of the moment it was developed.

The itinerary goes further and globally represents a territory with its more or less complex road network. Among the printed itineraries, the first to appear was the itinerary included in a historical chronicle by the printer John Judson, in 1542 (Hodson, 2000, p. 73). The *Reportorio de todos los caminos de España* by Pedro Juan Villuga, published in 1546, is already an itinerary book dedicated to describing a territory through its roads (Villuga, 1546). It was followed by the *Guide des chemins de France*, by Charles Estienne, in 1552 (Estienne, 1552a). These works have a national and global itinerary character, i.e., they record all the roads that seemed helpful to the author. They were quickly expanded to include international routes and to meet the needs of an increasingly integrated Europe. Thus, given the sales success of his guide, Estienne published an expanded version the same year, including other European countries and the Holy Land (Estienne, 1552b).

In the following years, there was a proliferation of editions of new general and specialized itineraries. The anonymous itinerary *Le poste necessaire ai Corrieri per l'Italia, Francia, Spagna e Ale magna*, printed in Venice in 1560, focuses on postal routes (Semper, 2005). Gail's of 1563 focuses on trade routes (Lang, 1950).

Until the arrival, in the mid-17th century, of new intaglio techniques that made it possible to include more detail on maps, itineraries were the usual means of providing information on routes because they were more helpful, cheaper, and easier to transport than maps.

This paper presents two maps, referring to the Spanish territory, which, although known, have not been studied in depth. Both are unique specimens of extraordinary singularity. One is the anonymous and manuscript *Modern Map of Spain* from codex 2586 of the General Library of the University of Salamanca, from the end of the 15th century, which we can characterize as the first map of the Iberian Peninsula with an express layout of some communication routes. The other formally copies the previous one but dramatically increases the communication network. It is the work, also anonymous but already printed, *Spagna con le distantie de li loci*, conserved in the Correr Museum of Venice from the beginning of the 16th century, and constitutes the first thematic map of the Iberian Peninsula on transport lines. The two maps are framed in a European context in which new instruments for travel planning became necessary. People and goods are transported in them, but information transport is a common link to both maps. In these maps, as in Gough's and others from the early modern period, as well as in the itineraries we have discussed, we can observe the persistence of a network structure that emerged at the end of the Middle Ages, which can be seen in several European countries, such as Great Britain, Spain and France (Pablo-Martí and López-Requena, 2022).

Based on these maps, we propose an alternative interpretation of the origin and meaning of what could be the first maps of Spanish itineraries of national scope. They are the antecedents of those that emerged in the second half of the 16th century with a radial design centered on Toledo (Pablo-Martí and Romanillos, 2023), the prime example of which does Hogenberg edit the *Hispania* map in 1579 (Pablo-Martí and López-Requena, 2022). In addition, we advance in their study through an exhaustive formal analysis that corrects previous errors, applying the statistical methodology for studying the routes and their units of measurement and using computer programs for planimetric analysis and projections that clarify their conception and execution. Although still far from a complete multidisciplinary analysis like the one used in the Gough map (Delano-Smith et al., 2017),

our work allows us to formulate a main thesis: the two maps of Spain are part of the same historical-cartographic process, as they are the beginning and the culmination of a new concept in Hispanic cartography: the route map as a representation of a communications network and an aid for planning the journey. And this process, as all the maps and itineraries listed so far show, is international in scope, extending throughout Europe.

After this introduction, the paper is structured into four sections. In the section “Margarit’s map”, we analyze the *Modern Map of Spain* of the University of Salamanca. We study both the document itself and its historical and cartographic context. This scheme is repeated in the following section, on the map *Spagna con le distantie de li loci*. The “Discussion” section focuses on the elements for discussion. Firstly, the relationship between both maps as part of a cartographic and historical process, located in the north of Italy, constitutes a fundamental advance in the cartography of Spanish communications. Secondly, the question of their chronology. Finally, the issue of their functionality, according to the road networks represented on them. The “Conclusions” section presents some conclusions in which we modify the dating of both maps, establish several hypotheses about their authorship, and advance an explanation of the communication network reflected in them. Throughout the work, we highlight the formal and conceptual relationships of these Hispanic maps with what was thought to be the only communications map before the arrival of the first printed maps in the sixteenth century: the British Gough map.

Margarit’s map

Formal analysis. The *Modern Map of Spain* from codex 2586 of the General Library of the University of Salamanca was presented with a brief but exhaustive study by Sanz (2001). The map, manuscript on parchment, is inserted in a codex reproducing Ptolemy’s *Geographia*. However, it is alien to the rest of the document: it had to be cut out to be bound with the rest of the maps and sheets of the codex, which may have caused the loss of the original title (Sanz, 2001, 2006, p. 80). It is dated 1456, after the codex in which it is bound, and is also known as a *map of Spain* (ca. 2015) or *Hispania Moderna* (Manso, 2018) since it is currently untitled. That of its first holder always accompanies either of these names, Cardinal Joan Margarit i Pau.

The map measures 57 × 40 cm, and the map body is framed by a black and ungraduated double neat line, to which the cut-out has been fitted. The space represented is the Iberian Peninsula, the Balearic Archipelago, and North Africa. It has no title, author, or date. However, almost all scholars grant it an Italian origin and, most probably, Florentine (Manso, 2011, p. 18; Manso, 2018; Reguera, 2010, p. 95) because of its relationship with other maps of this origin already studied by Almagià (1948). Only Sanz (2001, p. 13) supposes that the author is Catalan or, at least, from the kingdom of Aragon.

The relief is represented by spots colored in ochre, delimited by black lines, and, in its interior, with a schematic and ideal representation of shaded cliffs. This symbolism is halfway between the cordiform drawing and the outlines of the mountains. The main mountain ranges appear, and only one mountain is named: “Motserrat” (Montserrat, Barcelona). Apart from this toponym, only two natural sites are mentioned. One is the Mar Menor, named “Albufiera,” and the other is the “Valle di mori”, a valley between Albacete and Murcia for which we find no current correspondence. As for hydrography, the primary network is delineated, colored in blue between black lines. It names 17 rivers. In the Júcar he draws an island with two place names: “Zicira” and “¿Zicitai?”, probably a correction. The sea appears colored in blue and labeled in white, with romanilla capital letters. It names ten capes with their toponyms, sometimes illegible, as in some rivers. It names four of the Balearic Islands. The relief is not represented in them nor in the north of Africa and, here, only the Loukous river is drawn, next to “Larxi” (Larache, Morocco), and the toponym of “MAVRITANIA TINGITANA” appears (Fig. 1).

Groupings of buildings represent the settlement. The most essential nuclei show crenelated walls and a more significant number of towers. This hierarchy does not obey fixed parameters. Their lettering is in Gothic script, generally with the initial letter in capital letters. Only “GRANATA” (Granada) appears entirely in capital letters. Fifty-two localities are labeled in red, 39 in the peninsula and 13 in Africa. Most coincide with episcopal sees, but not all of them are, as is especially evident in the cities of North Africa. At the same time, some sees are not highlighted in red, such as Osma, Vic, Girona, La Seu d’Urgell, Jaén, Cádiz, Badajoz, Orense, Mondoñedo, etc... In total, the map shows 489



Fig. 1 Margarit’s map of Modern Hispania. Source: University of Salamanca (Spain), General Historical Library, Ms. 2586, ff. 70v-71r.

localities¹, of which 465 are named with their place names. One town has its place name corrected.

This map shows in red the borders between the different peninsular kingdoms, except Navarre. In addition, some lines (mostly intermittent) link localities with each other, with the distance between them in Arabic numerals, like the well-known map of Gough: 71 lines in the peninsula's interior. Their distribution is not uniform since we only see them with a high density in Portugal, except in the extreme north and the current Spanish autonomous communities of Andalusia, Murcia, and Castilla-La Mancha. They are more isolated in Extremadura and Madrid. The entire northern half of the Iberian Peninsula, the Balearic Islands, and North Africa are not home to any. These unite 84 localities, i.e., 17.25% of all those represented on the map and 19.44% of those located on the Iberian Peninsula and the Balearic Islands. In the sea, 25 lines connect the most prominent capes of the peninsula and some outstanding ports. Almost all of them also offer the distance noted in Arabic numerals except for two; we cannot determine whether they never had it or have lost it. Multidisciplinary analyses would be necessary, as have been done on the Gough map, and have allowed enormous advances in their knowledge (Delano-Smith et al., 2017, Lilley et al., 2021).

Interpretation of the map: its author and its realization. The map raises many questions. The codex in which it is found was within the intellectual circles and political power of the late 15th and early 16th centuries. Its promoter, Joan Margarit i Pau, was bishop of Elna and Girona, held high positions in the Vatican curia, and became a cardinal. Politically active, he was chancellor of the kings of Aragon, John II and Ferdinand the Catholic, and ambassador to the Vatican and several Italian courts. He defended the royalist cause in the Catalan civil war (1462–72) and was very involved in the political project of the Catholic Monarchs (Tate, 1976). His solid humanist training was due to his studies in Bologna and his repeated stays in Italy. He wrote political and historical works, with the *Paralipomenon Hispaniae libri decem* standing out in the latter field. This work combines his political thought with History and Geography, and some relate it to our map, which contrasts and renews the Ptolemaic vision of Hispania. He sketches an itinerary that barely coincides with what is reflected on the map (Sanz, 2001, p. 14). However, Reguera (2010, pp. 92–102) assumes that the map is simultaneous to the codex and cartographically expresses Margarit's policy.

