39 • Spanish Peninsular Cartography, 1500–1700

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Introduction

Spanish peninsular and European cartography under the Habsburgs has largely been overshadowed in the literature by accounts of the remarkable achievements of Spanish mapmakers in the New World. Yet Spain's cartographers, both of the Old World and of the New, came out of the same institutions, relied on the same long-established traditions, called on the same rich scientific milieu, and in many cases developed similar solutions to their respective cartographic problems.[1]

In the late Middle Ages, many influences were at work in the territories of the Catholic Monarchs (of Castile and Aragon), with many different cartographic traditions. To the west, the Portuguese were pushing the portolan chart techniques to their limits, applying them to voyages that worked ever more southerly, around the west coast of Africa.[2] To the south, the Moors of Granada could draw on the riches of the Arabic tradition of cartography, going back to a Mediterranean antiquity whose achievements were largely forgotten in northwestern Europe.[3] In the east, there was the Majorcan school of marine cartographers, who from the thirteenth century onward had been drawing remarkably accurate maps of the Mediterranean Sea.[4]

Within Spain itself, the sciences ancillary to mapmaking thrived. There were mathematicians and instrumentmakers, often drawn from the Jewish communities, who could bear comparison with any elsewhere in Europe. There was also the making of an institutional framework, with a scattering of universities and some printing presses, though by 1500 neither the universities nor the presses were as well developed in Spain as they were in Germany or in Italy.

The leaders of Spain seem to have been aware of the potential of maps for the processes of government. We have no precise information about the attitudes of the Catholic Monarchs Ferdinand and Isabella, but Ferdinand came from Aragon, where he had cartographers at his court, and Isabella must have known of the importance of maps in overseas ventures, like the one she sponsored that opened up a new world. Their grandson, Charles V, was well aware of the value of maps, and, like his successor, Philip II, was seriously concerned with encouraging the production of a good map of the peninsula. Both Charles V and Philip II were surrounded by nobles and advisers who used and collected maps, as were their successors Philip III, Philip IV, and Charles II.

If none of them succeeded in their various efforts to produce a new and accurate printed map of the whole peninsula, it was partly due to the general decline that set in during the second part of the reign of Philip II. For a variety of reasons, the economy fell into disarray, and the society became less and less open to outside influences. This had a particularly harmful effect on intellectual life; the printing industry, for instance, was crippled both by the economic downturn and by rigid regulation of the press.

The strength of Spain, sapped by the overambitious policies of Philip II, continued to ebb during the long struggle with the Netherlands, and then France, which did not end until the middle of the seventeenth century. By then Portugal, united with Spain after 1580, had again be-

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Abbreviations used in this chapter include: *Diccionario* for *Diccionario histórico de la ciencia moderna en España,* 2 vols., ed. José María López Piñero et al. (Barcelona: Península, 1983); BNM for Biblioteca Nacional, Madrid; and AGS for Archivo General de Simancas.

1. I must here acknowledge the help of John S. Aubrey of the Newberry Library; Professor Geoffrey Parker, now of Ohio State University; and the late Richard Boulind of Cambridge University. Without their unstinting advice, it would have taken me even longer to penetrate some of the secrets of Spanish cartography on the peninsula. In its later stages, this chapter owes much to the advice of Agustín Hernando Rica and Richard Kagan.

2. For information about Portuguese cartography, see chapter 38 in this volume and the remarkable work of Armando Cortesão and A. Teixeira da Mota, *Portugaliae monumenta cartographica,* 6 vols. (Lisbon, 1960; reprinted with an introduction and supplement by Alfredo Pinheiro Marques, Lisbon: Imprensa Nacional–Casa da Moeda, 1987).

3. Juan Vernet Ginés, "Influencias musulmanas en el origen de la cartografía náutica," *Boletín de la Real Sociedad Geografica* 89 (1953): 35–62.

4. For information about these portolan charts, see Tony Campbell, "Portolan Charts from the Late Thirteenth Century to 1500," in *HC* 1: 371–463.

come independent. After that, the victorious French entered a period of great political and intellectual expansion (which included a great outburst of cartographic activity), but the Spaniards seem for some decades to have been dazed by their own misfortune. In the latter decades of the seventeenth century, however, there was a distinct revival as the peripheral regions began to recover economically, and the *novatores* (innovators) began to put forward ideas of reform in political and scientific life. Spain had missed the first phase of the scientific revolution, but from the 1670s onward there was a steady revival in the natural sciences that naturally included a revival in cartography.[5]

The primary sources for analyzing these developments over the two centuries from 1500 to 1700 are found in the great repositories of Madrid, Simancas, and, to a lesser extent, Seville. The BNM contains manuscript material generated by both military and civil cartographers, as well as most of the printed maps of the peninsula.[6] Also, the Archivo Histórico Nacional in Madrid is rich in manuscript material, though much of it is not fully cataloged.[7] At Simancas, the maps and plans of the AGS are under excellent bibliographic control and offer a rich source for civil and military maps from 1503 onward.[8] The Archivo General de Indias at Seville is primarily concerned with overseas material, but among its many manuscript maps some allow us to trace the development of cartographers who began their career on the peninsula.[9]

Some of the archived materials concern Spanish cartographers who worked in Europe outside the peninsula, and some were generated by non-Spanish mapmakers who entered the service of the kings of Spain, often as military engineers. At this time, the Spanish possessions in Europe covered not only much of the peninsula (all of it during Portugal's alliance with Spain from 1580 to 1640), but also vast lands in Italy and in the Low Countries ruled by regents and viceroys. This chapter does not include native-born cartographers of Italy and the Low Countries unless they were more or less permanently in the Spanish royal service when they served outside their place of origin. Indeed, it was one of the great strengths of the Spanish monarchy that it could draw on specialists from all over Europe for its projects: military engineers from Italy, miners from Germany, cartographers from the Low Countries, and so forth.[10]

The secondary literature on this vast theme is not rich. At the beginning of the twentieth century, several long and original articles were published by Antonio Blázquez y Delgado-Aguilera,[11] but there followed several decades during which the subject was neglected, until Gonzalo de Reparaz Ruiz began working on it in the 1930s. About the same time, the Escuela de Estudios Hispanoamericanos at Seville began its long series of publications, many of which used and reproduced as plates the type of maps that are of interest here. In the past two decades, our knowledge of the world in which the Spanish mapmakers moved has been greatly expanded by the works of José María López Piñero. The late Francisco Vázquez Maure also provided a brief but up-to-date paper for the *Curso de conferencias sobre historia de la cartografía española* (1982), and more recently Agustín Hernando Rica has been publishing on the history of cartography on the peninsula.

The Medieval Traditions

From the start of their occupation of a large part of the Iberian Peninsula in the eighth century, the Moors had been composing geographical descriptions of it. They were particularly strong in astronomy and instrument-making, and had accepted the concept of latitude and longitude at an early date. By the middle of the eleventh century, for instance, a certain al-Zarqēllo (Azarquiel) was chiefly responsible for the composition of the Toledo tables that listed many places and their geographical coordinates based on the prime meridian of the Canaries.[12]

5. For the cultural and political history of Spain at this time, I have relied on various volumes of the *Historia de España,* founded by Ramón Menéndez Pidal (Madrid: Espasa-Calpe, 1935–), and Richard L. Kagan, ed., *Spanish Cities of the Golden Age: The Views of Anton van den Wyngaerde* (Berkeley: University of California Press, 1989).

6. Manuscript maps are found in the Sección de Manuscritos, which has its own catalogs, and in the Sección de Geografía y Mapas, whose holdings are largely described in Biblioteca Nacional, *La Historia en los Mapas Manuscritos de la Biblioteca Nacional,* ed. Elena [Maria] Santiago Páez, exhibition catalog ([Madrid]: Ministerio de Cultura; Dirección del Libro y Bibliotecas, 1984). Printed maps are found in the Sección de Geografía y Mapas and also in the Sección de Incunables y Raros.

7. For the division "Estado," see Pilar León Tello, *Mapas, planos y dibujos de la Sección de Estado del Archivo Histórico Nacional* (Madrid: Ministerio de Cultura; Dirección General del Patrimonio Artístico, Archivos y Museos, 1979).

8. See Archivo General de Simancas, *Mapas, planos y dibujos,* 2 vols., by Concepción Alvarez Terán and María del Carmen Fernández Gómez (Valladolid: El Archivo; [Madrid]: Ministerio de Cultura, Dirección General de Bellas Artes, Archivos y Bibliotecas, 1980–90).

9. For catalogs of the maps in this archive, we still have to rely on those produced by Pedro Torres Lanzas in the early 1900s; work is being done to develop an electronic catalog.

10. For an interesting survey of this scientific talent, see David C. Goodman, *Power and Penury: Government, Technology and Science in Philip II's Spain* (Cambridge: Cambridge University Press, 1988), 88–150.

11. Antonio Blázquez y Delgado-Aguilera, "La descripcion de las costas de España por Pedro Teixeira Albernas, en 1603," *Revista de Archivos, Bibliotecas y Museos* 19 (1908): 364–79; idem, *Estudio acerca de la cartografía española en la edad media, acompañado de varios mapas* (Madrid: Imprenta de Eduardo Arias, 1906); and idem, "El Itinerario de D. Fernando Colón y las relaciones topográficas," *Revista de Archivos, Bibliotecas y Museos* 10 (1904): 83–105.

12. David Woodward, "Medieval *Mappaemundi,*" in *HC* 1:286–370, esp. 323.

The Christian kingdoms of the north were not so prominent in the natural sciences, but the kingdom of Aragon, with its great maritime center at Barcelona, was expanding its trading interests in the Mediterranean Sea from the twelfth century onward. This maritime activity gave rise to a major school of chartmakers based on Majorca and supported by the crown of Aragon. In 1359, for instance, this government decreed that all its galleys should henceforward carry at least two charts; no doubt they were produced locally.[13]

Some of the Aragonese chartmakers seem to have been Jews, of whom the best known was probably Abraham Cresques. The Jewish community was prominent in both Castile and Aragon, and was noted for the excellence of its astronomers and doctors. In the late fifteenth century, its leading astronomer was Abraão Zacuto, whose *Almanach perpetuum* (1496) was crucial for developing a navigation system based on astronomy. Zacuto worked at Salamanca, where there had been a university since 1227. The Spanish universities were not as well developed as those of Italy or parts of northern Europe, but Salamanca did have a good reputation for studies in mathematics and astronomy, and it was there that special astronomical tables were calculated in 1460.[14] Zacuto probably encountered Columbus in 1486 or 1487, when the latter was at Salamanca, but Zacuto's fate foreshadowed that of many Spanish men of learning; after the anti-Jewish edict of 1492, he emigrated to Portugal and then to Tunis, dying at Damascus in 1515.[15]

The fourteenth-century kings of Aragon were distinguished for their patronage of the natural sciences, but those of Castile, apart from Alfonso X, were less remarkable in this respect. Their position was difficult, for the intellectual leaders in the natural sciences were generally either Jews or Moors, and both these groups lay outside the main Christian body. Indeed, the Jewish communities of Majorca and Barcelona were severely reduced by the pogroms of 1391, and until its successful conclusion in 1492, the rulers of Castile were engaged in a long campaign to expel the Moors from the peninsula. In spite of these political difficulties, the legacy of the Moors and Jews to sixteenth-century Spain was a brilliant one in mathematics and astronomy, sciences basic to the eventual development of cartography.

Outside this mainstream of cartographic activity and apart from what might be called the great tradition of mapmaking, some medieval maps were composed in a more or less pragmatic way, without reference to astronomy, mathematics, or cartographic theory. Such maps appear to have been rare; indeed, Harvey remarked that for Spain and Portugal "no medieval maps of small areas have been reported."[16] However, the absence of such maps from the catalogs of the AGS and the BNM does not mean that they did not exist. A relatively superficial investigation turned one up at the Archivo Histórico Nacional in the section "Clero," and it is very likely that others will be found in this repository. Figure 39.1 reproduces this map, of Argeles, a small walled town near Valladolid. The plan was drawn in 1458 for a lawsuit in which the church of San Benito was involved. The roads leading out of the town are sketched in, and in the town is shown the fountain ("la fuent") with its streams. Maps like this, showing outlines of buildings and very rudimentary exterior features, seem to have been characteristic of the fifteenth century in many parts of Europe and were often composed in the course of legal arguments.[17]

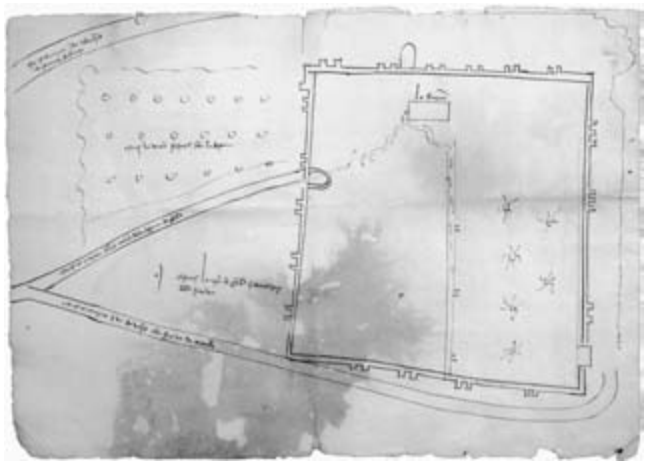

FIG. 39.1. ANONYMOUS MAP OF ARGELES, 1458. This town plan of the mid-fifteenth century was composed in the course of a lawsuit; others are probably to be found in the Spanish archives.
Size of the original: 22 × 31 cm. Photograph courtesy Spain, Ministerio de Cultura, Archivo Histórico Nacional, Madrid (Mapas, Planos y Dibujos, n. 223).

It is even possible that a distinctive map style had emerged in Spain out of this "little," unlearned tradition. Figure 39.2 shows a map of this style portraying the tilled ground between Usanos and Valdeaverlo, two villages in the province of Guadalajara near the headwaters of the Tagus River. The features are mostly named, beginning with the hill in the foreground called "cuesta del Aguila." Two streams curve in from the right and join together be-

13. José María López Piñero, *El arte de navegar en la España del Renacimiento,* 2d ed. (Barcelona: Editorial Labor, 1986), 120.

14. Guy Beaujouan, *La science en Espagne aux XIV^e^ et XV^e^ siècles* (Paris: Palais de la Découverte, 1967), 34–35.

15. López Piñero, *El arte de navegar,* 34.

16. P. D. A. Harvey, "Local and Regional Cartography in Medieval Europe," in *HC* 1:464–501, esp. 465.

17. See, for instance, François de Dainville, "Cartes et contestations au XV^e^ siècle," *Imago Mundi* 24 (1970): 99–121.

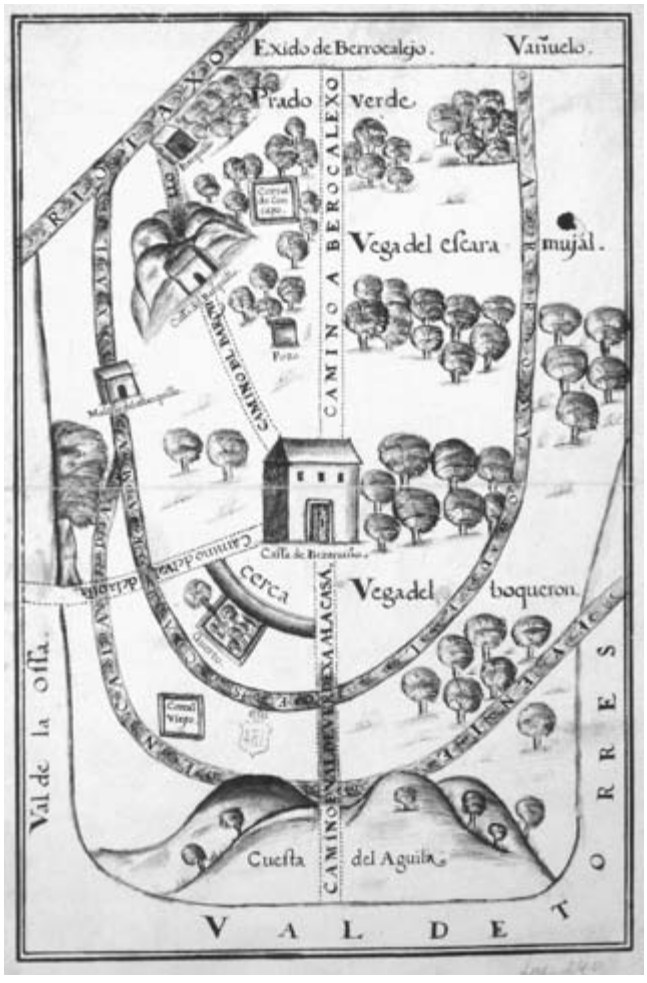

FIG. 39.2. ANONYMOUS SIXTEENTH-CENTURY MAP OF THE SURROUNDINGS OF VALDEAVERLO. This map is curiously reminiscent of some maps drawn in the New World, and it may belong to an indigenous mapping tradition that has been little studied.
Size of the original: 34 × 23 cm. Photograph courtesy Spain, Ministerio de Cultura, Archivo Histórico Nacional, Madrid (Mapas, Planos y Dibujos, n. 34).

fore flowing into the Tagus River ("Rio Taxo") at top left. Each road ("camino") is shown with dotted borders, and stylized trees indicate woods. Isolated features like the farmyards ("corrales"), the mill ("molino"), and the well ("pozo") are also identified, as are the areas of meadow ("prado") and plain ("vega"). The style of this map is reminiscent of some of those drawn for the *pinturas* commissioned by Philip II for the *relaciones geográficas,* and it seems entirely possible that they all emerged from a native mapping tradition distinctive to peninsular Spain.

Often towns and cities were portrayed in some detail using the style of these unsophisticated sketches. Sometimes the sketches are perspective views, and in other cases they

FIG. 39.3. ANONYMOUS PROFILE OF CÁDIZ, 1513. This elegant profile of Cádiz is an early example of a cartographic form that would become common in Europe during the sixteenth century.
Size of the original: 41.5 × 58.5 cm. Photograph courtesy Spain, Ministerio de Cultura, AGS (MPD. XXV-47).

are more like ground-level profiles. The perspective view of Aranda de Duero shown in plate 38 much resembles contemporary plans from other parts of Europe in its stylized (excessively symmetrical) outline and gives us a good idea of the general layout of the streets and houses within the circular wall. The major churches are named, as are features of particular interest, like "la plaza nueva" (lower right, by the triumphal column). Outside Aranda de Duero, which was about ninety miles north of Madrid, the Douro River is shown flowing toward the Atlantic Ocean, turning two mill wheels on the way. This map is exceptional because we know just when and why it was made. In 1503, Fernando de Gamarra, royal judge, sent it back to the royal council together with information about a case concerning the opening of a street in Aranda de Duero. Of course, we do not know who drew it or whether Gamarra was exceptional in soliciting documents of this kind.

Figure 39.3 shows a ground-level profile of 1513, also probably submitted to the royal council, for a case concerning the opening of a new gate in the wall at Cádiz. Perhaps that gate is the one immediately below and to the right of the prominent tower crowned with a cross. We have no idea who drew this rather compelling little sketch, but like that in plate 38, it shows that in late medieval Spain some people realized the value of adding visual evidence to their written testimony.

The Sixteenth-Century Scientific Milieu

Around the turn of the century, many Spaniards were acquainted with the latest ideas in cartography. In 1498, for

instance, Francisco Nuñez de la Yerba published his edition of Pomponius Mela's *Chorography* (*Cosmographia sive De situ orbis*), relying in one map on the Ptolemaic coordinates. A year later, Antonio de Nebrija published his *Cosmographiae hiae libros Introductorium,* in which the Ptolemaic idea of two projections and the graticule were fully developed. We do not know how Ptolemy's *Geography* was diffused in Spain, whether in manuscript or (after 1477) in printed form, but it is likely that this work was to be found in most humanist libraries by 1500. In general, Spanish cartographers were exceptionally aware of the mathematical basis for all mapmaking; as Miguel Servet observed in his 1535 edition of Ptolemy's *Geography,* "Nobody can call himself a geographer without mathematical training." [18]

After 1508, the most talented cartographers, not only from Spain but also from Portugal and Italy, tended to be drawn to the navigation school attached to the Casa de la Contratación (House of Trade) at Seville. There the crown had established a group of pilots and cosmographers whose task was to train and license Spanish mariners and to delineate the new worlds being revealed by their voyages. As ship captains went into Seville, they were obliged to report to the navigation school, and their novel observations were plotted onto the *padrón real,* or master map of the world. These cosmographers produced remarkable maps that are fully discussed in chapter 40 in this volume; here we are concerned simply to notice the existence of the Seville navigation school as an example of the preeminence attained by Spanish mapmakers in the early sixteenth century. Nor was it the only such establishment, for other lesser-known schools also existed at Cádiz and San Sebastián.

Occasionally, mapmakers attached to the Casa also undertook terrestrial maps. One such person was Francisco de Ruesta, a member of a family associated with the Casa. In 1660, he drew a plan of the limits of Salteras, near Seville (fig. 39.4), that very much resembles the equally spare work of the graduates of the Academia de Matemáticas (discussed later). Ruesta was appointed pilot major in 1633, but did not serve much in the Casa before his capture by the French in 1643. From the time after his release, Ruesta is best known to us for his quarrel with his brother Sebastian, whom he accused of negligence in maintaining the *padrón real.*[19]

Other institutions existed in which some training in mapping might be offered. By the 1540s, there were artillery schools in Burgos, Barcelona, Gibraltar, and Milan, joined in 1559 by one on Mallorca.[20] These schools produced gunners, who needed to be able to read maps in order to site guns or design fortifications. It is not clear how the excellent Spanish engineers were trained, but many were accomplished cartographers, and at least some probably came from these schools. Often they formed dynasties, one of the most prominent of which was the Antonelli family.[21] Juan Bautista Antonelli had gone from Italy to serve Charles V; he fought in various campaigns and then in the 1580s turned his attention to civil engineering, producing a scheme for the navigation of Spanish rivers (possibly using maps) that foundered under technical problems and the opposition of mill owners.

Juan Bautista's younger brother, also named Juan Bautista but known simply as Bautista, was more celebrated and worked at many sites both in Spain and in the New World. In 1610, for instance, the town of Larache, on the Atlantic coast of Morocco, was ceded to Philip III of Spain, and engineers were called upon to strengthen its fortifications. Figure 39.5 shows the plan of the city drawn for this occasion by Bautista Antonelli. It has no scale or orientation, but seems, on comparison with an early twentieth-century plan of the town, to be substantially accurate. Note that Antonelli has inserted the streets, and that the whole plan is in planimetric form except for one building and the cliffs bordering the water.

Figure 39.6 shows an example of the simplest kind of map produced by the engineers. The map shows Cádiz and was drawn in 1578 by Francés de Alava, captain general of artillery and a leading engineer of the period.[22] He inserted a scale and seems to have delineated the fortifications and coastline attentively, though the area of the city itself is left almost blank; after all, this was a plan for designing fortifications: an outline of the way in which Cádiz needed to be protected. It is typical of many such plans drawn by military engineers during the late sixteenth century and the seventeenth in various countries of Europe. The engineers developed what might be called a "military style," with close attention to scale, orientation, and the line of the fortifications, but a general indifference to such features as internal roads or the surrounding countryside.

18. Quoted in López Piñero, *El arte de navegar,* 74.

19. On the Ruesta brothers, see the entry "Ruesta, Francisco de," in *Diccionario,* 2:272–73. This biographical encyclopedia has supplemented Felipe Picatoste y Rodríguez, *Apuntes para una biblioteca científica Española del siglo XVI* (1891; reprinted Madrid: Ollero y Ramos, 1999).

20. José María López Piñero, *Ciencia y técnica en la sociedad española de los siglos XVI y XVII* (Barcelona: Labor Universitaria, 1979), 106, and Goodman, *Power and Penury,* 123–25.

21. See Diego Angulo Iñiguez, *Bautista Antonelli: Las fortificaciones americanas del siglo XVI* (Madrid: Hauser y Menet, 1942).

22. For some of his activities, see Goodman, *Power and Penury,* 110–33, and Víctor Fernández Cano, *Las defensas de Cádiz en la edad moderna* (Seville: [Escuela de Estudios Hispanoamericanos], 1973), 65. See also José Antonio Calderón Quijano, *Las defensas del Golfo de Cádiz en la edad moderna* (Seville: Escuela de Estudios Hispanoamericanos, 1976).

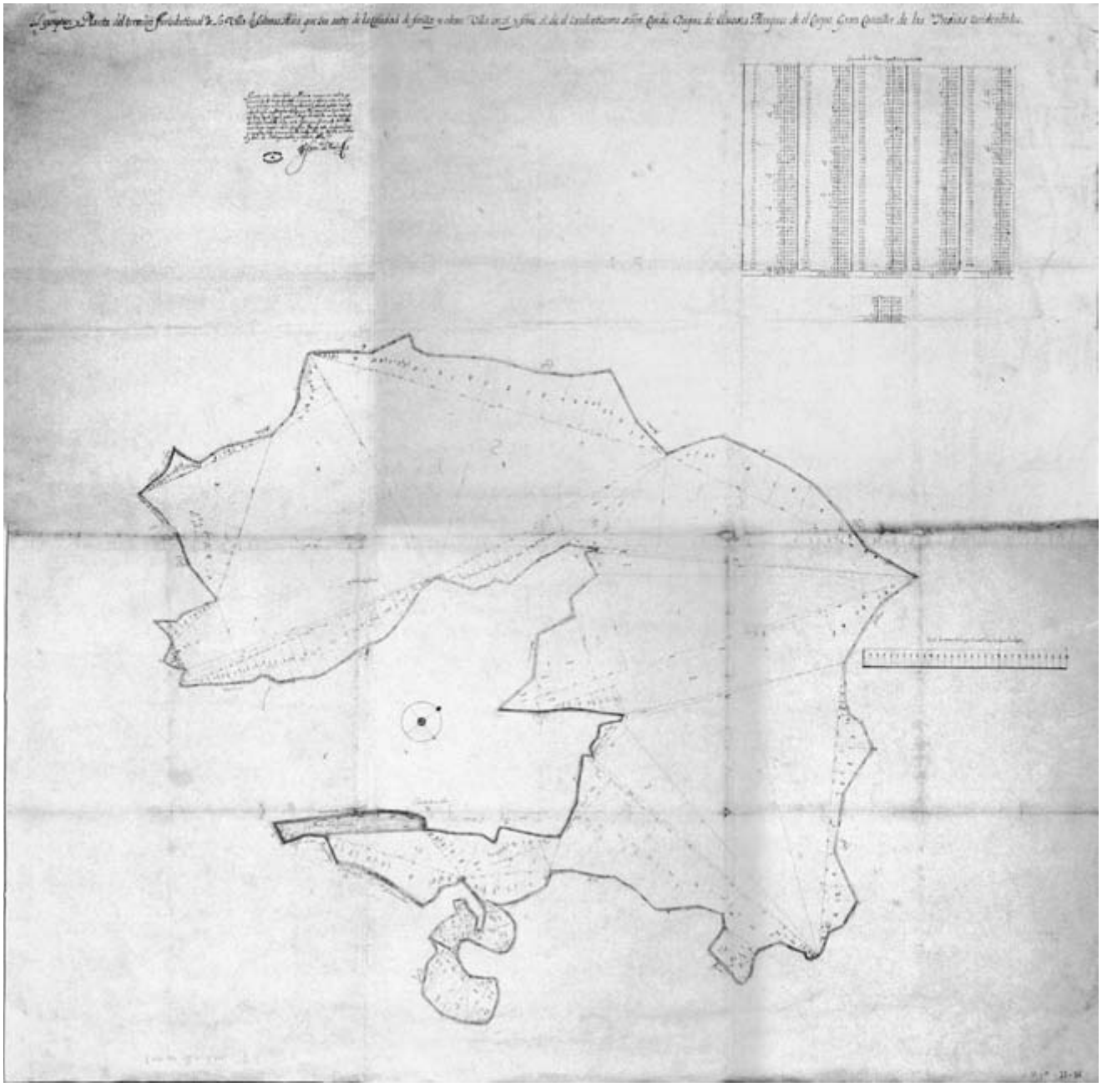

FIG. 39.4. FRANCISCO DE RUESTA, PLAN OF THE BOUNDARY OF SALTERAS, 1660. Such boundary maps seem to have been a particularly Spanish map form, perhaps because in that society it was unusually important to establish urban boundaries.
Size of the original: 125.6 × 127.6 cm. Photograph courtesy Spain, Ministerio de Cultura, AGS (MPD. II-36).

One highly accomplished draftsman among the engineers was Luis Bravo de Acuña, who in 1627 prepared an atlas of maps and plans of Gibraltar for Gaspar de Guzmán, third count of Olivares.[23] The atlas has found its way to the BL, and one of its maps is reproduced as figure 39.7. It shows the town of Gibraltar from the west, with

23. For examples of Bravo de Acuña's work, see José Antonio Calderón Quijano, *Las fortificaciones de Gibraltar en 1627* (Seville: Universidad de Sevilla, Secretariado de Publicaciones, Intercambio Científico y Extensión Universitaria, 1968), and the brief mention in José Antonio Calderón Quijano et al., *Cartografía militar y marítima de Cádiz,* 2 vols. (Seville: Escuela de Estudios Hispanoamericanos, 1978), 1:640.