Margarit wanted to give the codex as a gift to Ferdinand, the Catholic (Sanz, 2001, p. 1), but everything points to the fact that it did not reach the monarch. After an interview with Columbus, the latter asked the city of Valencia for a copy of the Ptolemaic geography to document himself (Manso, 2015, p. 120). Our codex would later appear in the Colegio Mayor de Cuenca library of the University of Salamanca, almost certainly coming from the personal library of Cardinal Diego Ramírez de Villaescusa, its founder. It remained in this college until after the middle of the 18th century. Antonio Tavira y Almazán still lists it among the holdings of the collegiate library: “373 *Claudii Ptolomei Cosmographia. Codex membrano optima notae et elegans cum tabulis etiam chartaceis, ac litteris initialibus miniatis*” (Tavira, ca. 1764, p. 255). Logically, Tavira had to make this account after receiving his doctorate from the University of Salamanca in 1764. However, the codex no longer appears in another manuscript, dated unequivocally in 1782 (Navarro, 1782). Sanz (2001, p. 4) places it at the beginning of the 19th century in the library of the Royal Palace. It is currently in the Biblioteca General Histórica of the University of Salamanca.

As can also be seen in the other Ptolemaic maps of Hispania Nova related to it (Almagiá 1948), and as demonstrated by our

formal analysis of the planimetric distortions (Figs. 2 and 3), Margarit's map shows significant distortions in the northeast and west of the peninsula, showing a very oversized Catalonia and a compacted central area of Portugal. These problems were because the coordinates used to make the map were biased in the longitudes. The reason was Ptolemy's well-known error in estimating the circumference of the Earth, underestimating it by about 40% by using the standard measurements instead of the more precise estimates of Eratosthenes (Russo, 2013; Shcheglov, 2017).

Figure 2 shows these distortions in the grid made with Map Analyst software, applying a Helmert adjustment algorithm (Jenny and Hurni, 2011). The white circles indicate the size of the error and the line inside the direction of the distortion. The map uses a scale of 1:2,993,200 and slightly shifts to the left of 10°. This lack of north orientation is common in Ptolemaic maps (Snyder, 1997).

To determine which of the three projections proposed by Ptolemy in his *Geographia* was used in elaborating the map, a detailed study was carried out using *detecproj* software (Bayer, 2014). The results obtained seem to indicate that it was the conic projection. However, the lack of precision of the map does not allow us to rule out the use of the pseudoconic projection, the one preferred by Ptolemy and, as far as we know, first used by Nicolaus Germanus in his copies of the *Geographia* made from 1470 onwards (Snyder, 1997).

Figure 3 shows the planimetric errors made using pairs of circles linked by a line. The red circles show the position on the Margarit map, and the yellow circles show the place they should occupy according to the projection.

Map interpretation: routes and distances. The lines on the map leave us with numerous questions. Those of the coast seem clear that they obey an idea of *descriptio* and, above all, *terminatio*, of definition of the Hispanic territory (Reguera, 2010, pp. 70–89). He marks the outline of the Iberian Peninsula by the sea just as Ocampo will do, years later, by land, in the second chapter of the first book of the *Crónica General de España* entitled “Del asiento y figura de España: con la medida que tiene por sus contornos...” (Ocampo, 1543). But if the purpose of the coastal lines is quite straightforward, something quite different happens with those of the peninsular interior.

They do not coincide with the territorial area in which Margarit was interested, as is the case with the rest of the map, a faithful reflection of the cardinal's concerns, so it is very doubtful that they were made or induced by him. The fact that the codex where the map was bound belonged to the library of the Colegio Mayor de Cuenca opens the possibility of the influence of another eminent prelate: Cardinal Diego Ramírez de Villaescusa, founder of the Colegio Mayor de Cuenca at an approximate date between 1500 and 1510 (Carabias, 1983, p. 58; Castro, 2009, p. 68). He was born in Villaescusa de Haro (Cuenca) and was ordained a priest in Jaén in 1489 when he attended the siege of Baza. He was chaplain to Princess Juana and dean of Seville and Granada. He became bishop of Astorga, Malaga, and Cuenca and even presided over the Royal Chancery of Valladolid. He served as ambassador to France and England. His ascendancy over the daughter of the Catholic Monarchs was notable, and he baptized Emperor Charles (Jiménez, 2009, pp. 229–264). As can be seen, a good part of his biography is related to localities that are linked by the lines drawn on the map. This is the case of the networks drawn in Andalusia and Castilla-La Mancha. But other vital scenarios do not appear linked to them on the map. Salamanca, for example, whose university he maintained very close ties with since his student days and where his most beloved foundation

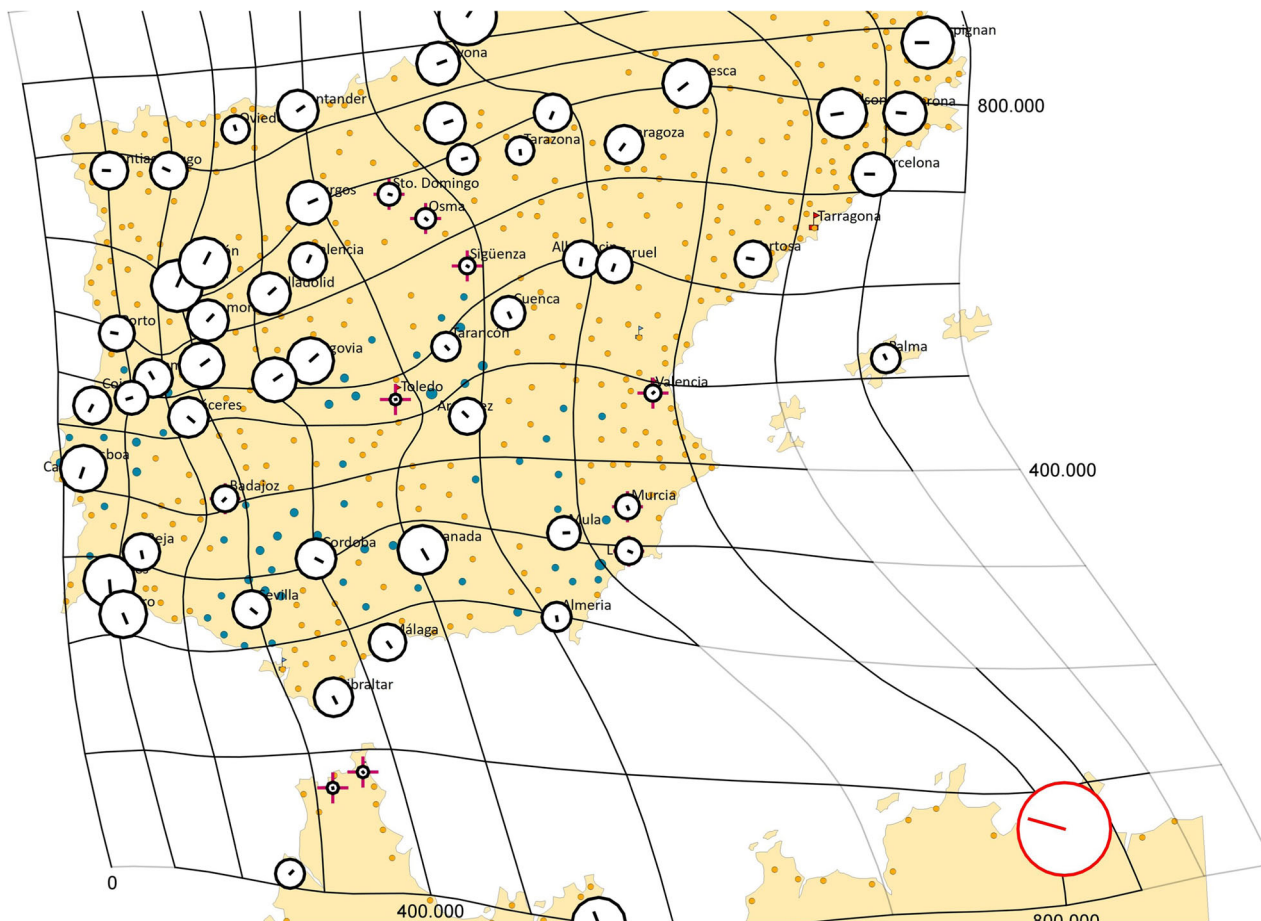


Fig. 2 Planimetric distortions of the Margarit map. Source: Own elaboration using MapAnalyst software (Jenny and Hurni, 2011; Jenny, 2020).

was, and Valladolid, whose chancery he became president. Many other places that are, however, had nothing to do with him, such as the Portuguese networks. The possibility that the drawing of the lines we are concerned with is after making the map was already pointed out by Dr. Manso Porto (2015, p. 120). In this sense, involvement in this last task on the Cardinal Ramírez de Villaescusa map should not be disdained in advance.

These measurements, or numbered lines, indicate routes, not roads, and would not constitute itineraries, although they are close to their conception (Fig. 4). These routes do not follow a clear pattern: they link localities of both lordship and royalty, which house convents of various orders and fall within different administrative units.

The accompanying numbers indicate distances, but not as the crow flies, which would be of little practical use, but on the road. To check this hypothesis, we calculated the walking distances between each pair of towns linked by the lines using Google Maps and always choosing the shortest route among those provided by this navigator. The results show a high correlation between the distance in kilometers and the numbers drawn. The slope of the regression line (Fig. 5) indicates that each unit on the map represents, on average 6.4 km, so that the unit of distance used corresponded to one of the types of leagues that existed in Europe at the end of the Middle Ages. The leagues reflected, with different degrees of approximation, the distance that can be covered on foot in one hour.

The high variability observed made it necessary to check whether the same type of leagues had been used throughout the map or whether, on the contrary, the vernacular leagues of each region had been used. The comparison of the variability of the

units of measurement used in Margarit’s map with those of Villuga’s itinerary, together with the shape of the distribution (Fig. 6) and the lack of a geographical pattern, show that the hypothesis of a single unit of measurement can be accepted and, therefore, attribute the divergences to measurement errors typical of the time. And in addition, it should be noted that, as in Gough’s map, some of the distances may have been calculated, not measured (Delano-Smith, 2022, p. 80).

It thus appears that the unit used on the map was the Castilian *legua de camino* (6.662 km) and that it represents approximately 1 h and 20 min of walking, a somewhat larger measurement than the Spanish league of 20 to the degree (5.573 km) used in Villuga’s itinerary.