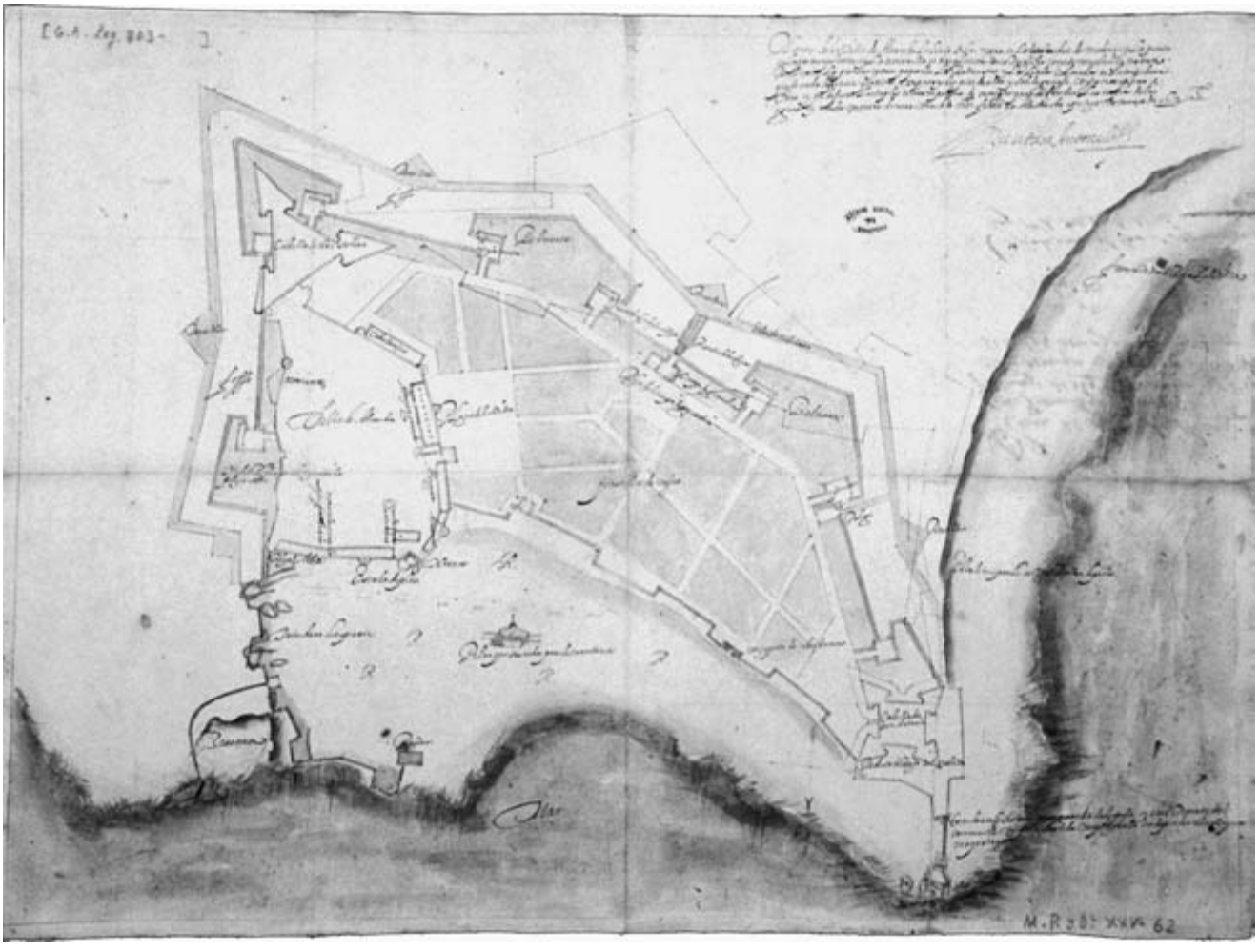

FIG. 39.5. BAUTISTA ANTONELLI, PLAN OF THE CITY OF LARACHE, 1612. The development of bastioned traces to defend cities necessitated accurate plans from the engineers; this plan is typical of those that began to be drawn in the 1530s in many European countries.
Size of the original: 43.1 × 58.4 cm. Photograph courtesy Spain, Ministerio de Cultura, AGS (MPD. XXV-62).

the great cliff behind it. Bravo de Acuña prepared views from this angle that showed only the fortifications, but on this map he chose to draw in the town as well. It is a good example of a perspective view that is almost planimetric, giving even the uninformed map reader a very full impression of the layout of the little town. Olivares was a keen collector of maps and atlases of this kind[24] and probably had such views of many other Spanish towns. But he gave his collection to the Escorial Library when he died, and most of it seems to have perished in the fire of 1671.

Another remarkable atlas is the one compiled by Francisco Negro, who flourished in the 1630s and 1640s. His manuscript collection "Plantas de todas las plaças y fortaleças del Reyno de Sicilia" was drawn in 1640.[25] His town views are very fine, but even more remarkable is his rendering of the castle at Marsala. It is shown first in plan view and then in a drawing that seems exceptionally accurate when compared with the plan (fig. 39.8). Alas, we have no way of knowing exactly how engineers like Negro, Alava, and Bravo de Acuña were trained, but we may presume that at least some came out of the artillery schools, and that, as time went by, the original system of apprenticeship was replaced by a more formal type of instruction.

Another institution concerned with mapping was the Academia de Matemáticas, which was founded at Ma-

24. See John Huxtable Elliott, *Richelieu and Olivares* (Cambridge: Cambridge University Press, 1984), 28.

25. BNM, Manuscritos 1.

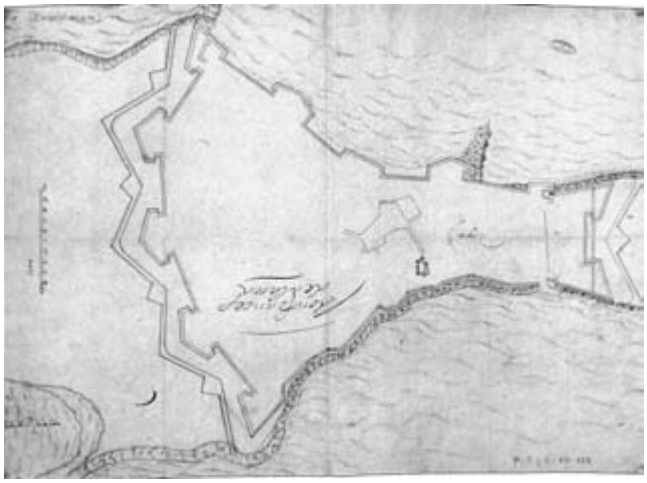

FIG. 39.6. FRANCÉS DE ALAVA, DETAIL OF WORK TO BE DONE ON THE FORTIFICATIONS OF CÁDIZ, 1578. Alava was captain general of the artillery of Spain, and this plan is typical of the scaled and functional drawings that sixteenth-century soldiers were producing.
Size of the original: 42.6 × 58.0 cm. Photograph courtesy Spain, Ministerio de Cultura, AGS (MPD. VII-124).

drid in 1582 by Philip II. Among its first professors were João Baptista Lavanha, famous for his map of Aragon (discussed later); Cristóbal de Rojas, author of a treatise on fortifications and of many manuscript maps; and Pedro Ambrosio de Ondériz. In his course, published as *Teórica y practica de fortificación, conforme las medidas y defensas destos tiempos* (Madrid, 1598), Rojas maintained that for understanding fortifications three things were needed: much mathematics, some arithmetic (for calculating costs), and the ability to survey sites.[26] Figure 39.9 is a good example of his work. In 1591, he went to Santander in order to accompany an expedition to Brittany, and probably on that occasion drew the little plan of Fort Saint Martin. On the right, he showed it from above and marked the orientation; only the ships escaped the general planimetric design. On the left, he showed the site in elevation, and here the curious nature of the fort becomes evident, with one wall much higher than the other and a church most inconveniently placed in the middle. The scale of "pies" above the left side applies both to the planimetric view and to the elevation, giving us a good idea of this unusual site.

Rojas's colleague Ondériz taught courses in mathematics and cosmography, translated a mathematical work of Euclid (*La perspectiva y especularia de Euclides,* 1585), and left a manuscript on these themes. He became royal cosmographer and was commissioned to go to Seville and identify the errors on the *padrón real,* though he died before he could carry out that task.[27]

Through the years, the Academia de Matemáticas continued to attract persons skilled in applied mathematics. For example, Juan Cedillo Díaz was a professor at the academy who was interested in navigation and hydraulic engineering. He authored a text on the *trinormo* (an instrument for measuring slopes, heights, and distances) with applications for "the engineers and land-surveyors [*agrimensores*], mariners, architects, and artillery men." The mention of *agrimensores* is particularly interesting, for we know little about this category of cartographer in Spain.[28]

One of the few well-documented land surveyors was Luis Carducci, also a graduate of the Academia de Matemáticas.[29] Born in Madrid of Italian parents, he became *matemático de su majestad,* and was drawing plans from as early as 1627. In 1634, he published at Madrid a treatise on practical surveying called *Cómo se deben medir las jurisdicciones y demás tierras*. Carducci also left nine maps: one plan is preserved at the BNM and eight are at the AGS. Figure 39.10 shows a plan of the boundaries of Atalaya de Cañavete that he drew in 1638; the town is in the center, with a number of meandering roads converging on it. The points at which the property of other towns begin are labeled, and numerous parcels of land are marked with letters or numbers, with their area in *varas* (roughly, square yards) given in two lists. There is a scale, and the whole map is rather reminiscent of contemporary work in England, except that it has no triumphal quality; it was drawn simply to provide information. Figure 39.11 shows an earlier and more finished work by Carducci. It is a plan of the area near Alcalá la Real that had been sold by Philip IV to the marquis de los Trujillos about 1631. The city is shown at the top, and the area is divided as in figure 39.10, but this time there has been some attempt to show mountains, and Carducci has introduced an elegant cartouche at the lower right.

The nine plans that we know by Carducci are probably a mere fragment of his total work, given his long and active life. In 1645, the king ordered him to make a survey of the Tagus River to see how it could be made navigable from Aranjuez to Lisbon; the "Corografía del río Tajo" at the Academia de la Historia survives from this venture.[30] In 1656, just a year before Carducci died, the Council of War ordered him to give classes in mathematics and engineering to make up for the grave shortage of engineers. He seems to have been a skillful and active car-

26. For a biography of Rojas, see Eduardo de Mariátegui, *El Capitan Cristóbal de Rojas: Ingeniero militar del siglo XVI* (Madrid: Imprenta del Memorial de Ingenieros, 1880), and see "Rojas, Cristóbal de," in *Diccionario,* 2:259–62.

27. See "Ondériz, Pedro Ambrosio de," in *Diccionario,* 2:130–31.

28. See "Cedillo Díaz, Juan," in *Diccionario,* 1:203.

29. See "Carduchi, Luis," in *Diccionario,* 1:180–81.

30. See "Carduchi, Luis," 1:181.

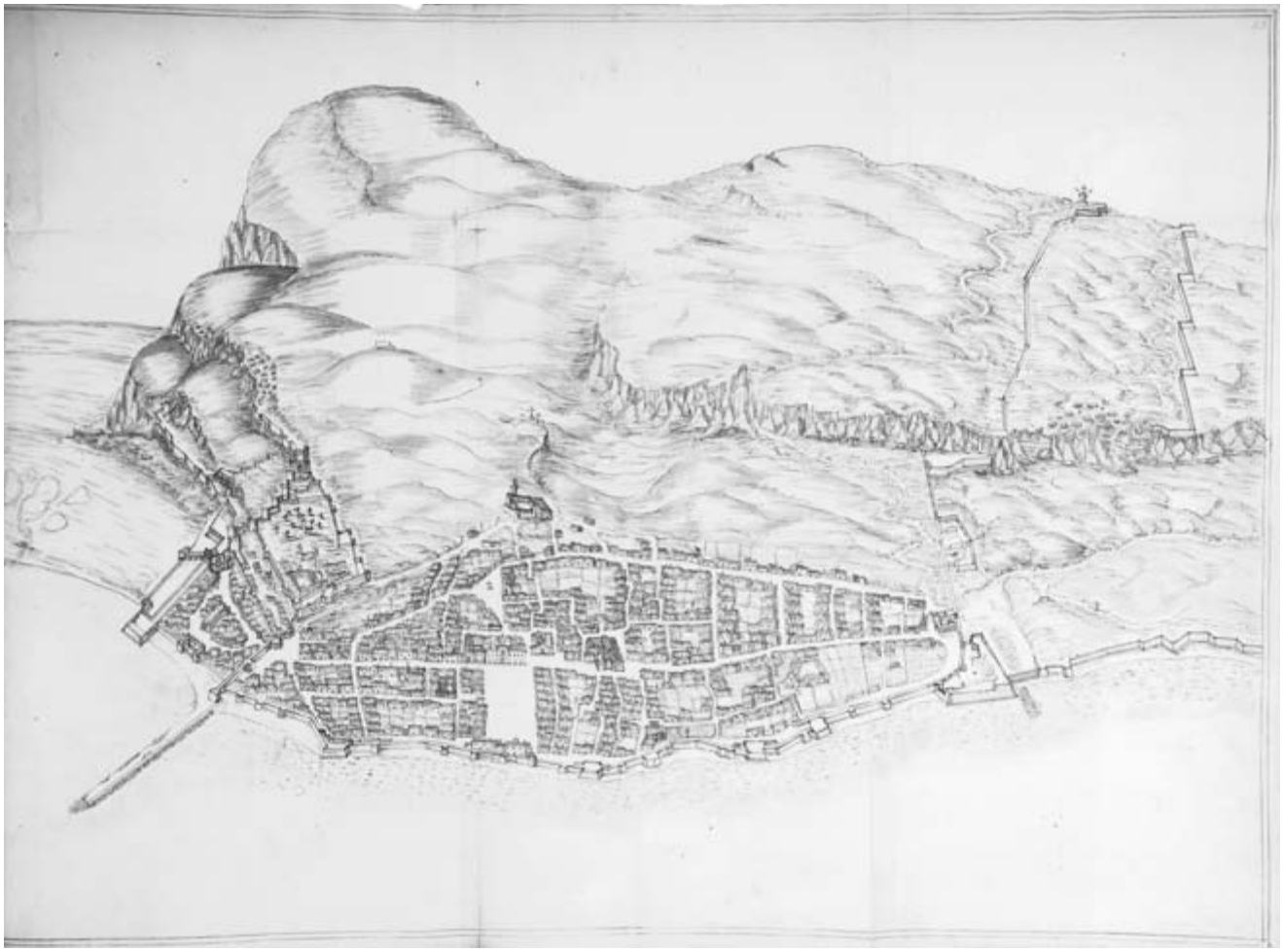

FIG. 39.7. LUIS BRAVO DE ACUÑA, PLAN OF GIBRALTAR FROM THE WEST, 1627. The early modern engineers adopted various techniques for displaying the features of the cities that they were fortifying. For this plan, Bravo de Acuña adopted a compromise between a perspective view and a properly planimetric image.
Size of the original: 42 × 57 cm. Photograph courtesy of the BL (Add. MS. 15152, fol. 23).

tographer, working during a rather dry period in Spanish mapmaking.

There was never any formal relationship between the Academia de Matemáticas and the Casa de la Contratación, but some contemporary scholars moved easily between them. One such scholar was Andrés García de Céspedes. A professor at the Academia, he was also between 1596 and 1598 pilot major at the Casa, where he was notable for his skill with instruments and for the corrections he made to the *padrón real.* He returned to Madrid in 1598 as cosmographer to the Council of the Indies and in 1606 published the *Libro de instrumentos nuevos,* one of whose three parts contained a practical geometry with instructions for measuring height and distance.[31] Philip II also commissioned him to write a "General corografia e historia de Espana." In general, the maps of the members of the Academia were different in style from those of the military engineers, because the preoccupations of the two groups were also different. Whereas the engineers concentrated on fortifications, the members of the academy were concerned to show the boundaries of jurisdictions, the line of communications, and the possibilities for hydraulic engineering.