The measurements of the coastal crossings that appear on the map constituted a great cartographic innovation since it is not a portulan, where such measurements were usual, but a map of inland, land routes. These coastal measurements do not appear in Gough’s map or in other later works if we discount the copy that was made of it. Deficiencies in the projection used, together with planimetric errors, meant that the actual distances differed greatly from those noted, so accurate estimates of sailing time could be very useful.

The unit of measurement used in the case of the sea is very close to the sea mile of 80 parts of a degree (1.388 km) since the average unit yields 1.357 km. This explains the peninsular coastal profile’s accuracy and the measurements’ coherence and accuracy. This result seems plausible since Margarit states that among his sources were portulan charts and information from navigators (Reguera, 2010, p. 94; Sanz, 2001, p. 14; Tate, 1976, p. 240).

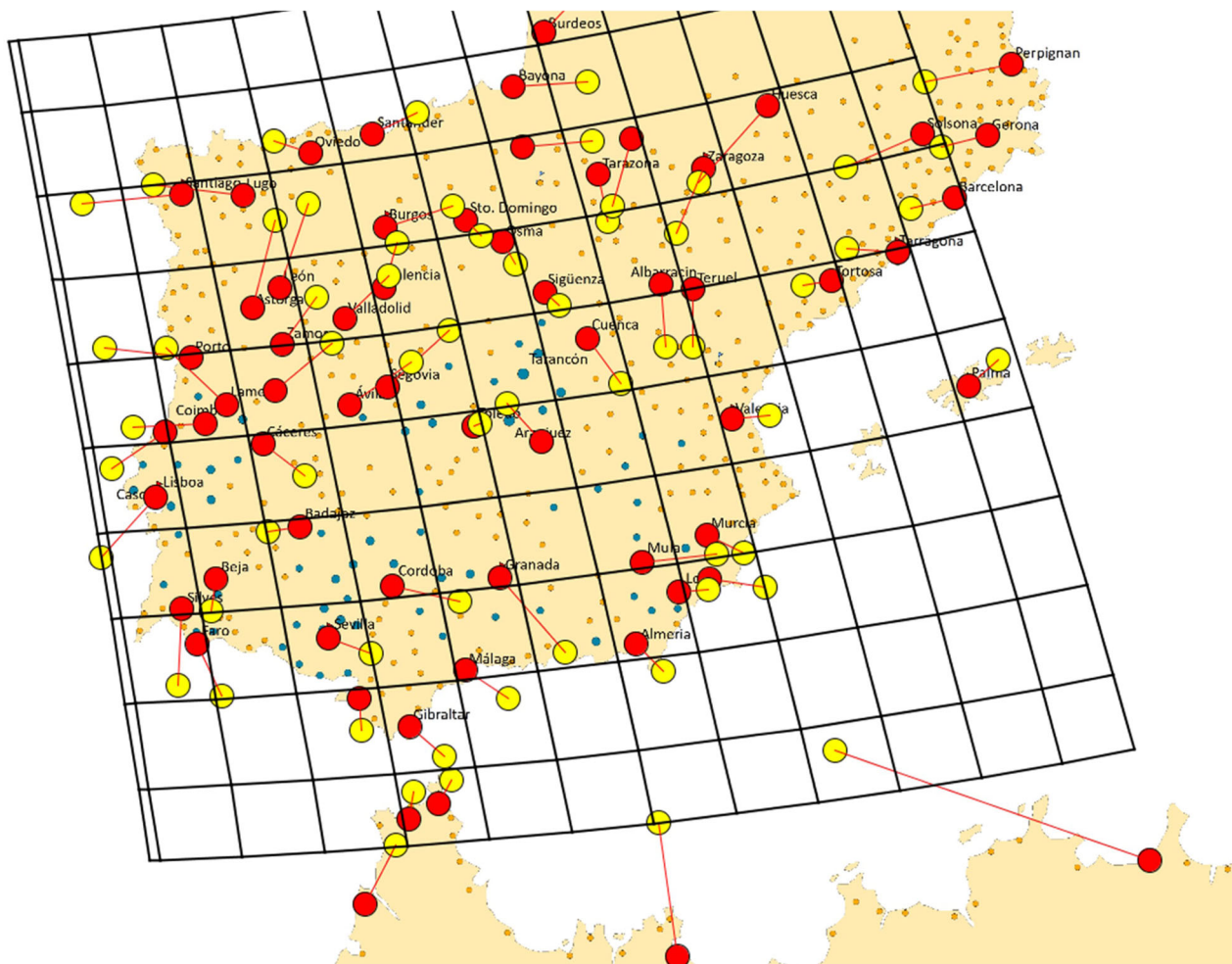


Fig. 3 Projection used in Margarit's map. Source: Own elaboration using detectproj software (Bayer, 2014).

The map *Spagna con le distantie de li loci*

Formal analysis. Of the map entitled *Spagna con le distantie de li loci* (hereafter *SCLDL*) there is only one known copy in the Correr Museum in Venice. It is a colored woodcut facing south, with no mention of author or date, although it received the mandatory authorization to be published by the Venetian Senate (Gallo, 1947, p. 263). It is printed on two sheets, and the body of the map is surrounded by a black neat line. The cartographic area is now in full bleed as the margins were trimmed down to this box. It measures 54'5 × 73'7 cm. At the top is the title of the map and, to the left, the printing privilege (Fig. 7). Most recent studies relate this map closely to the previous one (Manso, 2015, p. 120; Reguera, 2010, p. 98; Sanz, 2001, pp. 10–12).

As for the representation of the natural landscape, he draws the primary hydrographic network colored in blue, although with an error, derived from copying Margarit's map: he confuses rivers with borders of kingdoms, coloring everything in the same tone and generating impossible courses and slopes. This error is not attributable to the engraver but to the one in charge of coloring the preserved copy. It only labels the names of four rivers: the Ebro, the Júcar, the Guadiana, and the Miño. The relief is represented using mountains in profile and shaded. It only names two mountainous features: "MONT.SERRAT" (Montserrat, Barcelona) and "MO. ARAGON" (probably, the Castle of Montearagón, in the province of Huesca). Apart from this, the names of three other natural sites are indicated. Two are taken from Margarit's map: "VAI E DI MORE", which corresponds to the "Valle di Mori" and the Murcian Mar Menor, called here

"CALBVEIERA"; the third is not seen in Margarit's copy, a forest in the north of the province of Huelva, called "CERAFFA SELVA DVLIVETI"². Schematic silhouettes of trees rarely represent the vegetation on the profile of some mountains. Of seas and coasts, he only names the Mediterranean and two capes: "C. SCIABIA" (Cape of the Nao) and "C. ALOIGVR" (Cape St. Vincent), in contrast to the greater abundance of these toponyms on Margarit's map. The seas are colored blue and are highlighted with stripes along the coasts. Only in the Gulf of Valencia is the map ornamented with the schematic representation of two-masted coca (Carbonell, 1986; Ortega, 2008).

Grouping buildings represent the settlement, sometimes with shading and perspective simulation. This grouping becomes more extensive and more complex, according to the importance of the locality, until reaching cities such as Seville, Zaragoza, Gerona, Zamora, or Granada, which are symbolized by a more significant number of buildings, even drawing the walls, although without following a fixed pattern in this gradation. The symbols are more schematic than in Margarit's map. They tend to be flatter and more straightforward. There is no exact correspondence with the hierarchy of that map.

The map shows 435 localities, naming 401 (2 with double place names). Three hundred thirty-three straight lines link most localities, tracing routes between them. Precisely 339 locations (78.47% of the total) are connected by one of these lines. The lack of links is usually more remarkable in coastal areas, such as the Basque Country, Cantabria, Gerona, the French Roussillon, Malaga, Granada, Huelva, northern Portugal, western Extremadura, and