The peak of Spanish activity in maritime and terrestrial cartography was probably reached about the middle of the sixteenth century. By then the works of Antonio de Guevara, Pedro de Medina, and Martín Cortés were being translated into many other European languages, and the prestige of the navigation school at Seville was at its height, so many Europeans instinctively looked to the

31. See "García de Céspedes, Andrés," in *Diccionario,* 1:375–76.

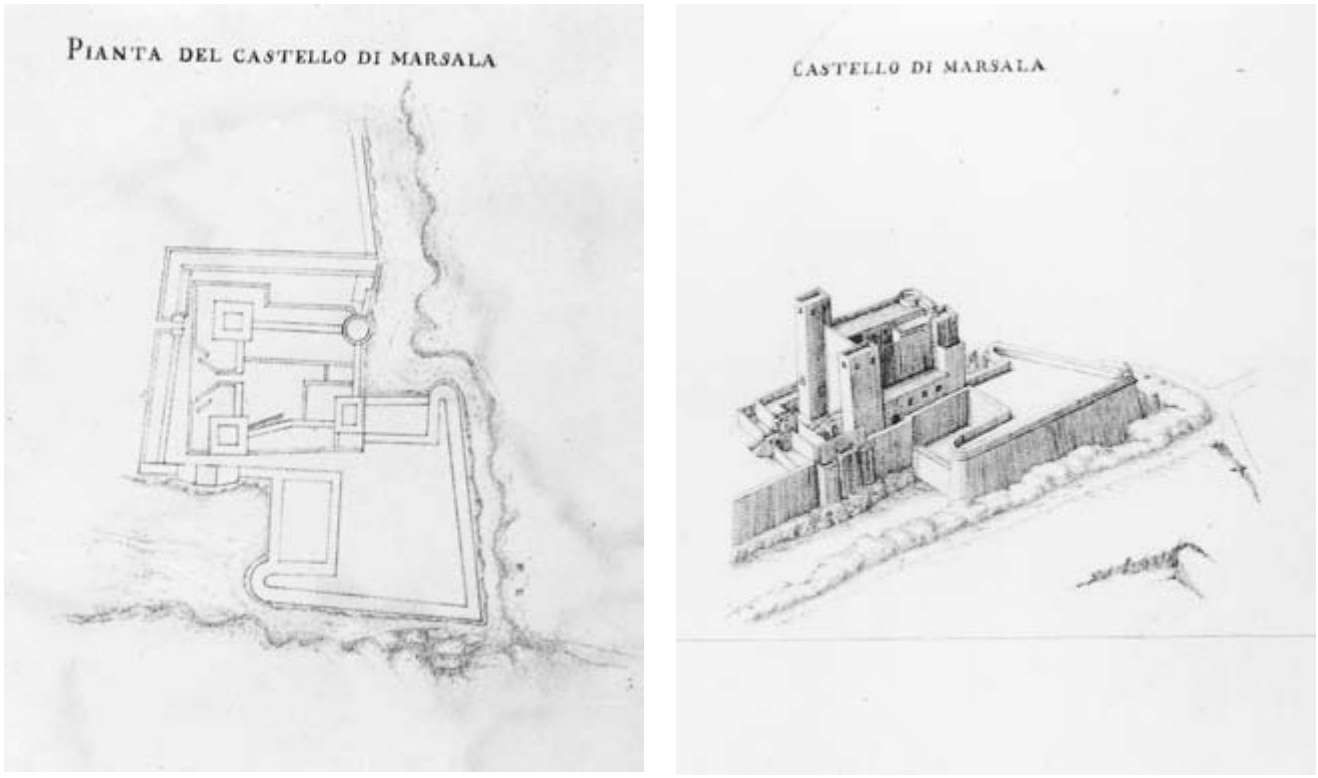

FIG. 39.8. FRANCISCO NEGRO, PLAN AND PERSPECTIVE VIEW OF THE CASTLE AT MARSALA IN SICILY, 1640. Engineer Negro adopted two different ways of bringing out the main features of the fortress at Marsala: left, plan view; right, perspective view.
Photograph courtesy of the BNM (facs-763, 67 and 68).

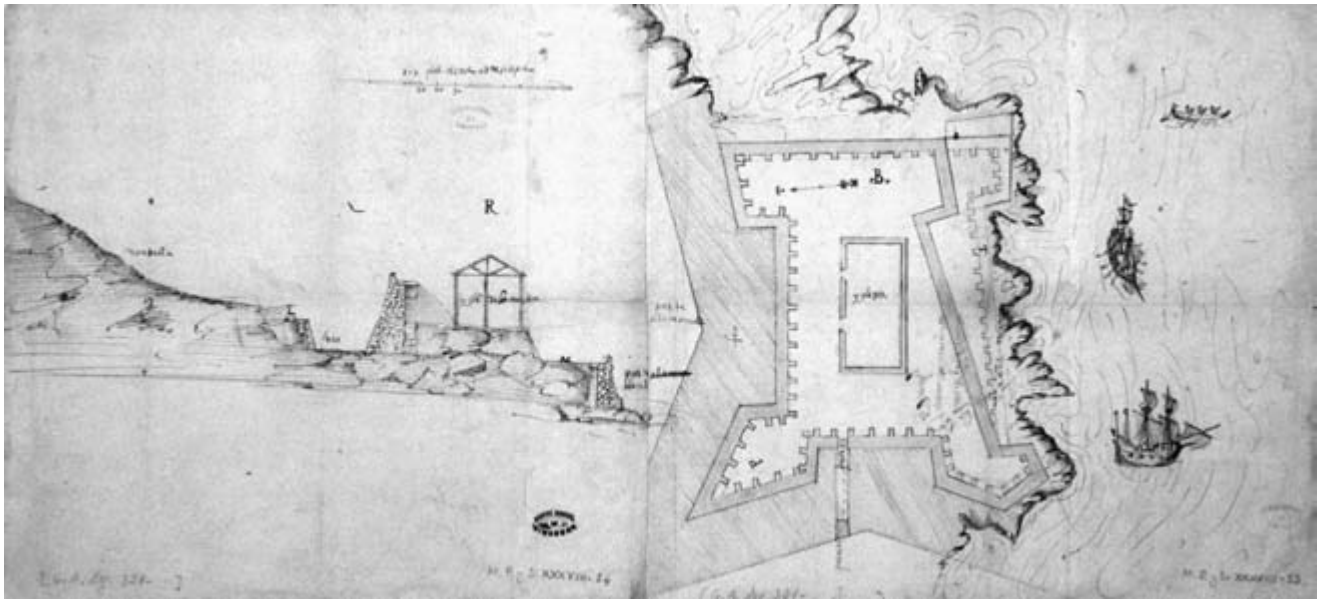

FIG. 39.9. CRISTÓBAL DE ROJAS, PLAN OF FORT SAINT MARTIN AT SANTANDER, 1591. Rojas, the leading Spanish engineer of the day, rendered the little fortress in both plan and elevation.
Size of the original: 33.6 × 74.0 cm. Photograph courtesy Spain, Ministerio de Cultura, AGS (MPD. XXXVIII-53, 54).

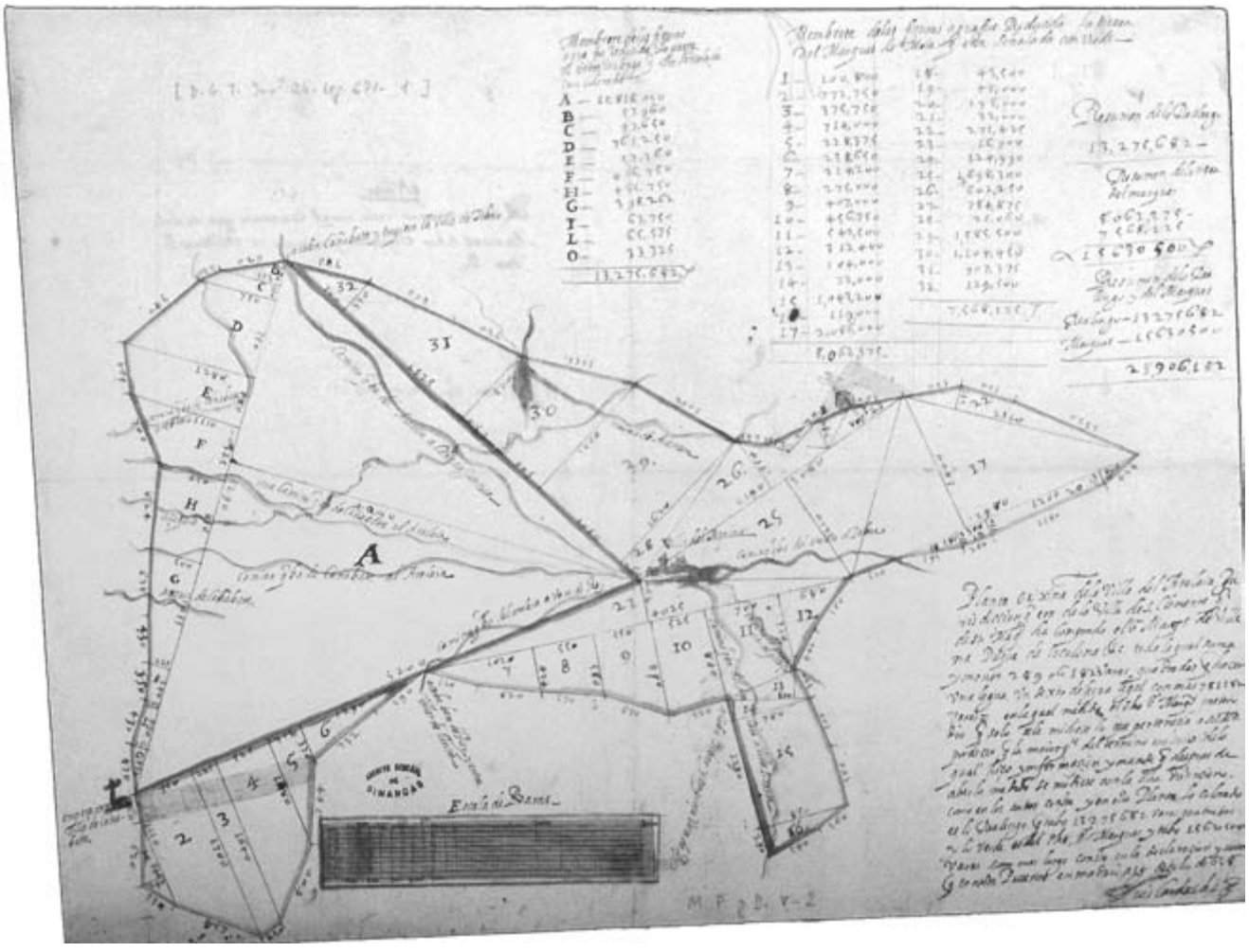

FIG. 39.10. LUIS CARDUCCI, PLAN OF THE BOUNDARIES OF ATALAYA DE CAÑAVETE, 1638. This is another peculiarly Spanish town boundary map, rather like that shown in figure 39.4.
Size of the original: 37.4 × 47.8 cm. Photograph courtesy Spain, Ministerio de Cultura, AGS (MPD. V-2).

Iberian powers for the latest techniques in mapping both land and water.[32]

Decline and Revival in the Natural Sciences, 1550–1700

During the second half of the sixteenth century, Spanish cartographers were equaled and then surpassed by those of other European powers. This relative decline was no doubt associated in part with the economic and social problems that beset Spain toward the end of the century. But it was also related to the undercapitalized nature of the printing press in Spain and to an intellectual climate in which foreign influences were discouraged. These two phenomena help to further explain the absence of a regular trade in printed maps in Spain.

Printing had made a good start in Spain, largely through the efforts of German immigrants. By 1480, there were seven towns with presses in Spain, compared to nine in France and four in England, and at the end of the century Spain was still holding her own with these two countries.[33] However, she began to fall behind in the early sixteenth

32. Goodman, *Power and Penury,* 50, and E. G. R. Taylor, *The Haven-Finding Art: A History of Navigation from Odysseus to Captain Cook* (London: Hollis and Carter, 1958), 172–91, esp. 174 and 189–90.

33. For a general survey, see Lucien Febvre and Henri-Jean Martin, *The Coming of the Book: The Impact of Printing, 1450–1800,* ed. Geoffrey Nowell-Smith and David Wootton, trans. David Gerard (London: New Left Books, 1976), 180–97, and Clive Griffin, *The Crombergers of Seville: The History of a Printing and Merchant Dynasty* (Oxford: Clarendon, 1988), 1–19.

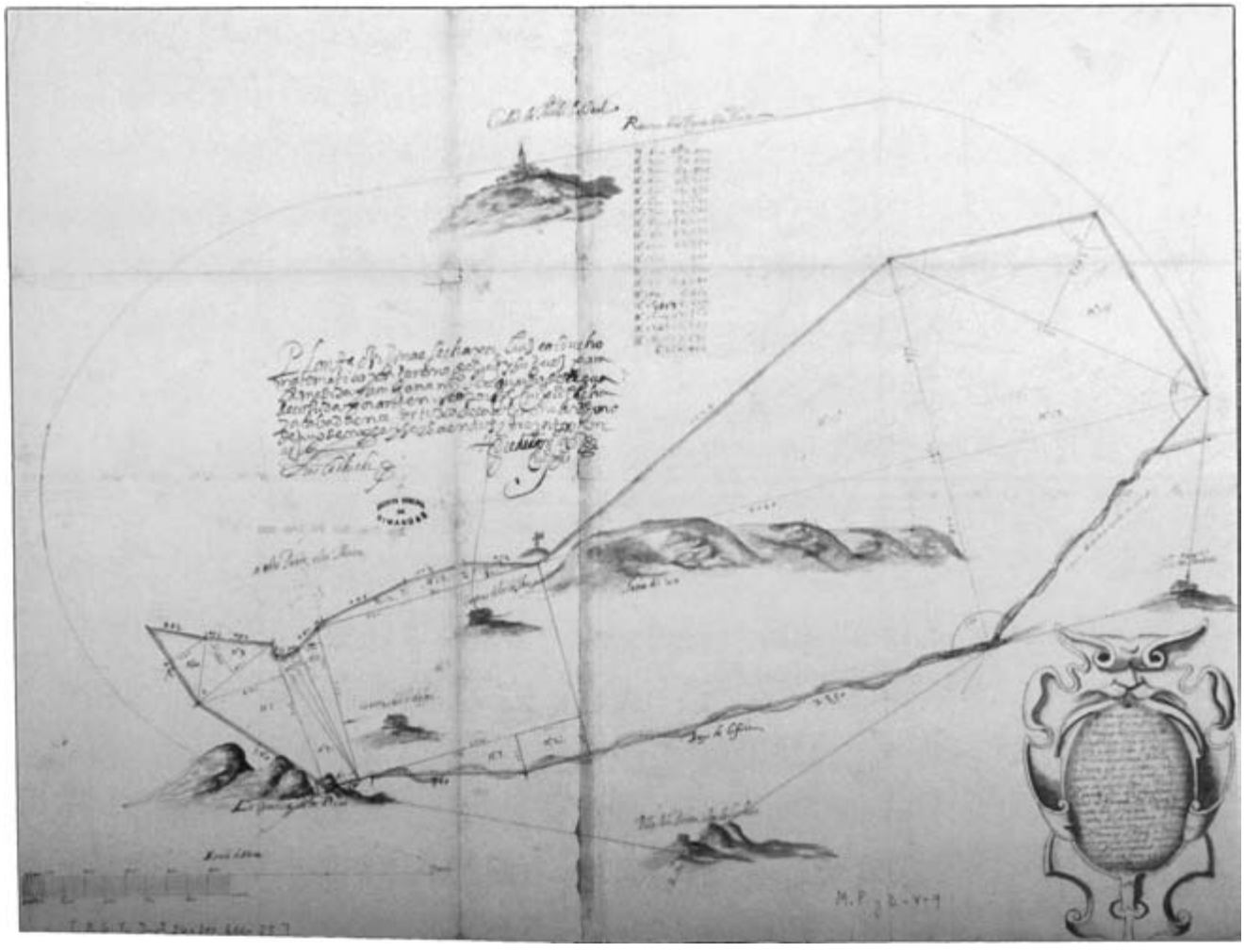

FIG. 39.11. LUIS CARDUCCI, PLAN OF THE SURROUNDINGS OF ALCALÁ LA REAL, 1631. This is a more finished version of a map by Carducci, similar to the map shown in figure 39.10, drawn on the occasion of a sale of property. Size of the original: 43.0 × 56.5 cm. Photograph courtesy Spain, Ministerio de Cultura, AGS (MPD. V-9).

century, showing extraordinary conservatism in her adherence to outdated printing techniques such as the use of small presses, black-letter type, and crude woodcuts. This conservatism hampered the growth of the industry, and in particular meant that detailed maps demanding large presses and copperplates could scarcely be produced in Spain, which had to rely on imports from the presses of Italy and the Low Countries for cartographic material.[34]

There was a similar decline in the percentage of scientific books published at Seville, Salamanca, Barcelona, and Burgos. At Seville, for instance, almost 14 percent of the pre-1500 imprints were scientific in nature, and between l500 and 1550 this figure rose to 23 percent. However, during the rest of the century, it fell back to about 16 percent, probably because it was becoming dangerous to publish books that might fall foul of the Inquisition.[35] Many foreign books were liable to be banned, and because a good many of the leading cartographers worked in theologically dubious areas like the Low Countries, their books and atlases were particularly vulnerable. As time went by, the pressure against scientific works began to build up; although relatively few works of this kind had appeared in the index of prohibited books of the 1560s and 1580s, they were numerous in those published in 1612 and 1632. By then Gerardus Mercator himself was prohibited, because some of his work seemed to be in the style of the heretics, with many of whom he had been friendly. This distressing period of Spanish intellectual life also saw the decline of most of Spain's learned institutions.

The universities, which had never been as thriving as those of some other countries, were hard hit by the in-

34. Griffin, *The Crombergers of Seville,* 183–210, esp. 200.
35. See López Piñero, *Ciencia y técnica,* 58–81, esp. 66.

junction of Philip II at the beginning of his reign against Spaniards' studying abroad.[36] Some continued to do so, of course, but there was steady official pressure against contacts of this kind. The Casa de la Contratación continued to work well until about 1650, when it fell into decay. The artillery schools at Burgos and Seville were closed, as was the Academia de Matemáticas in 1625. All this was happening when many other European countries were undergoing the first phase of a scientific revolution that was felt only faintly in Spain.

In the closing decades of the seventeenth century, though, there was a marked revival.[37] When the Academia closed in 1625, it was replaced by the Jesuit Colegio Imperial de Madrid.[38] In many countries during the seventeenth century, Jesuits were prominent in mathematics and its applications, and so it was in Spain: by the late 1660s, their leading figure was José Zaragoza, who was in some sense the intellectual leader of the *novatores* and who wished to make sweeping changes. He had first taught in Valencia, but then in 1670 became chair of mathematics at the Colegio Imperial, where he published widely, contributing to the French *Journal des Savants*. He personally constructed a variety of survey instruments described in his *Fabrica y uso de varios instrumentos matematicos* (Madrid, 1675), and was often consulted about the best way to undertake large-scale engineering projects. He thus acted as adviser for the opening of a mine in Chilapa, for the construction of a breakwater at Sanlúcar de Barrameda, and for the development of another mine at Almadén; most of these projects involved careful surveying and mapping.[39] Among Zaragoza's disciples was José Chafrion, whom we shall meet as a regional cartographer.

Although the artillery schools in Spain had been closed, training in gunnery, engineering, and cartography was now available from the schools in Naples, Ferrara, and Brussels, the latter directed from 1675 onward by the redoubtable Sebastián Fernández de Medrano. Born near Toledo in 1646, Medrano probably attended a military academy in Madrid and then went to Flanders in 1667 with a Spanish *tercio* (infantry unit). In 1674, he was named professor at the newly founded military academy in Brussels, where he taught until 1704, publishing vigorously from 1677 onward. His best-known work was no doubt *El ingeniero,* published in Spanish in 1687 and in a French translation, *L'ingénieur pratique,* in 1696.[40]

There were also signs that a renewed scientific life was returning to peripheral centers like Barcelona, Valencia, Cádiz, and Seville. In Seville, for instance, the Colegio de San Telmo was founded in 1681 in order to educate orphans in the latest navigational techniques and so prepare them for a career as pilots. The renewal also came from Spanish European possessions like those in Italy and Flanders. In Italy, the leading figure was Juan Caramuel Lobkowitz, a Cistercian who enjoyed royal protection and published on a wide variety of subjects.[41] His *Cursus mathematicus* of 1667 was very influential and did much to introduce the Spanish-speaking world to the ideas of Descartes. One way and another, there was a distinct scientific revival in late seventeenth-century Spain, even before the sharp renewal associated with the Bourbon alliance of the eighteenth century.

The Mapping Sense among Spain's Rulers

There is no direct evidence concerning the attitude of Ferdinand and Isabella toward maps, but they did have the Catalan cosmographer Jaime Ferrer de Blanes at their court and must have known of the Majorcan chartmakers. Moreover, it was in 1508 that the new navigation school was established in Seville, and this became famous and remained so for many years throughout Europe. When Ferdinand died in 1516, he was succeeded by his grandson Charles I, who in 1519 became the emperor Charles V. The young king united the dominions of Austria and Spain, inheriting from the Austrian region a rich tradition of mapmaking. His paternal grandfather, Maximilian I, was apparently able to draw an impromptu map of any part of his vast realms,[42] and the German-speaking regions were at this time exceptionally rich in cartographers, whose names mark the earliest printed maps of the New World: Johannes Ruysch, Martin Waldseemüller, Gregor Reisch, Peter Apian, and so on.

Charles, therefore, grew up with a full awareness of cartographic possibilities, and throughout his life he was in

36. See David C. Goodman, "Philip II's Patronage of Science and Engineering," *British Journal for the History of Science* 16 (1983): 49–66, esp. 50–52, and Pedro González Blasco, José Jiménez Blanco, and José María López Piñero, *Historia y sociología de la ciencia en España* (Madrid: Alianza Editorial, 1979), 30–31.

37. Well described in José María López Piñero, *La introducción de la ciencia moderna en España* (Barcelona: Ediciones Ariel, 1969).

38. José Simón Díaz, *Historia del Colegio Imperial de Madrid,* 2 vols. (Madrid: Consejo Superior de Investigaciones Científicas, Instituto de Estudios Madrileños, 1952–59).

39. On these developments, see José María López Piñero, "La ciencia y el pensamiento científico," in *Historia de España,* ed. Ramón Menéndez Pidal, vol. 26, pt. 1, *El Siglo del Quijote (1580–1680): Religión, filosofía, ciencia,* 2d ed. (Madrid: Espasa-Calpe, 1986), 159–231.

40. See "Fernández de Medrano, Sebastián," in *Diccionario,* 1:329–30, and Joaquín de la Llave y Garcia, "Don Sebastián Fernández de Medrano como geógrafo," *Boletín de la Real Sociedad Geográfica* 48 (1906): 41–63, esp. 42–49.

41. See Julián Velarde Lombraña, *Juan Caramuel: Vida y obra* (Oviedo: Pentalfa Ediciones, 1989).

42. See Heinrich Ulmann, *Kaiser Maximilian I.: Auf urkundlicher Grundlage dargestellt,* 2 vols. (Vienna: Verlag des Wissenschaftlichen Antiquariats H. Geyer, 1967), 1:206, and Gerald Strauss, *Sixteenth-Century Germany: Its Topography and Topographers* (Madison: University of Wisconsin Press, 1959), 82.

close contact with maps and mapmakers. In 1539, for instance, when he was laid up with gout in Toledo, he spent many days with the royal cosmographer, Alonso de Santa Cruz, learning about astronomy and cartography, "from which he derived much amusement and delight."[43] The engineer Juanelo Turriano was a personal friend who accompanied the emperor in his eventual retreat after 1556.[44] Charles's wife, Empress Isabella of Portugal, was equally interested in cartography and geography, tastes she had no doubt inherited from her father, Manuel I, king of Portugal. In 1536, she wrote to the viceroy of New Spain: "We very much want to have a plan or picture of the principal cities, ports, and coastline of that land."[45]

It is little wonder that Charles transmitted these interests to his son Philip II. For example, by 1545 Charles had already given Philip an exceptionally decorative world atlas by Battista Agnese.[46] Philip later spent many years in the Netherlands, then the great center of scientific mapmaking, where he became acquainted with the work of cartographers like Gerardus Mercator and Jacob van Deventer and took up again a plan to make a small-scale map of Spain (mentioned later in this chapter). At his newly built palace within the Escorial (a monastic complex including a royal mausoleum, a church, a college, and a monastery), he had the throne room hung with more than seventy maps taken from the 1578 edition of Abraham Ortelius's *Theatrum orbis terrarum,* and he commissioned Antoon van den Wijngaerde (Anthonie van den Wyngaerde, Antoin de la Vigne, Antonio de las Viñas) to paint cityscapes for the decoration of both the Pardo palace and the Alcázar in Madrid.[47]

The same sort of cartographic sensibility was widespread among the leaders of Spain during Philip's reign. When his librarian, Benito Arias Montano, was in Antwerp between 1568 and 1575, "trunks full of mathematical instruments, astrolables, paintings . . . maps of Ortelius, and above all books, were shipped by him to his friends in Spain, Juan de Ovando, Luís Manrique, the Duke of Najera and Zayas."[48] Similarly, when Luis Hurtado de Toledo was Spanish ambassador in Venice in the late 1560s, he assembled a collection of maps for Philip II. This atlas, described in its dedication as a "Book of Islands and Important Regions and Fortified Cities," grouped together the latest Italian products and survives in mutilated form.[49] Many libraries were formed in Spain at that time, like the one assembled by Philip's architect Juan de Herrera. It contained over four hundred volumes, including not only the works of Spanish cartographic authors like Jerónimo Girava, Jerónimo de Chaves, and Martín Cortés, but also those of Gemma Frisius, Oronce Fine, and Gerardus Mercator.[50] Herrera's library, like that of Arias Montano, eventually swelled the immense collection assembled by Philip at the Escorial; alas, much of it perished in the fire of 1671.

Spain's naval commanders had to have a mastery of charts, but her land generals were also skillful map users at that time. When the duke of Alba marched north from Italy into the Netherlands in 1567, he used a map of Franche-Comté prepared by Ferdinand de Lannoy; its publication was delayed for a decade, but it appeared in the 1579 edition of Ortelius's *Theatrum orbis terrarum.*[51] In 1568, when he followed the prince of Orange (Willem van Oranje) into Limburg, three other maps were drawn, and two others were produced for Alba's expedition of 1573.[52] These military maps were selective in their representation of terrain and highly schematic, but they evidently formed a crucial part of the tactical thinking of commanders like Alba.

From the seventeenth century, references to map use among Spain's leaders are rarer, perhaps because it had now become so commonplace that it was no longer worth mentioning. However, we do know that "[Gaspar de Guzmán, third count of] Olivares had a special map-room in his quarters in the palace, where he would spend long hours poring over his maps and charts; and Flanders veterans were amazed by his detailed knowledge of the local topography."[53] His master, Philip IV, was also reputed to have inherited the mapping interests of Charles V and Philip II, as he showed by personally encouraging cartographers and by hanging the walls of his palaces with new maps and views.[54]

43. Quoted in Kagan, *Spanish Cities,* 41.

44. González Blasco, Jiménez Blanco, and López Piñero, *Historia y sociología,* 23.

45. Quoted in Kagan, *Spanish Cities,* 41.

46. Now in the John Carter Brown Library at Brown University, Providence, R.I., and described in Samuel J. Hough, *The Italians and the Creation of America,* exhibition catalog (Providence, R.I.: Brown University, 1980), 70–71. See also Goodman, "Philip II's Patronage," 49–66.

47. Kagan, *Spanish Cities,* 48 and 56.

48. B. Rekers, *Benito Arias Montano (1527–1598)* (London: Warburg Institute, University of London, 1972), 75.

49. George H. Beans, *A Collection of Maps Compiled by Luis Hurtado de Toledo, Spanish Ambassador in Venice, 1568* (Jenkintown, Pa.: The George H. Beans Library, 1943).

50. See F. J. Sánchez Cantón, *La librería de Juan de Herrera* (Madrid, 1941); idem, *La biblioteca del marqués del Cenete, iniciada por el cardenal Mendoza (1470–1523)* (Madrid: [S. Aguirre, impressor], 1942); and López Piñero, *Ciencia y técnica,* 134–35.

51. See Geoffrey Parker, *The Army of Flanders and the Spanish Road, 1567–1659: The Logistics of Spanish Victory and Defeat in the Low Countries' Wars* (Cambridge: Cambridge University Press, 1972), 83.

52. These maps are reproduced in Parker, *Army of Flanders,* 102–5 (figs. 11 and 12).

53. Elliott, *Richelieu and Olivares,* 28.

54. See the chapter by Richard L. Kagan, "Arcana Imperii: Mapas, ciencia y poder en la corte de Felipe IV," in *El Atlas del rey planeta: La "Descripción de España y de las costas y puertos de sus reinos" de Pedro Texeira (1634),* ed. Felipe Pereda and Fernando Marías (Madrid: Editorial Nerea, 2002), 49–70.