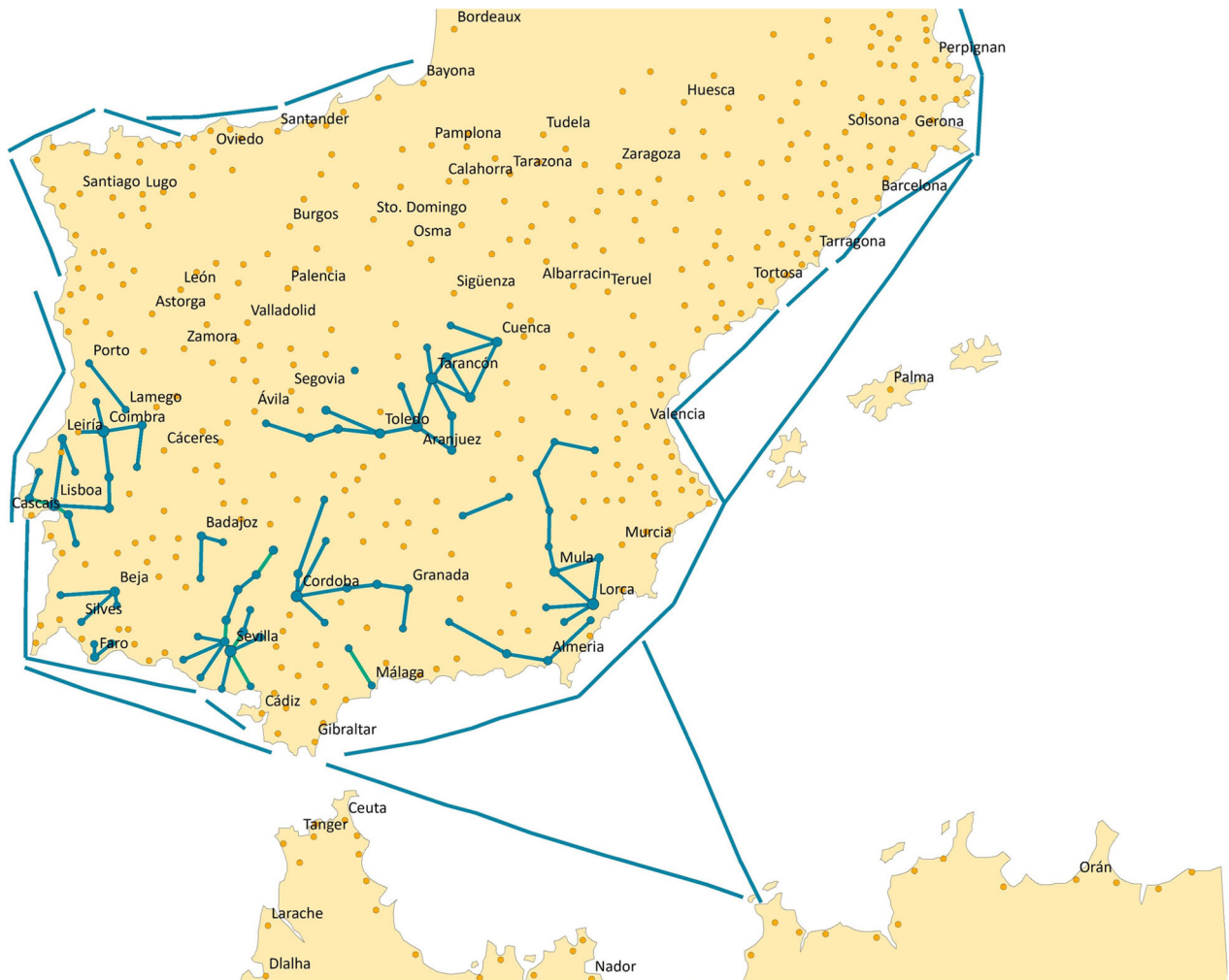


Fig. 4 Populations and lines represented in Margarit's map. Source: own elaboration.

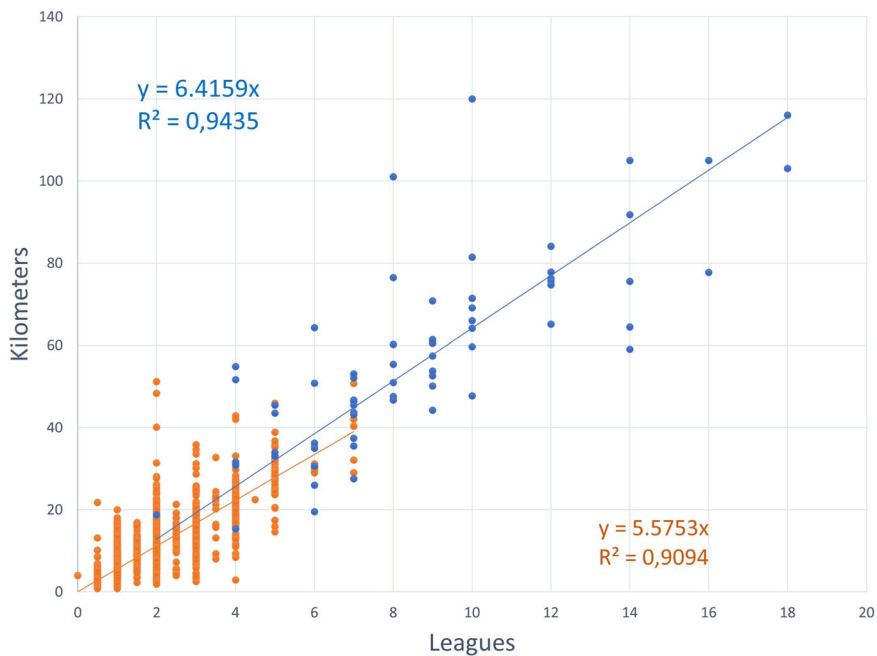


Fig. 5 Errors in the measurement of distances in leagues by Margarit and Villuga. Source: Own elaboration according to Hibberd and Owens (2015).

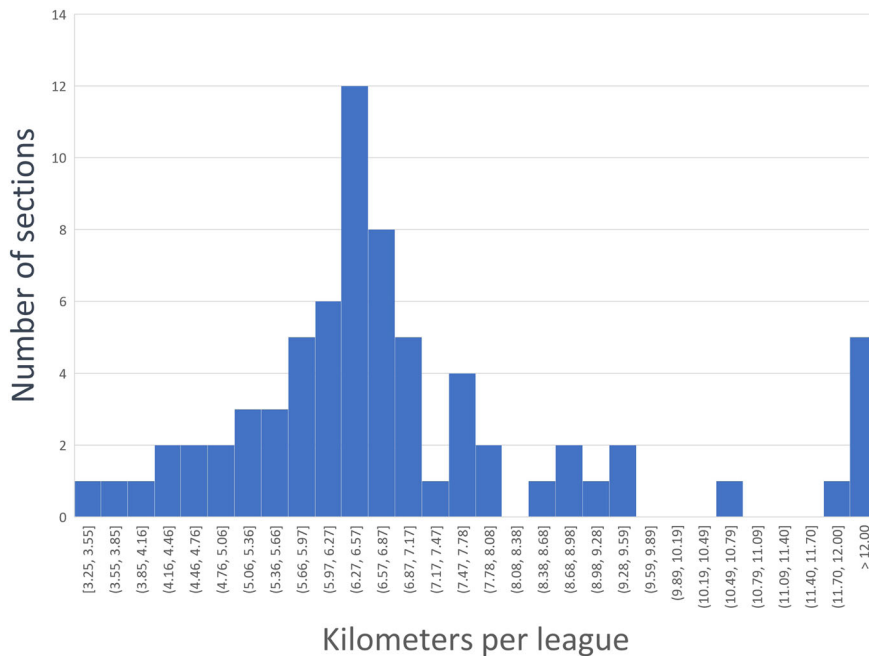


Fig. 6 Length of the leagues in the lines of Margarit's map (kilometers per league). Source: own elaboration.



Fig. 7 Map *Spagna con le distantie de li loci* and its relation with Margarit's map. Source: own elaboration on the image of the map *Spagna con le distantie de li loci*, 2020 © Archivio Fotografico—Fondazione Musei Civici di Venezia.

the Portuguese Alentejo. In the rest of the territory, only isolated enclaves are not linked. These lines show figures in Roman and Arabic numerals (unlike Margarit, who only uses Arabic numerals), indicating the distance between localities. In 14 cases, there are no distances noted. This occurs in the following routes: between Almería and Vera, Granada and Cazorla, Úbeda and Baeza, Estepona and Gibraltar, Sevilla and Carmona, and this with Palma del Río, Banyoles and Girona, Chinchilla de Monte-Aragón and Hellín, Tamarite de Litera and Barbastro, Ateca and Daroca, Segovia and El Espinar, Talavera de la Reina and Puente del Arzobispo, and Lagos (Portugal) and an unnamed locality at Cabo de San Vicente. Sometimes a route ends in a void, leaving two localities unlinked, such as the one from Montemor-o-Novo (Portugal) to the north or the one from Alcocer to the location

that would undoubtedly be Cuenca, which did appear on Margarit's map but does not do so now. Exceptionally, there is so little room between two urban symbols that there is no space for the distance between them, as between Aspe and an unnamed town to the north (probably Sax, Alicante). In addition, Fisteria, which appears as "S. Maria" on the map, shows Figure VI on its right, without any route, since it is located by the sea and the route that joins it with Muxia ("Monza" on the map) already has the number indicated: 4 leagues. Curiously, the route that joins Orense and Santiago de Compostela has two Roman measurements: VIII and XII. These two distances suggest two roads on this route, one three leagues longer than the other. In two Portuguese routes linking Monçao with Ponte de Lima and Melgaso, we find the distances written in hollow Latin, with three vertical rectangles.

As in Margarit's map, other lines, precisely 18, join the coastal highlights, with distances expressed exclusively in Arabic numerals. Finally, the lettering is invariably in romanilla capital letters, except for the printing privilege, which is printed in rounded gothic.

Interpretation of the map: its origin and historical context.

Margarit's map has been used as a base map but has not been the only cartographic source. The author had access to a modern map of Spain lost today or one of the maps that followed it. A copy of that lost map is included in the *Codex Magliabechiano XIII.16*, in the Biblioteca Nazionale Centrale in Florence, by Henricus Martellus. In it appears the toponym "ceraffa silua oliuarum" with the olive grove represented. In our copy, the toponym "CERAFFA SELVA DVLIVETI" is in the same location but designating one more mountainous feature. This toponym also appears in the new maps of Spain of the second recension of Nicolaus Germanus, made around 1467. Thus, we see it in the *Codex rpsBoz 2* of the Biblioteka Narodowa of Warsaw and the *Codices Urb. Lat. 274* and *Urb. Lat. 275* of the Biblioteca Apostolica Vaticana. Here only the toponym "Coraffa Silua oliuarum" is labeled. Either of these maps could have been the secondary cartographic source for the author of *SCLDL*.

In addition, we believe that the author has used two other sources to lay out the routes. One is the walkers and travelers since the map indicates routes that coincide with roads that will later appear in the itineraries. Another source is information about some cities. The map radiates the distances to their nearby nuclei, as in Columbus' *Description and Cosmography of Spain* (Crespo, 2012, 103). This was already more slightly observed in Margarit's map, but the incomparably higher density of the Venetian map's networks makes it especially evident.

As for the unit of measurement used and the explanation for the use of Latin and Arabic numerals in certain sections, little progress can be made after comparing the different measures of the map with the actual distances using the same methodology as in the previous map.

The measurements that appear on the map suffer from the same level of imprecision as in the case of Margarit. Still, their distribution allows us to consider that, like Margarit, the map uses the Castilian *legua de camino* as a unit. Regarding the type of numbering, no logical relationship can be established between Roman and Arabic numbering with routes, distances, or meaning. In the same route, they alternate in different sections throughout the map. We even find distances written backward, as if it were specular writing. Thus, for example, the distance between Barcelona and Manresa is expressed as IIV and not VII; between Jumilla and Murcia, and between Mula and Socovos, it is written as 01, when it is obvious that it should be 10 leagues; or between Murcia and Lorca the figure 21 appears when this same route is found in Margarit's map with the correct figure, 12 leagues. The map does not show bridges, but many routes cross rivers.