Even Charles II, often characterized as a feeble-minded king, was not immune from cartographic influences, for José Zaragoza, the Jesuit mathematician, claimed that in 1675 he was trying to make the king pay more attention to maps.[55] Of course, the references that we have assembled are no doubt partial and defective, but it does seem that from 1500 to 1700 there was a relatively elevated level of map consciousness among Spain's rulers, and indeed among the rulers of France and other European countries as well.[56]

Royal Mapping on the Peninsula

During the fifteenth century, there had been verbal descriptions (*relaciones topográficas*) of various parts of Castile.[57] In 1517, though, Fernando Colón, son of Christopher Columbus, received a royal commission to map and describe the whole country. This remarkably precocious venture came to an end in June 1523, when the commission was annulled by the royal council, but the manuscript "Itinerario de Fernando de Colón" survives.[58] By 1523, about sixty-five hundred communities had been enumerated, though no map appears to survive. The reasons for the suppression of the venture are obscure, unless Blázquez y Delgado-Aguilera is correct in thinking that the royal administration did not wish to leave so important a task in the hands of an individual, even one as prominent and well protected by the crown as Fernando Colón. Be that as it may, the collapse of the enterprise meant that no further work was undertaken during the reign of Charles V. There was a topographical description by Pedro de Medina called the *Libro de grandezas y cosas memorables de España* (Seville, 1548), but this fell far short of a true survey, and its rather crude map of Spain eloquently testifies to the need for something better.

It was either Charles V or Philip II who seems to have commissioned Pedro de Esquivel, professor of mathematics at the University of Alcalá de Henares, to draw a series of detailed maps of Spain during the 1550s. Esquivel set to work at once, using a set of specially designed and very large instruments to make what were probably accurate triangulation measurements. By 1560, the fieldwork was largely completed, leading one of the project's supporters to report of Esquivel that "there was not a parcel of land in the entire kingdom that he did not see, walk on, or inspect, assuring himself about the truth of everything with his own hands and eyes and to the extent that mathematical instruments allow."[59] Esquivel enjoyed the support of Philip II and seems to have worked through the 1560s and 1570s until his death in 1577, when the work was taken over by Juan de Herrera.

The result of these efforts seems to be preserved in the "Escorial Atlas," a manuscript held in the royal library at the Escorial palace outside Madrid. It consists of a key map of the peninsula (fig. 39.12), followed by twenty detailed maps, one for each of the keyed divisions. Scholars have differed concerning its date. Marcel, writing in 1889, thought it dated from the middle of the seventeenth century.[60] Reparaz Ruiz, in his article of 1950, claimed that it dated from 1585; more recently, Vázquez Maure inclined toward a date of about 1590.[61] On the whole, the earliest date seems most likely. The fact that a bishopric is marked at Elne and there is no bishopric at Valladolid points to a

FIG. 39.12. KEY MAP FROM THE "ESCORIAL ATLAS." This map of Spain, drawn within the lattice of latitude and longitude and divided into twenty numbered sections, testifies to a remarkable mastery of the new mathematically based cartography.
Size of the original: 30.5 × 45 cm. Photograph copyright © Patrimonio Nacional, Madrid (MS. K.I.1, fols. 1v–2r).

55. Communication from the late Richard Boulind early in 1981.

56. An attempt to track this development is presented in David Buisseret, ed., *Monarchs, Ministers, and Maps: The Emergence of Cartography as a Tool of Government in Early Modern Europe* (Chicago: University of Chicago Press, 1992).

57. See Blázquez y Delgado-Aguilera, "El Itinerario," 84–85.

58. It is preserved at Seville, Biblioteca Colombina. See Tomás Marín Martínez, ed., *"Memoria de las obras y libros de Hernando Colón" del Bachiller Juan Pérez* (Madrid: [Cátedra de Paleografía y Diplomática], 1970), 161–251, and Blázquez y Delgado-Aguilera, "El Itinerario," 87–88.

59. Quoted in Kagan, *Spanish Cities,* 44–45.

60. Gabriel Marcel, *Les origines de la carte d'Espagne* (Paris, 1899).

61. Gonzalo de Reparaz Ruiz, "The Topographical Maps of Portugal and Spain in the 16th Century," *Imago Mundi* 7 (1950): 75–82; Francisco Vázquez Maure, "Cartografía de la Península: Siglos XVI a XVIII," in *Curso de conferencias sobre historia de la cartografía española: Desarrollado durante los meses de enero a abril de 1981* (Madrid: Real Academia de Ciencias Exactas, Físicas y Naturales, 1982), 59–74, esp. 63; and idem, "Cartographie Espagnole au XVIe siècle" (typescript, held at the BNM, n.d.), 63.

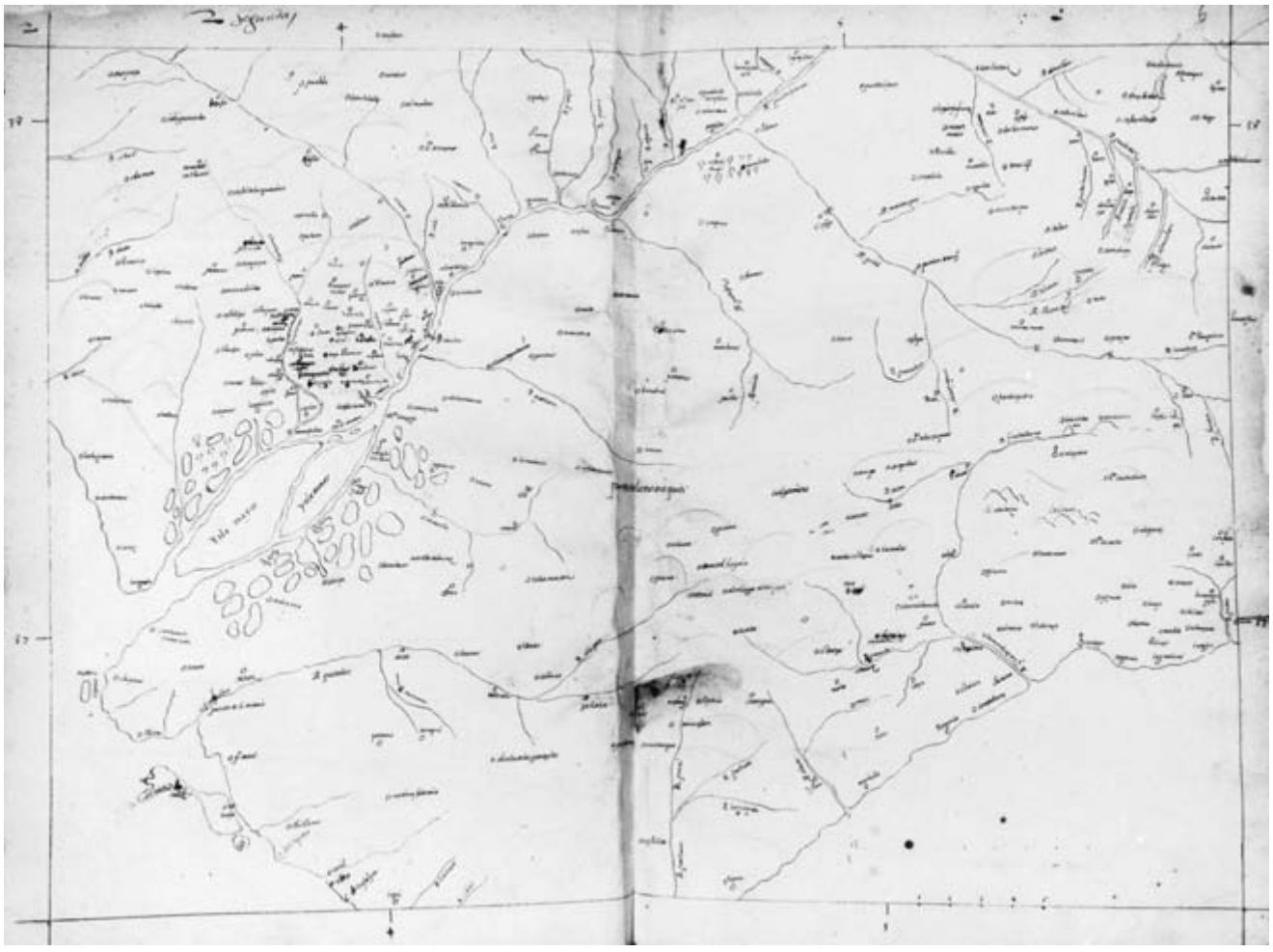

FIG. 39.13. PART OF SECTION 2 FROM THE "ESCORIAL ATLAS." This detail of section 2 (see figure 39.12) shows how thick was the network of towns and villages whose position was established by the cartographer.
Size of the entire original: 30.5 × 45 cm. Photograph copyright © Patrimonio Nacional, Madrid (MS. K.I.1, fols. 5v–6r).

date before 1604 and 1598, respectively; moreover, the manuscript has annotations in the hand of Juan López de Velasco, who died in 1598. The outline of the peninsula is distinctly archaic, with too great a distance between Gibraltar and Cartagena, and consequently an extended north coast; it is hard to believe that a map like this could have been produced as late as the seventeenth century, after so many editions of the Thomas Geminus–inspired maps had appeared.

If indeed the Escorial Atlas is the product of the Esquivel venture, it is of the highest interest for showing the strengths and limitations of Spanish cartography at that time. To begin with, it is astonishingly detailed, containing about six thousand place-names. Reparaz Ruiz observed that the Portuguese sections were particularly accurate, but many of the Spanish ones are also well observed. For instance, analysis of section 2 (fig. 39.13) shows that the numerous towns have been very accurately placed, though the course taken by the rivers is rather schematic. Perhaps this suggests that the map was constructed by taking observations from high structures in the towns, and thus building up a network of reference points, after which the hydrography could be sketched in relatively grossly. Indeed, on the back of one of the maps (fol. 9r), there is a fan-shaped listing of names that represent landmarks in the city of Toledo as sighted from a central vantage point; this list certainly survived from the process of mapping that city. The existence of this rough work on the back of one of the maps reminds us of the unfinished nature of the Escorial Atlas, in which only the general key map was carefully drawn. Perhaps the work never got beyond this stage, or perhaps a more finished

version was destroyed in the fire of 1671 that burnt up so many treasures in the library of the Escorial.

The concept of having a key map of a whole country and then following it with detailed maps showing each section at a common scale is very sophisticated. The only roughly contemporary atlas to use this method of presentation was Philipp Apian's *Bairische Landtafeln* of 1568. Contemporary French maps used the province as the mapping unit, so the first atlas of France, made by Maurice Bouguereau in 1594, consisted of an assemblage of disparate maps at different scales and did not quite cover the whole country. When Christopher Saxton mapped England in the 1570s, he chose the county as his mapping unit, so although he did indeed cover the whole country, it was at a variety of scales. Whoever drew the Escorial Atlas showed a remarkable ability to produce individual maps, all at the same scale, and all tied to the network of latitude and longitude set out on the key map. Historians have wondered why this marvelous work was never published, and some have speculated that it was because Philip II wanted to keep the information secret. A simpler explanation is that the work was never finished; moreover, Spain did not have the presses needed to print detailed maps of this kind at an appropriate scale. In order to be published, the atlas would have had to be finished off and then sent to Flanders or Italy for printing; this stage was never reached.

Philip II encouraged various other projects for making a "general description" of Spain, but none of them involved drawing maps on the scale of the Esquivel project. In the late 1570s, for instance, he began commissioning *relaciones geográficas* from various provinces, of the kind that in the New World were often accompanied by maps. However, only those for New Castile and the Archdiocese of Toledo were completed; these were without maps.[62] He also sponsored the work of Diego Pérez de Mesa, whose *Primera y segunda parte de las grandezas y cosas notables de España* (Alcalá de Henares, 1590) was a revision of Pedro de Medina's work of 1548, but this, too, lacked novel cartography. When Philip died in 1598, there still was no published large-scale map of the peninsular provinces.

In 1619, though, the Portuguese Pedro Teixeira Albernaz, son and brother, respectively, of cartographers Luís Teixeira and João Teixeira Albernaz I, was called to Madrid and became "Cosmographer of His Majesty." In 1622, with a royal commission, he began mapping the coasts of Spain (and Portugal, then linked to Spain). Starting at San Sebastián, he worked for some years at this task, completing it in 1634. The resulting atlas was used by Philip IV, but never found its way into print; like the Escorial Atlas, it lay in the archives from which it has only recently been retrieved and published.[63] Teixeira is also known for his remarkable plan of Madrid, published at Amsterdam in 1656. Kagan has described this plan as strongly "monarchocentric," in the sense that the size of the royal palaces was exaggerated and Madrid was presented as the royal capital of a worldwide monarchy.[64]

Regional Cartography

The history of provincial mapping in Spain is complex and intermittent, as is that of other countries in sixteenth-century Europe. Many of the original manuscript maps have been lost, so now it is often possible to reconstruct the cartographic activity only by reading the contents of general atlases like those of Ortelius, Mercator, and Blaeu.

The first surviving regional map by a Spaniard shows part of France (fig. 39.14). It offers us an image from about 1539 of Champagne as seen in a perspective view from the northeast.[65] At the top right is Fontainebleau, in the center Troyes ("Troy"), and at left center Châtillon-sur-Seine. The Seine River meanders from left to right across the center, joined by the Aube River just before Troyes. The map was drawn with great delicacy of detail, and in this fashion represents an imaginative leap in visualizing a whole province. Perspective views of towns and small areas of countryside would become common during the sixteenth century, but the delineation of a whole province in this way never became an accepted form until aerial imagery offered perspectives of this kind in the twentieth century. The author is unknown, though it was no doubt someone attached to the court of Charles V. This drawing formed part of a series, to judge from the note on the back that calls it "number 9," but none of the other maps are known to have survived.

The first surviving map of a Spanish province is the one of Andalusia found in the 1579 edition of Ortelius's *Theatrum orbis terrarum* (fig. 39.15). It was drawn by Jerónimo de Chaves, son of the royal cosmographer Alonso de Chaves. Jerónimo belonged to the circle of mapmakers associated with the Casa de la Contratación, and was appointed to its newly created post of professor in 1552—the same year his father became pilot major. His map is therefore interesting as a unique example of the application of techniques developed at the Casa for peninsular

62. Kagan, *Spanish Cities,* 47.

63. See Felipe Pereda and Fernando Marías, eds., *El Atlas del rey planeta: La "Descripción de España y de las costas y puertos de sus reinos" de Pedro Texeira (1634)* (Madrid: Editorial Nerea, 2002).

64. See Richard L. Kagan, "*Urbs* and *Civitas* in Sixteenth- and Seventeenth-Century Spain," in *Envisioning the City: Six Studies in Urban Cartography,* ed. David Buisseret (Chicago: University of Chicago Press, 1998), 75–108, and figure 27.6 in this volume.

65. See the color reproduction in Santiago Páez, *La Historia en los Mapas Manuscritos,* 192.

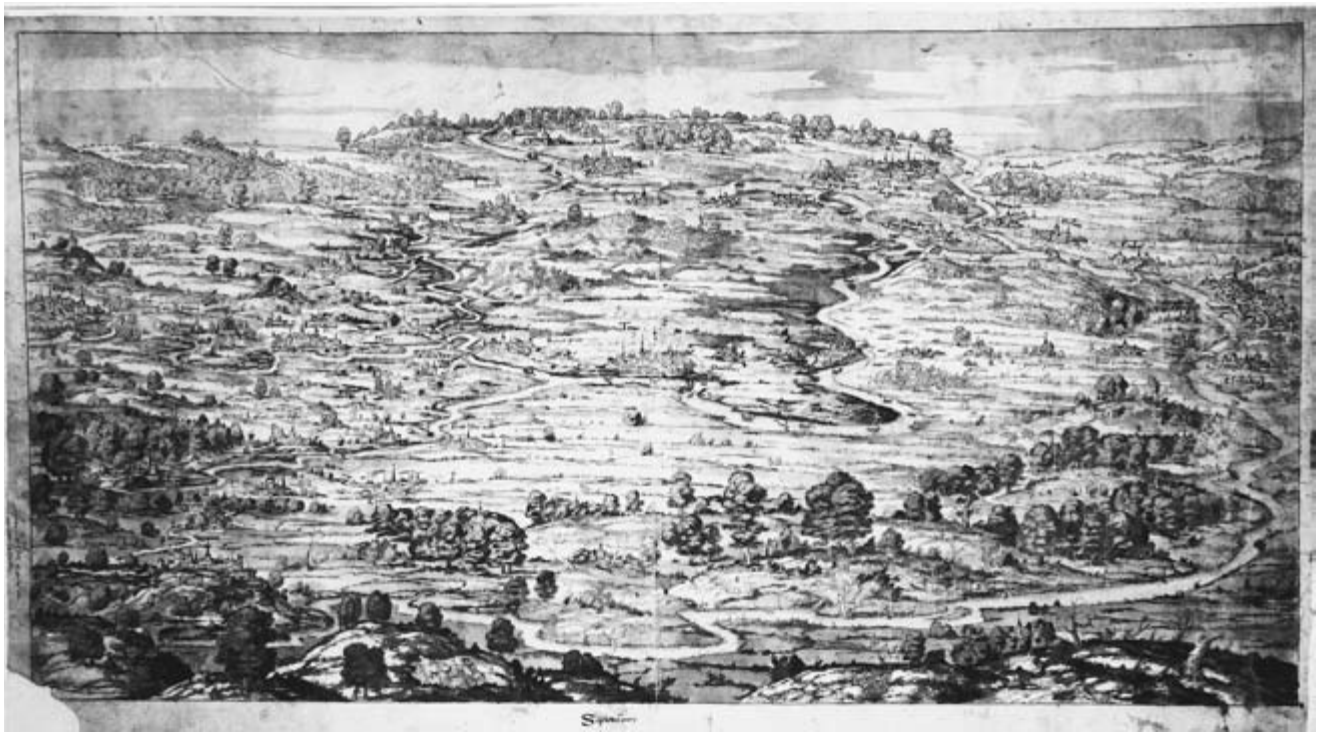

FIG. 39.14. ANONYMOUS BIRD'S-EYE VIEW OF CHAMPAGNE, CA. 1539. This extraordinary view makes the imaginative leap toward the kind of aerial imagery that would become commonplace only in the later twentieth century; such views were very unusual in early modern Europe. Photograph courtesy of the BNM (M-1v 283).

cartography, though we have no idea why he chose to delineate the area around Seville in this way.

Thereafter, successive editions of the *Theatrum* contained an increasing number of maps of Spanish provinces, as Hernando Rica has shown.[66] When the Mercator-Hondius *Atlas* was published in 1606, there were maps of Aragon, Biscay, Castile, Catalonia, Galicia, Granada, Leon, Navarre, and Valencia (fig. 39.16). Although this expansion in knowledge of the geography of the peninsula covered most of the territory except Andalusia, we do not know the circumstances in which the spurt came about or the names of most of the cartographers. The only map with attribution is that of Galicia, for which Fernando de Ojea was responsible.[67] This work, like so many others in the *Atlas,* represents a distinct advance in detailed knowledge; Ojea is described as a member of the Order of Preachers, that is, a Dominican, but otherwise we know nothing about him. If the example of France is anything to go by, some of the other maps in the 1606 *Atlas* were probably also drawn by clerics, but we cannot be sure. The only thing that seems fairly certain is that the contributors were Spaniards, or Castilians, for in this period of heightened suspicion between the leading European powers it would have been difficult for foreigners to move about the peninsula with the leisure suggested by the detail of the maps.

In some of the Spanish possessions, extensive mapping was undertaken by the military engineers. This was particularly the case in the Netherlands, where in 1643 "L. Ingelbert, ingénieur du roy d'Espagne" composed a map showing the frontier with France.[68] This work was detailed and was precocious in showing the frontier with red-colored dashes; we know nothing about its author, and it survives only because a copy was made, perhaps by stealth, for the French.

Among Ingelbert's colleagues as engineers in service to Spain in the Netherlands were various members of the Van Langren dynasty. The founder, Jacob Floris van Langren, was a globemaker working in Amsterdam in the 1580s and 1590s, but his son Arnold Floris moved south to Antwerp about 1610 and there became *Sphérographe de leurs Altesses,* or globemaker to Albert and Isabella Clara Eugenia, the regents of the Spanish Netherlands.

66. See Agustín Hernando Rica, *Contemplar un territorio: Los mapas de España en el* Theatrum *de Ortelius* ([Madrid]: Ministerio de Fomento, Instituto Geográfico Nacional, Centro Nacional de Información Geográfica, 1998).

67. Hernando Rica, *Contemplar un territorio,* 35–36.

68. Quoted from the map at the BNF, Cartes et Plans, Ge DD 4121 (180).

FIG. 39.15. JERÓNIMO DE CHAVES, *HISPALENSIS CONVENTVS DELINEATIO,* FROM THE 1579 EDITION OF ORTELIUS'S *THEATRUM.* This elegant map of Andalusia covers one of the earliest areas to be described in a printed map of Spain. Size of the original: 50 × 66 cm. From Abraham Ortelius, *Theatrum orbis terrarum* (Antwerp: C. Plantinum, 1579), pl. 20. Photograph courtesy of the Geography and Map Division, Library of Congress, Washington, D.C. (G1006.T5 1612).

Arnold Floris later moved into mapmaking, becoming *cosmographe du roy* in 1628, and his sons Michael Florent, Jacques Florent, and perhaps Fredericq Florent became very prominent in provincial mapping.[69]

Michael Florent van Langren worked during the mid-1620s on maps of the fortifications of Ostend and of the canals and dunes of the Mardyck (near Dunkirk), to judge from the manuscript maps now held by the BL.[70] In about 1626, he drew a map of the newly dug canal between the Meuse and the Rhine Rivers; it was dedicated to Isabella Clara Eugenia and appeared in Blaeu's *Atlantis appendix* of 1630 as the *Fossa quæ a Rheno ad Mosam.* In 1629, he was appointed *cosmographo* or *mathematico de Sa Mag^d en Flandres* (the mixture of French and Spanish is characteristic), and between 1631 and 1633, he visited Spain.[71]

These various preliminary maps must have laid the groundwork for Michael Florent van Langren's great map of Brabant, which appeared in the second volume of Willem Jansz. Blaeu's *Novus atlas* of 1635.[72] It is divided into three parts, all oriented to the west and all overlap-

69. See Johannes Keuning, "The Van Langren Family," *Imago Mundi* 13 (1956): 101–9; "Langren (Michel-Florent van)," in *Biographie nationale, publiée par l'Académie royale des sciences, des letters et des beaux-arts de Belgique* (Brussels: H. Thiry-van Buggenhoudt, 1866–), vol. 11, cols. 276–92; and Claire Lemoine-Isabeau, ed., *Cartographie belge dans les collections espagnoles, XVI^e au XVIII^e siècle,* exhibition catalog (Brussels: Crédit Communal, [1985]).

70. See BL, Add. MS. 14007.

71. Keuning, "Van Langren Family," 108–9.

72. See the listing in Peter van der Krogt, *Koeman's Atlantes Neerlandici* ('t Goy-Houten: HES Publishers, 1997–), 2:97–98.

FIG. 39.16. PROVINCES OF THE SPANISH PENINSULA NEWLY SHOWN IN THE 1606 MERCATOR-HONDIUS *ATLAS.*

ping, covering roughly the central and northern regions of modern Belgium. Within this area fell the Mechelen region, which Michael Florent had also covered in a map published by Blaeu; his style is sober, with particular attention given to forts, to fortified towns, and to watercourses, as was no doubt appropriate for a royal cartographer who had worked on defenses and canals. During the 1640s, he was busy with a variety of projects in mathematics, surveying, and hydraulic engineering, and in 1644 he published his most celebrated book, *La verdadera longitud por mar y tierra* (Madrid, 1644). That same year, Michael Florent also published his masterly map of the duchy of Luxembourg, known in its first edition only from the deteriorated copy at the Royal Library of Belgium in Brussels. Figure 39.17 shows a later edition of this map that he drew about 1671/72.[73] Michael Florent drew maps that are visually very pleasing, with woods and rivers clearly defined and an elaborate system for assigning priorities by typographic ranking.

We know little about Michael Florent van Langren's brother Jacques Florent van Langren except that he was *cosmographe et ingénieur de Sa Majesté* about 1620, and that he drew maps and plans of small districts and fortresses. The other brother (Fredericq Florent van Langren?), seems to have gone to work for the French, for there are numerous maps by him in the French archives, generally dedicated to the prince de Condé.[74] Curiously enough, his father, Arnold Floris van Langren, also worked at least once for the French, to judge from his manuscript dedicated to Cardinal Richelieu titled "Théâtre des guerres entre le Roy d'Espagne et les Estats de Hollande."[75]

The Spanish royal engineers were responsible for provincial maps in Italy as well as in the Low Countries. Some of their work is anonymous, like the map accompanying a collection titled "Plantas y mapas de lugares fuertes de la Italia."[76] This map was designed to locate those forts whose plans were also given (fig. 39.18); the hydrography is carefully drawn, and so are the boundaries (dotted line) between the Milanese and adjacent states. Maps like this testify to a considerable mastery of the general features of a province.

Just as the 1606 Mercator-Hondius *Atlas* had contained a whole set of new maps of the Spanish provinces, so did the editions of the Mercator-Hondius-Janssonius *Atlas* of 1636 and Johannes Janssonius's *Atlas novus* of 1658.[77] This time the material was concentrated in the northeast and was the work of João Baptista Lavanha (Juan Bautista Labanna). Born in Portugal about 1550, Lavanha studied there and in Italy, and in 1583 was called to the newly founded Academia de Matemáticas in Madrid as professor of mathematics and the theory of navigation. He became a prolific writer on such subjects as geography and genealogy and left much work in manuscript form.[78] Lavanha was also a practical engineer who consulted on such projects as the scheme for improving navigation on the Tagus River.[79] In 1612, he visited the Spanish Netherlands, and in 1610–11 he was in Aragon, working on behalf of the estates on a new map of that region.

Much of the territory of Aragon is mountainous, presenting great difficulties to the cartographer. Its representation in the 1606 Mercator-Hondius *Atlas* had been extremely summary in nature along with that of Catalonia. The map that Lavanha later compiled was much more detailed and accurate.[80] It was oriented northward

73. On this map, see Emile van der Vekene, *Les cartes géographiques du Duché de Luxembourg éditées aux XVI^e^, XVII^e^ et XVIII^e^ siècles: Catalogue descriptif et illustré,* 2d ed. (Luxembourg: Krippler-Muller, 1980), 102–7.

74. See, for instance, BNF, Cartes et Plans, Ge B 8203 and 8204, and Ge AA 2042–44.

75. Brussels, French Ministère des Affaires de Hollande, now preserved in the Section Géographique du Service des Archives et Documentation.

76. BNM, Manuscritos, 12678.

77. For example, see Van der Krogt, *Koeman's Atlantes Neerlandici,* 1:445–46.

78. For example, at the BNM, Manuscritos, 1450, 7632, 11499, 11572, and 11680; others are at the Real Academia de la Historia, at the Universiteitsbibliotheek Leiden, and at the Kungliga Biblioteket in Stockholm. See also Agustín Hernando Rica, *La imagen de un país: Juan Bautísta Labaña y su mapa de Aragón (1610–1620)* (Zaragoza: Institución "Fernando el Católico," 1996).

79. BNM, Manuscritos, 18630.

80. Cortesão and Teixeira da Mota, *Portugaliae monumenta cartographica,* 4:69–70.

FIG. 39.17. MICHAEL FLORENT VAN LANGREN, *LUXEMBVRGENSIS DVCATVS,* 1671/72. Several members of the Van Langren family served the rulers of the Spanish Netherlands, compiling a variety of maps at different scales. Photograph courtesy of the BNF (Ge D 13064).

and succeeded to a remarkable degree in capturing the difficult topography and hydrography of Aragon (fig. 39.19). When the 1636 edition of the Mercator-Hondius-Janssonius *Atlas* came out, it included a very faithful copy of Lavanha's map, this time oriented westward to fit the page format.

Johannes Janssonius's *Atlas novus* of 1658 contained maps showing the bishoprics and archbishoprics of northeastern Spain in great detail; these had no doubt been drawn by Lavanha in the course of mapping Aragon over forty years earlier. The six maps, showing the areas around Barbastro, Huesca, Pamplona, Saragossa, Tarra-

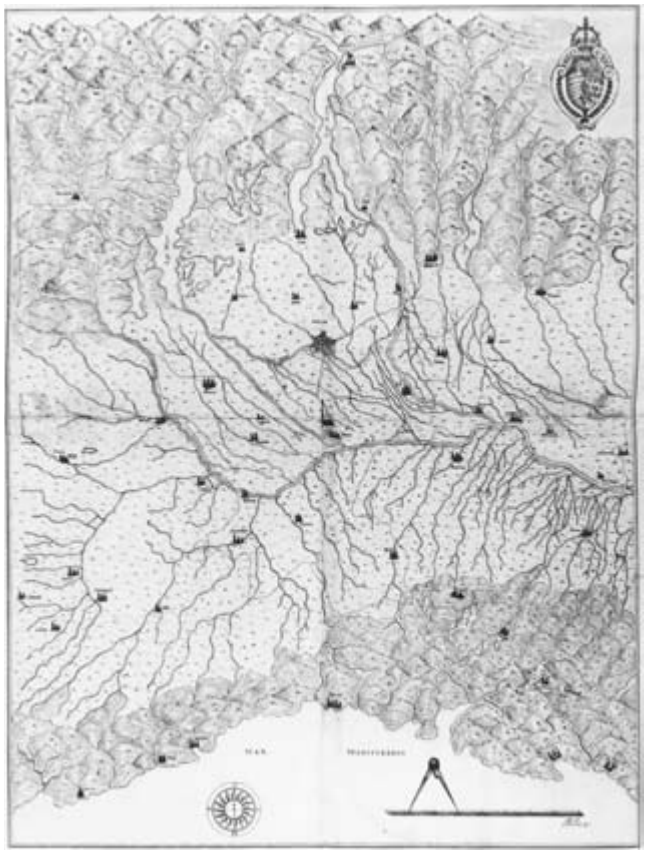

FIG. 39.18. ANONYMOUS MAP OF NORTHERN ITALY. The Spanish king's engineers were active in mapping northern Italy, as in this map setting out the position of the main fortresses in relation to the mountains and rivers.
Photograph courtesy of the BNM (MS. 12678, fols. 41–42).