The authorship of this anonymous map raises, as it is logical, many discussions. The Correr Museum still maintains in its catalog Vincenzo Paletino de Curzola as its author (Correr Museum, 2021). Gallo initiated this ascription, and Almagià, who shared the same thesis, abandoned it soon after (Almagià, 1948, p. 31; Gallo, 1947, p. 265). Despite this, current authors maintain this attribution (Parker, 1992, p. 126; Samson, 2008, p. 99). We believe that Almagià was right. Paletino was in Spain from 1529 to 1537, when he left for America, and we know that it was during his stay in Bologna, in 1550, that he made his map of Spain, for which he asked the opinion of some Spanish bishops he knew (Lapaine et al., 2003, p. 92). The Croatian's authentic map of Spain, published in 1551, measures 93 × 96 cm, is included in the

Doria Atlas, and remains in a private collection. Apart from its reproduction in some publications, such as that of Lapaine et al. (2003), we can analyze it today thanks to the copy engraved by the Antwerp-born Hieronimus Cock in 1553: *Nova Descriptio Hispaniae* (Cock, 1553). In his map, Paletino himself mentions other earlier sources: that of Gastaldi (1544), and an older one without the author's name (Lapaine et al., 2003, pp. 92–94). This anonymous map was likely *SCLDL*.

As for its date of realization, the Correr Museum dates it generically in the sixteenth century (Correr Museum, 2021), but, as mentioned above, we are inclined to advance its dating. In addition, we also base ourselves on the fact that the image of the Iberian Peninsula that it reflects, being based on Margarit's map, was already surpassed in the middle of the 16th century, for example, by Gastaldi's map of 1544, already engraved on a copper plate and with better cartographic measurements. This hypothesis is also reinforced by the archaism of maintaining the Gothic script in the printing privilege, while the rest of the map uses Romanilla. In short, all this leads us to suggest as a date ante quem, at least, the decade of the 30s of the sixteenth century. Everything points to the fact that the anonymous map we are dealing with must be earlier.

Interpretation of the map: its functionality. This specimen is unique for several reasons.

First, its unusual southern orientation, especially when it is a copy of a north-facing map. It is a printed map and, therefore, intended for sale. Reorienting Margarit's map entailed a cost that the author only undertook because he considered it more attractive to potential buyers. In the 15th century, almost all maps of the Iberian Peninsula were oriented to the north, so most users would have felt more comfortable with an orientation to which they were accustomed.

Only when users consult a map of a territory unknown to them on a table, they prefer to put the most known area in the part closest to them, i.e., at the bottom (Kimerling et al., 2016). This makes us think that the map was aimed at users north of the Iberian Peninsula, French or Flemish. A close example of this usage is the *Rom Weg* (Etzlaub, 1500), in which the map is oriented for Central European pilgrims heading to Rome. Another, more distant in time, but even more evident, is the 1730 map of the Pyrenees made by Roussel for the King of France (Roussel and La Blotière, 1730), in which the farther into the territory of Spain, the farther away from the edge of the table the reader is left.

The coastal atlases of the 16th and 17th centuries are an even more straightforward example. Insofar as they are aimed at seafarers who want to identify the place where they are based on the characteristics of the coast, the orientation of the maps is variable but always leaving the sea at the bottom of the chart to match the subjective vision of the reader by placing it between him and reality (Robijn, 1697; Teixeira, 1634; Waghenauer, 1584).

The Gough map is also not oriented to the north, but it is less strange since, in the Middle Ages, orientation to the east was quite common³.

Secondly, it is the first global communications map of peninsular scope. But what communications does it reflect? Like Gough's map, it is anonymous, and both reflect only a part of the routes or roads existing at the time, structuring them in a system of unconnected networks. Its very title, *Spagna con le distantie de li loci*, tells us that it reflects the distances of places but does not categorize or distinguish them. In analyzing the networks depicted, we see that, on numerous occasions, when the terrain is rugged or steep, the errors in the distance measurements increase, but not consistently. When the networks are small, the

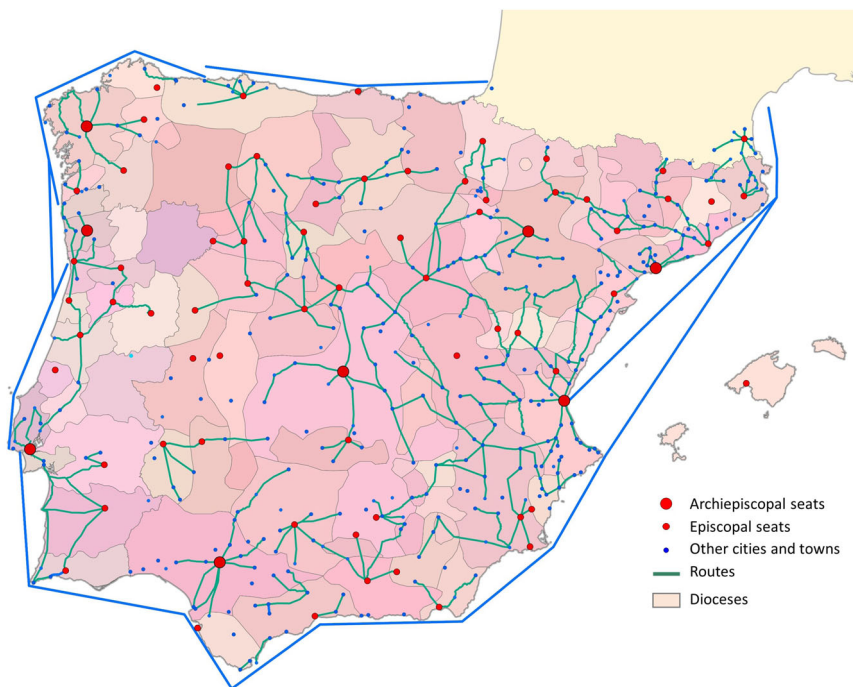


Fig. 8 Lines represented in SCLDL and their relationship with episcopal dioceses and other divisions of the old Spanish ecclesiastical administration.

Source: Own elaboration.

errors generally increase. This leads us to think that the simpler networks do not represent a lower density of communications but rather that the informant has less knowledge of them. However, complex networks also contain errors.

The lack of connection between networks is striking. The map looks like a dense and interconnected network, but it is nothing more than several networks with no connection. In reality, it is striking and impossible that the Burgos network does not connect with the rest of Castilla-Leon or Seville with Cordoba and Granada, for example. The same happens in Portugal. The most complex and best-connected networks are Valencia, the south-eastern plateau, Toledo and Castile-Leon, occupying a strip that runs from west to east through the peninsula's center. Considering all the lines, the network drawn differs significantly from the one that integrated transport in the Iberian Peninsula in the 16th century (Pablo-Martí et al., 2022). However, focusing on its different parts, we find radial networks that usually start from large cities and episcopal seats. More importantly: on numerous occasions, they are circumscribed, in general lines, to the limits of the dioceses (Fig. 8).

Large towns used to be centers of political and religious power, so, unsurprisingly, they were the center of regional communication networks. However, the sub-networks are not consistent with the complex territorial division that characterized the political level of the time (Monsalvo, 2010). This leads us to think that the information used by the author to trace the routes was of ecclesiastical origin. However, the market to which the map was directed was not limited to that sphere but a broader public. That is why the title does not specify: the places are of interest to clergypersons, travelers, pilgrims, couriers, etc. Not surprisingly, this map was intended to be sold, it is not a manuscript, and this differentiates it from both the map on which it is based, Margarit's, and Gough's, with which it shares many similarities.

Discussion

Two maps, a single cartographic process. As we pointed out in section 2, the *Modern Map of Hispania of the Library of the*

University of Salamanca is related to the maps of other codices made in Florence in the third quarter of the 15th century by the painter Pietro del Massaio and the copyist Ugo Comminelli. However, it differs from them in many aspects. Firstly, it “surpasses them in quality and geographical information” (Manso, 2011, p. 22). Apart from the evidence of the routes and distances drawn and of representing the Maghreb coast, Sanz (2001) lists other differences, such as the strange disposition of the map within the codex, the evident influence of the portulanos on the peninsular contour, and the greater abundance of place names. Finally, the same researcher, five years later, even doubts that it was made in the same workshop and affirms that the map is “a unique example of a representation of this type” (Sanz, 2006, p. 80). Above all, the representation of the settlement using pictograms with the grouping of buildings marks a notable difference from the other maps of the group, which represent it with dots and triangles. And this relates it to the map that, according to Almagià (1948, p. 28), was the source for all of them: a map lost but whose copy appears in the *Codex Magliabechiano XIII*, 16 of the Biblioteca Nazionale Centrale in Florence, made by Henricus Martellus. The representation of the settlement is very similar in both maps, and even the disposition of the cartouches with the labels on the sea of this map seems to inspire the lines' location with the Salamanca map's marine distances.

We have already noted that this lost map or one of its followers (Martello or Germanus) was also the source for the SCLDL map. And this leads us to mention a fruitful exchange of geographical and cartographic information throughout northern Italy, during the second half of the fifteenth and early sixteenth centuries, based on the rediscovery of Ptolemy's Geography and its diffusion. This environment is already excellently described by P. Gautier (2007).