FIG. 39.19. JOÃO BAPTISTA LAVANHA, DETAIL OF *ARAGON,* 1622. This province had given early cartographers a great deal of trouble, but its difficult terrain was convincingly delineated by Lavanha, a Portuguese cartographer who entered the service of the king of Spain.
Size of the original: 115 × 93 cm; size of detail: ca. 34.9 × 29 cm. Photograph courtesy of the BNF (Ge DD 2987 [1777] B).

gona, and Teruel, reached a new level of detail and accuracy. As may be seen from figure 39.20, they together covered much of the area described by Lavanha in his map first published in 1620. Lavanha's work had been commissioned by the estates of Aragon, but he chose to portray the country by its ecclesiastical subdivisions, no doubt because these were in practice the most important administrative units. Probably other dioceses had maps in the seventeenth century, but the most detailed one known to us is the remarkable map of the Archbishopric of Toledo published in 1681 by Cardinal Luis Manuel Fernandez de Portocarrero.[81] We know nothing about its author, but the map gives a masterly impression of the area around Toledo, and it has on each side detailed views of the region's leading cities.

Very similar in layout is the almost contemporary manuscript wall map of Catalonia preserved at the BNM and drawn about 1687 by Ambrosio Borsano.[82] Born in 1628 in Milan, Borsano entered Spanish service in 1653 and fought in north Italy during that decade. When peace came, he was sent to the Iberian Peninsula, working in Valencia and the Balearic Islands. In 1673, he was posted to Catalonia as engineer and artillery master, and it was no doubt at this stage in his life that he began to compose the great wall map of Catalonia that shows the principality with hitherto unknown detail and accuracy (fig. 39.21). It may well be that Borsano spent most of the 1670s preparing this map. An atlas in the BNM probably represents his preliminary work.[83] Many of its dozen or so town plans cover the same places as the town plans along the edges of the great wall map. In both atlas and wall map, the style and conventions are very similar to those of contemporary

81. Cataloged in *Castilla la nueva, mapas generales: Madrid, capital y provincia, siglos XVII a XIX* (Madrid: Instituto de Geografía Aplicada, Consejo Superior de Investigaciones Científicas, 1972), 7.

82. For a summary description, see Santiago Páez, *La Historia en los Mapas Manuscritos,* 66–67, and *Cartografia de Catalunya: Segles XVII–XVIII,* exhibition catalog ([Barcelona]: Institut Cartogràfic de Catalunya, [1986]), 24 and 25 (color reproduction).

83. BNM, Manuscritos, 12683 and 18054.

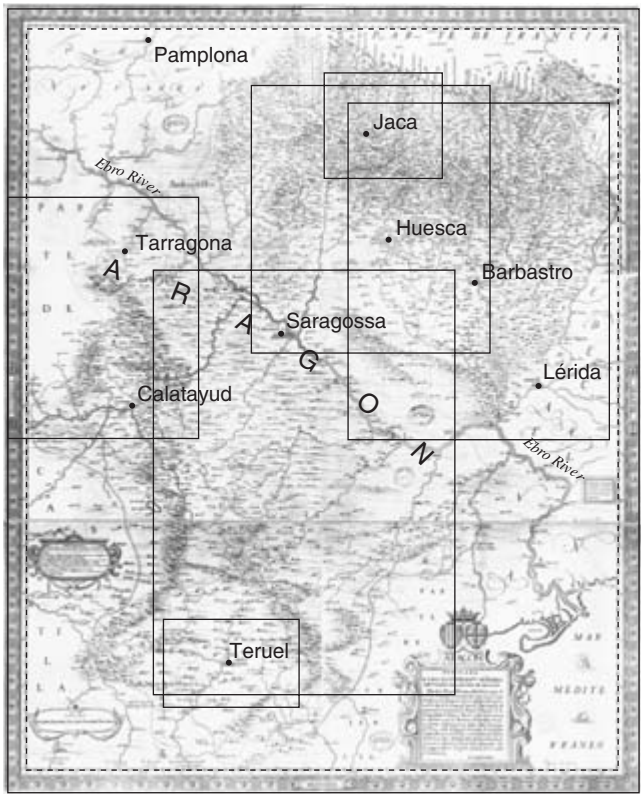

FIG. 39.20. THE AREAS OF LAVANHA'S *ARAGON* COVERED BY ECCLESIASTICAL MAPS.

French military cartographers. We do not know where Borsano was trained—perhaps at the Spanish military school in Milan—but in any case, it was almost inevitable that in this period other European cartographers would imitate the all-conquering French. Borsano was last heard of in 1696, and his life is ill known. However, he left at least one manuscript work apart from his maps, and his life and work deserve full investigation.[84]

The same is true of the life and work of José Chafrion, of whom we know at least that he was born in Valencia and became a protégé of José Zaragoza. He then worked in Italy, mapping Liguria, Genoa, and the Milanese; at this stage, he came under the patronage of Juan Caramuel Lobkowitz, a leader among the *novatores,* as we have seen. About 1680, he was in the service of the governor of Milan as a military engineer,[85] and this gave him the opportunity to collect material for his *Plantas de las fortificaciones de las ciudades, plazas y castillos del Estado de Milan,* published in 1687, and for his *Carta de la parte meridional del Estado de Milan,* published in 1685.

Figure 39.22 shows part of Chafrion's map of the southern part of the Milanese. It is oriented southward and covers the valley of the Po River. Its accuracy falls off somewhat in the farther reaches of the river valleys, but even there towns like Serravalle ("Sarauale") and Nizza Monferrato ("Nizza") are well placed; certainly it represents a great improvement over versions of the region available in such widely used atlases as Joan Blaeu's *Atlas maior* of 1662. Chafrion's 1685 map of the Republic of Genoa seems to have been particularly well conceived, for as late as 1784, we find a topographical map of that region "taken from the celebrated Spanish map by Chaffrion."[86]

Much of the regional mapping of Spanish possessions in Europe thus emerged from various types of royal institution after an early period when it is possible that the work of local clerics was prominent. Ingelbert, the Van Langrens, Borsano, and possibly Chafrion were royal engineers associated with the great schools of artillery and engineering. Lavanha had early been appointed at Philip II's Academia de Matemáticas, and no doubt applied the principles taught there to his cartographic activities. The general shape of the Spanish Peninsula had been set out with varying degrees of accuracy in the printed small-scale maps of the period;[87] by 1700, almost all parts of the area had been so carefully mapped that the general maps were becoming useful for quite complex administrative decision making.

Conclusion

When we review the body of maps drawn in Spain over the decades between 1500 and 1700, we are struck by the high level of technical expertise that was available from start to finish. Spain did not lack knowledge of the latest techniques practiced in other parts of Europe, and, except for a period about the middle of the seventeenth century, she also had the institutions necessary to preserve and transmit cartographic knowledge. Why, then, have historians of cartography usually come to a rather negative assessment of her achievements in terrestrial cartography at that time?

Part of the answer lies in the weakness of Spain's printing industry; although the products of the Netherlandish, German, and Italian mapmakers, and eventually those of

84. For some biographical details, see "Borsano (D. Ambrosio)," in *Bibliografía Militar de España,* by José Almirante (Madrid: Imprenta y Fundicion de Manuel Tello, 1876), 84.

85. See the cartouche on his *Topographia de la Liguria* (also known as *Carta de la Rivera de Genova con sus verdaderos confines y caminos*), published in 1685; reproduced in Massimo Quaini, "Dalla cartografia del potere al potere della cartografia," in *Carte e cartografi in Liguria,* ed. Massimo Quaini (Genoa: Sagep, 1986), 7–60, esp. 8–9.

86. Quoted from the map at the BNF, Cartes et Plans, Ge CC 2550.

87. Many of these are reproduced in Agustín Hernando Rica, *El Mapa de España, siglos XV–XVIII* ([Spain]: Ministerio de Fomento, Instituto Geográfico Nacional, Centro Nacional de Información Geográfica, [1995]).

FIG. 39.21. AMBROSIO BORSANO, "EL PRINCIPADO DE CATTALVÑA Y CONDADOS DE ROSSELLON Y CERDAÑA," CA. 1687. During the 1670s, the engineer and artillery master Borsano worked on this map of Catalonia, which set out the main features of the province with remarkable fidelity and was copied for many years.
Size of the original: 233 × 291 cm. Photograph courtesy of the BNM.

the French and English as well, were printed and disseminated throughout the Western world, those of Spanish cartographers tended to remain in manuscript form in the archives. The prime example of this is the project that gave rise to the Escorial Atlas, and this draws our attention to another aspect of the problem—that is, the apparent inability of successive Spanish governments to carry projects through to successful conclusion.

It seems idle to claim, as some authors do, that this was because of a defective administrative system or to the indifference of the monarchs. On the contrary, as we have seen, the monarchs were remarkably map conscious, and the various councils were at least as efficient as their counterparts in other, more productive, parts of Europe. What we need to remember is that during these years Spain was engaged in a huge enterprise of overseas colonization. That enterprise was not only political, but also technical and cultural, and took and diverted the energies of her best statesmen and technicians. We have to ask ourselves if Philipp Apian and Christopher Saxton, famous for their maps of Bavaria (1568) and England (1579), would have been drawing maps of European areas if they had been Spaniards. Almost certainly they would have been engaged in trying to map the sea lanes, coastlines, and interior regions of Spain's great and growing empire, for her attention and energies were keenly engaged across the Atlantic.

The maps that did emerge in Spain reflect the nature of its social and economic structure. There is nothing to compare with the contemporary English estate map, for there was nothing in Spain to compare with the precocious cap-

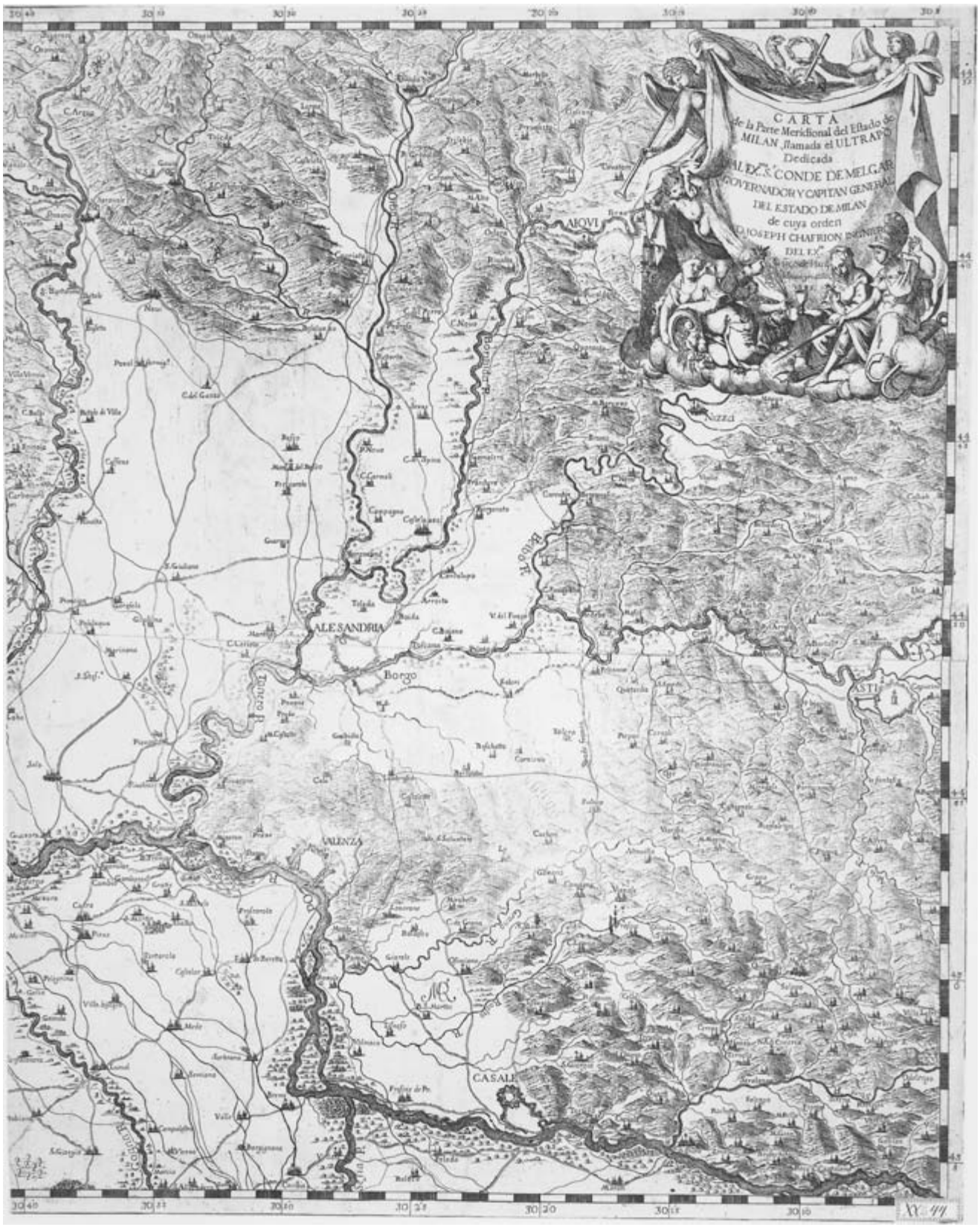

FIG. 39.22. JOSÉ CHAFRION, RIGHT HALF OF THE *CARTA DE LA PARTE MERIDIONAL DEL ESTADO DE MILAN,* 1685. In the late seventeenth century, Chafrion, like Borsano, succeeded in delineating a province, in this case Milan, with such accuracy that the map remained in use for many years.

By permission of Houghton Library, Harvard University (Liechtenstein Collection, *51-2469 PF).

italization of English agriculture.[88] The huge exchange of land involved at the Reformation and the subsequent burgeoning of the London market had no counterparts in Spain.[89] On the other hand, there were many maps whose makers sought to set out the position and territorial boundaries of Spanish cities, for Spain's culture was essentially an urban culture from the time of the Romans and therefore much concerned with the control exercised by the cities over the countryside. The monarchs, too, initiated many cartographic ventures, not only the abortive ones of the 1510s and the 1570s, but also the ones that ensured that many Spanish and Netherlandish cities, sketched by Antoon van den Wijngaerde and Jacob van Deventer, would appear in the *Civitates orbis terrarum* of Georg Braun and Frans Hogenberg. In short, in Spain as elsewhere, cartographic production faithfully reflected economic and social possibilities.

88. For an attempt to work out the incidence of estate maps in early modern Europe, and to explain their absence in Spain, see David Buisseret, ed., *Rural Images: Estate Maps in the Old and New Worlds* (Chicago: University of Chicago Press, 1996). For helpful material, see Andrés Bazzana and André Humbert, *Prospections aériennes: Les paysages et leur histoire, cinq campagnes de la Casa de Velázquez en Espagne (1978–1982)* (Paris: Diffusion De Boccard, 1983).

89. I would like to acknowledge the help of the Casa de Velázquez in Madrid, whose director allowed me to send a circular to the roughly twenty French scholars then working in Spain on subjects that might have revealed the existence of estate plans before 1700. Almost all replied, but almost all the replies were negative.