The relationship between the Margarit and SCLDL maps is evident: this is a formal copy of the first one. It is the same image of the Peninsula and the Balearic Islands, with the same projection and very similar hydrographic network, except for the error of the person who colored this map: he did not

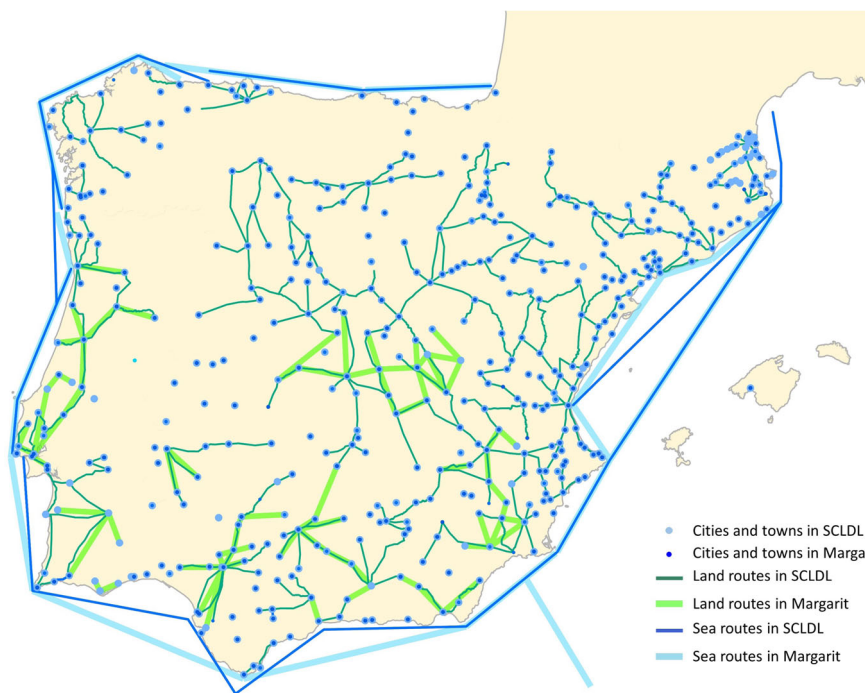


Fig. 9 Comparison between Margarit's maps (in green) and SCLDL (in blue). Source: Own elaboration.

distinguish between this network and the political borders drawn in Margarit's map. Consequently, he colors everything blue. As for the settlement representation, the coincidence between the localities in both maps, logically counting only the peninsular ones, is very high: 391 coincide, 89.88% (Fig. 9). In Margarit's map, in the Iberian Peninsula and the Balearic Islands, there are 451 localities. The Venetian copy adds 17 cities not reflected in Margarit and ignores 26 others. Only in northern Catalonia and Roussillon is this coincidence significantly lower, reaching only 20 cities, representing 42.55% of those in this area. This map does not represent the Maghreb area, where Margarit's map shows 38 towns. It also varies in the Balearic Islands, where the island of Mallorca corrects its position by moving to the northeast, and the rest of the islands disappear.

At sea, Margarit's map shows 25 lines and SCLDL 18. Although some vary from Margarit's, 10 are identical, 40%. SCLDL not only copies the cartographic support for the representation of Margarit's routes, but the network reflected by Margarit is also the basis for its own: it copies 46 of Margarit's 71 land routes, 64.78%.

Some things can be said about the modifications the author establishes on the routes of Margarit's map that he copies in this one.

In the first place, the SCLDL variations, in the case of land distances, always reduce the distances, except in one case, Alcalá la Real-Granada. In this route, the revision does bring the distance closer to the Castilian *legua de camino* used in Margarit, which, a priori, would be a correction made with better data. In the rest of the cases, the modifications imply more significant errors.

As on land, SCLDL fails to correct the sea routes. Also expressed in nautical miles of 80 parts of the degree, the corrections introduced by SCLDL are wildly inaccurate, breaking the great consistency Margarit shows in his coastal measurements.

The speculatively written figures are very striking. A priori, they point to the fact that the engraver was inexperienced and engraved on the wood plate some figures in positive so that when

they were printed, they were inverted. This lack of quality in the execution and the cartographic deficiencies mentioned above may cause its reduced publishing success.

As usual in cartography's history, each map has previous sources that make it possible. This cartographic process starts with Margarit's map, the main source for SCLDL. Not only is it the base map, but the incipient communication network that he draws is also the basis for the one that, expanded, appears in SCLDL. As we have also seen in Chapter 3, the process could have continued if, as we propose, this map was one of the sources for Paletino's map of 1551.

The issue of chronology. As for the dating of the modern maps of Hispania that we have studied, all the chronology assumed so far must be called into question.

First of all, the Margarit map must be separated from the codex in which it is found. The Modern Map of Spain in codex 2586 of the General Library of the University of Salamanca was not intended for this codex and its binding in it is undoubtedly later and probably late. We have already mentioned that Reguera Rodríguez (2010, p. 95) assumed that codex and map were coeval. Sanz, throughout his 2001 study, highlights the physical and conceptual differences between the map and the rest of the codex. He raises doubts in his work about the incorporation of the map into the present volume. However, in a later article, he openly states that "it was inserted in the Codex after its completion in 1456" (Sanz, 2006, p. 80). Until recently, the date of 1456 for the map did not seem to be too much of a joke because the Codex Lat. 4802 of the Bibliothèque Nationale de France, from the same workshop of Massaio and Cominelli, bore the same date, but L. Duval-Arnaud (2002, p. 229) already dates it unequivocally between 1474–75 and 1480. In other words, the productions of Massaio and Cominelli occurred between 1469 and 1480 (Duval-Arnaud, 2002, pp. 228–229), and the first author to introduce modern maps into the manuscripts of the Ptolemaic Geography was Nicolaus Germanus, who does not do so until 1466 (Gautier, 2007, pp. 320–322). Margarit's map cannot therefore be contemporary with the codex in which it is found.

This explains the anomalies already pointed out by Sanz in his 2001 work: the position of the map next to the traditional representation and not at the end of the work, it's sewing to the volume with thread different from the rest, the cutting of its margins to adapt it to the size of the codex. It may have been included in the codex at the end of the 15th century or even at the beginning of the 19th century when it was rebounded in the Royal Palace Library.

As for its date of production, it cannot be earlier than that of the maps of Massaio's workshop. We believe that it is later than them because of its toponymic richness; its greater precision; the use of other cartographic sources such as portulanos and the lost map, common origin of these Florentine maps, and the extension of the represented surface to North Africa. If we accept Margarit's participation in a corrected map of Spain (Reguera, 2010, p. 94; Sanz, 2001, p. 14; Tate, 1976, p. 240), which would be this one, its production would not be after his death in 1484. If this is true, he would have worked on this map very late in his life. But it is also possible that these newer sources were used for his other works, such as the *Paralipomenon Hispaniae libri decem*.

One element of dating can be the layout of the frontier of the Nasrid kingdom of Granada. Almost all the towns outside this frontier were conquered between the 13th and 14th centuries. There are only two dissonances. One is Zahara (Zara on the map), conquered by the Castilians in 1401, lost in 1481 and finally reconquered in 1483, in the course of the War of Granada. The other town in clear conflict with the layout of the frontier is Vera (Bers... on the map). It was conquered in 1488, also in the midst of the Granada War, and should have been placed within the boundaries of the kingdom of Granada.

The towns in the interior of the Nasrid kingdom offer further dates that may help to date the map. The earliest town of capture in the Granada War is Alhama de Granada (Alama on the map), taken in 1482. This would mean that the map reflects the border drawn before this date. However, it is not so clear because there are two errors. One is Gibraltar (Mote on the map), which was taken in 1462. As explained above, the map cannot be earlier than this date. Much bigger is the error in Socovos (Bochouo on the map). This village was conquered by the Christians in 1243, by the capitulation of the taifa of Murcia through the Treaty of Alcaraz.

All this seems to indicate that the map, or at least this borderline, was actually drawn during the War of Granada (1482–1492) and that neither the cartographer nor the informant had up-to-date information on the evolution of the conflict, as the errors referred to above indicate. Their information is old, which is why there are errors, as in Gibraltar and Vera. The absence of the frontier of the kingdom of Navarre incorporated into Castile in 1512, can only have two explanations: an oversight or that the map was not completed, at least as far as the layout of the frontiers is concerned.

It is evident that the author of the second map, *SCLDL*, had Margarit's map as a basic source, but he also had before him the lost original prior to the maps of Massaio and Cominelli or their continuations (the one made by Martellus for the Codex Magliabechiano XIII, 16 or the maps of Germanus), and he followed some things. All were drawn and physically coincided, in northern Italy. And this, assuming a later date of execution than previously assumed, implies a longer stay of Margarit's map in Italy, which, in turn, reinforces the thesis of a late incorporation to the Salamancan codex. This also implies that during this stay in Italy, the routes and distances were added, since *SCLDL* certainly took from him the idea of the routes, which he copied with very few variations, at least in the terrestrial ones. So it is possible that Margarit never knew this map. This would explain the fact that the drawn routes do not fit with his policy. It adds even more questions about who drew these routes. Ramírez de Villaescusa

was in Flanders in 1496 to marry Joan and Philip, on his return, he went to Louvain and Cologne. He returned to Flanders in 1498. That is to say, he was not in Italy when the "Margarit" map was still there at that time. So it does not seem that he was the author, or inspirer, of the lines either.

Lines and distances. The purpose of the lines with their distances represented on both maps is still not clear. As with the Gough map, neither represents the entire communication network of its time. Even more so, the Margarit map selects a very small portion. Why are these routes and not others? This is related to the question of who traced or selected them and, ultimately, who is the author. And as we have previously seen, it is very risky to attribute the intellectual authorship of the map, and of course, the drawn routes, to Cardinal Margarit. The same can be said of Cardinal Ramírez. These lines do not align with the life trajectory or the political or personal interests of either of the two. And it is clear that this selection of itineraries or routes in both cases must not be random and does not detract from the value, accuracy, or truth of what is represented on both maps (Lloyd and Lilley, 2009, pp. 28–29)

Conclusions

Chronology of the maps. As for the chronology of the "Margarit" map, for all of the above, we can date it to the eighties of the 15th century, much later than previously assumed. This would also explain its influence on the other map, the *SCLDL*.

All that has been said so far about the "Margarit" map is not incompatible with substantially advancing the chronology of the *SCLDL* map. We have already proposed the date of the third decade of the 16th century, but we have been able to be conservative and it cannot be ruled out that the map is earlier and was made between 1500 and 1530.

The purpose. Given the relationship between *SCLDL* and Margarit's map that we have explained in the previous chapter, it is evident that the Salamanca map begins a path that the Venetian map intended to culminate, although incompletely and partially as well. Suppose the information on the routes traced in the first map can be the fruit of a single informant, or very few. In that case, the network drawn in the second one obeys an effort of collective and varied information, pretending to cover the whole territory. The idea that *SCLDL* was related to the map presented by the Tassis family to Charles I and his mother, Joanna, in 1518 to obtain the monopoly of the post office in the Hispanic kingdoms is undoubtedly attractive. But the references to this postal chart are only indirect. Sebastián Pedro Pérez is the most explicit: "they represented ... this ydea with a circumstantial map, ... showing the races" (Pérez, 1758, p. 16). And from here Dr. Thebussem supposes the map's existence (Thebussem, 1895, p. 228). However, in the Real Cédula appointing Bautista, Mateo and Simón de Tassis, dated August 28, 1518, there is no mention of the map (Montañez, 1953, pp. 188–190). It is also probable that the manuscript that served as a reference for the printing could be the original mentioned by Pérez and that the low quality of the reproduction and the rapid obsolescence of the routes represented soon ruined it, but we cannot know this. In sum, it cannot be affirmed that *SCLDL* is related to the Tassis postal project.

However, in all administrative areas (civil, religious, judicial, etc.) of the Hispanic monarchy, a communication system that was born before the establishment of the mail by the Tassis family and survived until the nineteenth century, coexisting with the postal system: the "vereda". Its importance in the Spanish administration has been such that this term is still included in the Dictionary of the Royal Spanish Academy, although in disuse and in its 3rd

meaning: “Order or notice that is sent to make something known to a certain number of places that are on the same road or at a short distance” (RAE, 2022). This system consisted of the direct transport of official communications by people affected by that administration, known as “*verederos*” (Bermejo, 1983, p. 603). It was used by all administrations, including the religious one (Boullosa et al., 2011, p. 35). This system was used to record the receipt of the order or official communication, as the *veredero* noted that delivery and notified the authority that had sent it. Although the *verederos* have been documented mainly from the seventeenth century onwards, their use was before that date (Bermejo, 1983, p. 604) since the administrative complexity that made them necessary already began in the fifteenth century (Lorenzo, 2002, p. 7). The antecedent can be found in the couriers and emissaries established throughout the late Middle Ages in Europe (Delano-Smith, 2006, pp. 19–20). Logically, the different routes used by the messengers followed the jurisdiction of the authority that sent the communications (Bermejo, 1983, p. 608).

The routes indicated in the two maps we have studied correspond to those paths used by the ecclesiastical authorities. This is consistent with the broadly matching of the routes shown in *SCLDL* with the dioceses and religious divisions existing at the time (Fig. 7). The fact that the networks are, on many occasions, unconnected is normal, then: when passing from one administration to another or from one territory to another, the uniformity of the path is broken (Bermejo, 1983, p. 608), and this gives rise to the disconnection of the networks that we see in both maps. Margarit’s map started the matter by locating some trails known by an informant that we do not know, and *SCLDL* completed the information given in the previous map. Undoubtedly, the already existing network of trails determined the future postal network, configuring a sufficiently cohesive network, which made this map obsolete. This also contributed to the fact that, as Dr. Delano-Smith had already expressed, the usual orientation guide for the professional traveler was not the map but the itinerary (Delano-Smith, 2006, p. 34).

The uniqueness. Finally, the existence of these maps, especially the *Modern Map of Spain* from codex 2586 of the General Library of the University of Salamanca, breaks the notion that until now, the British Gough map was considered a *unicum* in medieval cartography. Indeed, the Salamanca map, although later by several decades and in the middle of the Renaissance, also expresses its routes and is followed by *SCLDL*, a map already printed that, for the first time, reflects a network, which pretends to be global, of communications in the Iberian Peninsula.

Data availability

The data that support the findings of this study are available from the Historical Library of the University of Salamanca and Museo Correr but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of the University of Salamanca and Museo Correr.

Received: 24 October 2022; Accepted: 25 September 2023;

Published online: 19 October 2023

Notes

1 We do not understand the figure provided by Sanz (2001, p. 9) that speaks of 278 towns, of which 266 appear with toponym.

2 We have not found any correspondence with current names for these places.

3 In fact, the term “orient” arises in medieval times, when monks drew maps of the known world with the Orient at the top (Kimerling et al., 2016).

References

- Almagià R (1948) The first “modern” map of Spain. *Imago Mundi* 5:27–31. <http://www.jstor.org/stable/1149779>
- Bayer T (2014) Estimation of an unknown cartographic projection and its parameters from the map. *GeoInformatica* 18(3):621–669. <https://doi.org/10.1007/s10707-013-0200-4>
- Behringer W (2006) Communications revolutions: a historiographical concept. *German Hist* 24(3):333–374
- Bermejo JL (1983) La circulación de disposiciones generales por el método de veredas en el Antiguo Régimen. *Anu Hist Derecho Español* 53:603–610
- Birkholz D (2006) The Gough map revisited: Thomas Butler’s the Mape off Ynglond, c.1547–1554. *Imago Mundi* 58(1):23–47. <https://doi.org/10.1080/03085690500362298>
- Boullosa P, Lara E, Martín E, Pascual M (2011) Los despachos de veredas como medio de circulación de las disposiciones oficiales a finales del Antiguo Régimen. *Estudio archivístico. Arch Secreto: Rev Cult Toledo* 5:34–41. <https://dialnet.unirioja.es/servlet/articulo?codigo=3763232>
- Calixtus II (1538) Liber Sancti Jacobi. National Library of Spain, MSS/4305. Madrid. <http://bdh-rd.bne.es/viewer.vm?id=0000100554&page=1>
- Carabias AM (1983) El Colegio Mayor de Cuenca en el siglo XVI: estudio institucional. University of Salamanca, Salamanca
- Carbonell L (1986) La “coca” nave del medioevo. *Rev Hist Nav* 15:45–64. https://armada.defensa.gob.es/ArmadaPortal/page/Portal/ArmadaEspañola/mardigitalrevistas/prefLang-es/03revistaHistoriaNaval-01catalogoRevista-1986-1986n15-es?_pageAction=selectItem&_selectedNodeID=4317257¶mNo=198600
- Castro A (2009) Diego Ramírez en la Universidad de Salamanca: su labor como visitador y mecenas. In: Millán JM, Martínez CJ (Coords.) *Don Diego Ramírez de Villaescusa: obispo y mecenas*. University of Castilla-La Mancha, Cuenca, pp. 55–87
- Cock H (1553) Nova Descriptio Hispaniae [General Map]. <http://bdh-rd.bne.es/viewer.vm?id=0000032007>
- Correr Museum (2021) Catalog. <http://www.archiviodelacomunicazione.it/sicap/Disegni/2375/?WEB=MuseiVE>. Accessed 11 Oct 2022
- Crespo A (2012) La descripción y cosmografía de España: el mapa que nunca existió. *CT Catastro* 74:83–109
- Delano-Smith C (2006) Milieus of mobility. Itineraries, route maps, and road maps. In: Akerman JR (ed) *Cartographies of travel and navigation*. The University of Chicago Press, Chicago, pp. 16–68, 294–309
- Delano-Smith C, Barber P, Bove D, Clarkson C, Harvey PDA, Millea N, Saul N, Shannon W, Whittick C, Willoughby J (2017) New light on the Medieval Gough Map of Britain. *Imago Mundi* 69(1):1–36. <https://doi.org/10.1080/03085694.2017.1242838>
- Delano-Smith C (2022) Who produced the Medieval Gough Map of Britain, way and how? In: Dumassy-Rabineau J, Serchuk C, Vagnon E (Dirs) *Pour une histoire des cartes locales à la fin du Moyen Age et à la Renaissance. Towards a history of local maps in Medieval and early modern Europe*. Le Passage, Paris, France, pp. 71–88
- Duval-Arnaud L (2002) Les manuscrits de la Géographie de Ptolémée issus de l’atelier de Piero del Massaio (Florence, 1469–vers 1478). In: Marcotte E (ed) *Humanisme et culture géographique à l’époque du concile de Constance. Autour de Guillaume Fillastre, Actes du Colloque de l’Université de Reims, 18–19 novembre 1999*. Brepols, pp. 227–244
- Estienne C (1552a) La guide des chemins de France. Charles Estienne, Paris
- Estienne C (1552b) Les voyages de plusieurs endroits de France & encores de la Terre Sainte, d’Espagne, d’Italie & autres pays: Les fleuves du royaume de France. Charles Estienne, Paris
- Etzlaub E (1500) Das ist der Rom Weg von meyllen zu meyllen mit puncten verzeychnet von eyner stat zu der andern durch deutsche lant. [General map]. Nürnberg. <https://gallica.bnf.fr/ark:/12148/btv1b55004869m>
- Fordham HG (1926) Les Guides Routiers, Itinéraires et Cartes Routières de l’Europe, 1500–1850. *Bull Soc Hist Artist Vieux Pap* 115:57–88
- Gallo R (1947) Fra Vincenzo Paletino da Curzola e la sua carta della Spagna. *Atti della Accad Naz Lincei CCCXLIV-II* 5–6:259–267
- Gastaldi G (1544) La Span[n]a [General map]. Venice. <http://bdh-rd.bne.es/viewer.vm?id=0000021075>
- Gautier P (2003) La trasmissione medievale e rinascimentale della “Tabula Peutingeriana”. In: Prontera F (Ed.) *Tabula Peutingeriana: Le antiche vie del mondo*. L.S. Olschki, Firenze, pp. 43–52
- Gautier P (2007) The reception of Ptolemy’s geography (end of the fourteenth to beginning of the sixteenth century). In: Woodard D (ed) *The history of cartography, vol 3. Cartography in the European Renaissance Part 1. The University of Chicago Press, Chicago, London, pp. 285–364*
- Hibberd R, Owens JB (2015) Before highway maps: creating a digital research infrastructure based on sixteenth-century Iberian places and roads. *Bulletin*

- for Spanish and Portuguese Historical. *Bull Span Port Hist Stud* 40(1):19–43. <https://asphs.net/article/before-highway-maps-creating-a-digital-research-infrastructure-based-on-sixteenth-century-iberian-places-and-roads/>
- Hodson D (2000) The early printed road books and itineraries of England and Wales. Doctoral thesis, University of Exeter
- Idrisi M (ca. 1300) *Nuzhat al-muštāq fi iḥtirāq al-aḥāq*. Bibliothèque nationale de France. Ms arabe 2221. Paris. <https://gallica.bnf.fr/ark:/12148/btv1b6000547/fl.item.r=langEN>
- Jenny B, Humri L (2011) Studying cartographic heritage: analysis and visualization of geometric distortions. *Comput Graph* 35(2):402–411. <https://doi.org/10.1016/j.cag.2011.01.005>
- Jenny B (2020) *MapAnalyst* (version 1.3.35). Windows. Monash University, Melbourne
- Jiménez M (2009) Don Diego Ramírez de Villaescusa y la prerreforma española. In: Millán JM, Martínez CJ (Coords) *Don Diego Ramírez de Villaescusa: obispo y cenenas*. University of Castilla-La Mancha, Cuenca, pp. 229–282
- Kimerling AJ, Buckley AR, Muehrcke PC & Muehrcke JO (2016) *Map use: reading, analysis, interpretation*, 8th edn. ESRI, Redlands
- Lang W (1950) The Augsburg travel guide of 1563 and the Erlinger road map of 1524. *Imago Mundi* 7(1):85–88. <https://doi.org/10.1080/03085695008591960>
- Lapaine M, Peric O, Novak D, Kljajic I (2003) Vinko Paletin of Korčula. *Kartogr Geoinform* 2(2):86–98. <https://kig.kartografija.hr/index.php/kig/article/view/410>
- Le Bouvier G (1908) *Le livre de la description des pays*. Ernest Leroux, Paris
- Lilley KE, Millea N, Vetch P, Solopova E, Barry L (2021). The Gough Map of Great Britain <http://www.goughmap.org/map/>. Accessed 16 Oct 2022
- Lloyd CD, Lilley KD (2009) Cartographic veracity in Medieval mapping: analyzing geographical variation in the Gough Map of Great Britain. *Ann Assoc Am Geogr* 99(1):27–48. <https://doi.org/10.1080/00045600802224638>
- Lorenzo PL (2002) Administrative correspondence in the Castilian absolute state (16th–17th centuries). *Tiempos Mod: Rev Electrón Hist Mod* 3(5):1–29. <http://www.tiemposmodernos.org/tm3/index.php/tm/article/view/15>
- Manso C (2011) La cartografía ptolemaica, precedente científico de la llegada a tierra firme. *Rev Estud Colombinos* 7:7–26
- Manso C (2015) El mapa de España en tiempo de los Reyes Católicos. *Rev Estud Colombinos* 11:115–130
- Manso C (2018) Primeras imágenes de España. *Portulanos y Geografía de Ptolomeo*. In: Sancho J (Dir) *España en mapas. Una síntesis geográfica*. Instituto Geográfico Nacional, Madrid
- Monsalvo JM (2010) *Atlas Histórico de la España Medieval*. Síntesis, Madrid
- Montañez M (1953) *El Correo en la España de los Austrias*. Consejo Superior de Investigaciones Científicas, Madrid
- Navarro A (1782) Copia del índice de los manuscritos que se hallan en la Biblioteca del Colegio Mayor de Cuenca de la Universidad de Salamanca. National Library of Spain, MSS/2952. Madrid
- Ocampo F (1543) *Los quatro libros primeros de la Crónica General de España*. Juan Picardo, Zamora
- Ortega A (2008) La coca en el intercambio mercante Atlántico-Mediterráneo. *Anu Stud Mediev* 38(1):429–444. <https://estudiosmedievales.revistas.csic.es/index.php/estudiosmedievales/article/view/72/73>
- Pablo-Martí F, Alañón Á, Myro R (2022) The choice of Madrid as the capital of Spain by Philip II in the light of the knowledge of his time: a transport network perspective. *PLoS ONE* 17(6):1–39. <https://doi.org/10.1371/journal.pone.0269419>
- Pablo-Martí F, López-Requena J (2022) The Hispania Map of the Hogenberg Road Atlas (1579) and the Current Spanish Transport Network. *Ann Am Assoc Geogr* 112(4). <https://doi.org/10.1080/24694452.2022.2042183>
- Pablo-Martí F, Romanillos G (2023) The naïve map of the sixteenth century roads in Spain. *J Maps* 19(1). <https://doi.org/10.1080/17445647.2023.2232360>
- Paris M (1250–1259) *Historia Anglorum*. British Library, Royal MS 14 C VII, London
- Parker G (1992) Maps and ministers: the Spanish Habsburgs. In: Buisseret D (ed) *Monarchs, ministers, and maps: the emergence of cartography as a tool of government in early modern Europe*. The University of Chicago Press, Chicago, pp. 124–152
- Pérez SP (1758) *Dialogo entre Pelayo, correo de gabinete de Su Majestad, and Toribio, su postillón, en el viaje que los dos corrieron de Madrid a Napoles*. National Library of Spain, MSS/20611, Madrid
- Real Academia Española (RAE) (2022) *Vereda*. In: *Diccionario de la Lengua Española*, 23rd edn. Real Academia Española (RAE)
- Reguera AT (2010) *Los geógrafos del Rey*. University of León, Salamanca
- Robijn J (1697) *Deel der Nieuwe Groote Zee Spiegel, Inhouende Het Straats Boeck ofte Vertooninge ende Beschryvinge der Middellansche Zee in Verschde Zee Kaarten en Opdoeningen van Landen en int Ligt Gebragt*. National Library of Spain, GMG/120, Madrid
- Roussel, La Blottière F (1730) *Carte générale des Monts Pyrénées, et partie des Royaumes de France et d'Espagne par le M. Roussel ingénieur du roy* [General Map]. Bibliothèque nationale de France, GE DD-2987 (1582, I–VIII), Paris. <https://gallica.bnf.fr/ark:/12148/btv1b8592259q/fl.planchecontact>
- Russo L (2013) Ptolemy's longitudes and Eratosthenes' measurement of the Earth's circumference. *Math Mech Complex Syst* 1(1):67–79. <https://doi.org/10.2140/memocs.2013.1.67>
- Samson A (2008) Mapping the Marriage: Thomas Geminus's "Britanniae Insulae Nova Descriptio" and "Nova Descriptio Hispaniae" (1555). *Renaiss Reform* 31(1):95–115. <https://doi.org/10.33137/rr.v3i1.9547>
- Sanz JM (2001) El mapa de España moderno del código 2586 de la Biblioteca General de la Universidad de Salamanca. In: *Actas del XIX Congreso Internacional de Historia de la Cartografía* [CD-ROM]. Ministry of Defense, Madrid
- Sanz JM (2006) La cartografía en la época de Colón. *Salamanca Revista de. Salamanca Rev Estud* 54:57–84
- Sempere JM (2005) De los mapas de postas a la carta postal de España de 1862. *Academus*, pp. 141–155
- Shcheglov DA (2017) Eratosthenes' contribution to Ptolemy's map of the world. *Imago Mundi* 69(2):159–175. <https://doi.org/10.1080/03085694.2017.1312112>
- Snyder JP (1997) *Flattening the earth: two thousand years of map projections*. The University of Chicago Press, Chicago
- Tate RB (1976) *Joan Margarit i Pau cardenal y bisbe de Girona. La seva vida i les seves obres*. Curial, Barcelona
- Tavira A (ca. 1764) *Índice de los libros manuscritos de los Colegios Mayores de San Bartolomé, Cuenca, el Arzobispo y Oviedo de Salamanca*. National Library of Spain, Madrid, MSS/4404, Madrid
- Teixeira P (1634) *Descripción de España y de las costas y puertos de sus reinos*. Österreichische Nationalbibliothek, Cod. Min. 46, Wien
- Thebussem DR (1895) *Fruslerías postales*. Sucesores de Rivadeneira, Madrid
- Villuga PJ (1546) *El repertorio de todos los caminos de España: Hasta agora nunca visto en el qual Allará Qualquier Viaje que Quiera Andar muy pvechoso pa todos los caminantes*. Pedro de Castro, Medina del Campo. Facsimile edition (2016). Maxtor, Valladolid
- Waghenaer LJ (1584) *Spiegel der zeevaert*. https://www.dbnl.org/tekst/wagh001spie01_01/
- Waldsemüller M (1511) *Carta Itineraria Evropaee*. Strasbourg. https://de.wikipedia.org/wiki/Datei:Carta_itineraria_evropaee_1520_waldseemueller_watermarked.jpg
- Wolkenhauer A (1908) *Eine kaufmännische Itinerarrolle aus dem Anfange des 16. Jahrhunderts*. *Hansische Geschichtsblätter* XIV:151–195. https://www.digihum.de/digiberichte/PDF/Wolkenhauer_1908_Itinerarrolle.pdf

Author contributions

All the authors contributed equally to this work.

Competing interests

The authors declare no competing interests.

Ethical approval

This article does not contain any studies with human participants conducted by any of the authors.

Informed consent

This article does not contain any studies with human participants conducted by any of the authors.

Additional information

Correspondence and requests for materials should be addressed to Federico Pablo-Martí.

Reprints and permission information is available at <http://www.nature.com/reprints>

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/>.

© The Author(s) 2023