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# *Cartography in the European Enlightenment*

PART 2

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townscapes. The *Engenheiro portuguez* concentrated on medium-scale topographic maps, instructing how to measure distance and accessible surfaces by using practical geometry and trigonometry. It also described the instruments and techniques used for surveying terrain, drawing elevations and perspectives of cities or buildings, transferring plans to a larger or smaller scale, and representing in aerial perspective the landscape around the city. Azevedo Fortes further highlighted the conventions, codes, and techniques of representation and of coloring maps (composition of pigments, techniques of watercolors, and the design, use, and role of colored symbols) (Bueno 2004, 226–27).

Adopted by the military academies, these two works unified the practice of cartographic representation in Portugal by introducing international rules and principles as discussed in similar French treatises, such as Jacques Ozanam's *Methode de lever les plans et les cartes de terre et de mer* (1693) and Nicolas Buchotte's *Les regles du dessein et du lavis* (1721/1722) (Bueno 2011, 102–27).

Urban maps of Portuguese America were created using instruments and techniques to measure lengths and plane surfaces, determine the volume and dimensions of a solid, and triangulate and measure space. These included the *prancheta circular moderna* (an ancestor of the theodolite), chains, ropes, and landmarks. To create perspective townscapes, engineers used the Dürer grid or the camera obscura (Bueno 2011, 124–25).

The reforms proposed by Azevedo Fortes for teaching mapmaking at the military academies had a positive effect; drawings multiplied and showed considerable technical refinement. Attractive cartouches framing titles and legends mirrored the aesthetic taste of the period (from Baroque to Rococo); the cartouche was one of the few elements on a map in which the engineer was free to escape from the increasingly codified rules of spatial representation that required increasing mathematical discipline.

<div align="right">BEATRIZ PICCOLOTTO SIQUEIRA BUENO</div>

SEE ALSO: Portuguese America

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***Urban Mapping in the Portuguese East Indies.*** The Portuguese tradition of mapping the empire's towns and fortresses in the East Indies on the eve of the Enlightenment is well illustrated by the "Livro das plantas de todas as fortalezas, cidades e povoações do Estado da Índia Ori-

ental" from 1635. This work includes fifty-two views and plans drawn or collected by Pedro Barreto de Resende, the secretary of the viceroy of India, together with texts by the chronicler António Bocarro. The work responded to orders issued by Filipe III of Portugal (Felipe IV of Spain) after five decades of Spanish rule in the context of the Iberian Union (1580–1640), at a time when Gaspar de Guzmán, count-duke of Olivares, sponsored a number of mapping projects on the Iberian possessions in Europe and other continents. Due to the strategic value of these materials, their publication was forbidden by law, thus reducing their circulation. Resende further improved and enlarged this work with a volume entitled the "Livro do Estado da Índia Oriental" (ca. 1636). The latest known version of this "Livro" is dated 1646 (London, British Library, Sloane MS 197), yet the seventy plans of eastern cities and fortresses included in a manuscript atlas by the royal architect João Nunes Tinoco in 1663 are still little more than reproductions of Resende's pictures (Lisbon, Biblioteca da Ajuda, MS 46–XIII–10). Simplified versions of the work compiled by Resende can be found in the influential *Asia portvguesa* of Manuel de Faria e Sousa (1666–75) (Garcia 2007, 405–15; 2009, 25–40; Oliveira 2009, 26–28; 2017, 42).

The roots of these works go back to sixteenth-century urban iconography, namely the views in the "Lendas da Índia" produced ca. 1550–63 by the chronicler Gaspar Correia in India under the viceroy João de Castro (Lisbon, Arquivo Nacional Torre do Tombo) (Alegria et al. 2007, 1017–19), who had himself prepared maritime rutters containing harbor views and plans. Two atlases made by the Luso-Malaysian cartographer Manuel Godinho de Erédia in 1610–ca. 1620 also contained harbor views and plans (Alegria et al. 2007, 1022–24; Oliveira 2017, 43–44).

Despite the difficulties of circulation imposed on these materials, they served as a basis for many plans and views of Portuguese cities in the East Indies produced in Europe, such as those by Arnoldus Montanus (*Ambassades mémorables*, 1680), Allain Manesson-Mallet (*Description de l'univers*, 1683), Pieter van der Aa (*La galerie agreable du monde*, 1690–1700), Alphonsus Lasor a Varea (*Universus terrarum orbis scriptorum calamo delineatus*, 1713), Joseph-François Lafitau (*Histoire des découvertes et conquestes des portugais*, 1733), and Antoine François Prévost (*Histoire générale des voyages*, 1746–70).

A number of new and more accurate representations of Portuguese cities—namely those captured by the Dutch, such as Mangalore, Cannanore, Cranganore, Cochin, Quilon, Jaffna, Colombo, Galle, and Malacca—also appeared in Northern European contexts. The two most important surviving possessions of the Portuguese in Asia, Goa and Macao, are thus represented in Dutch,
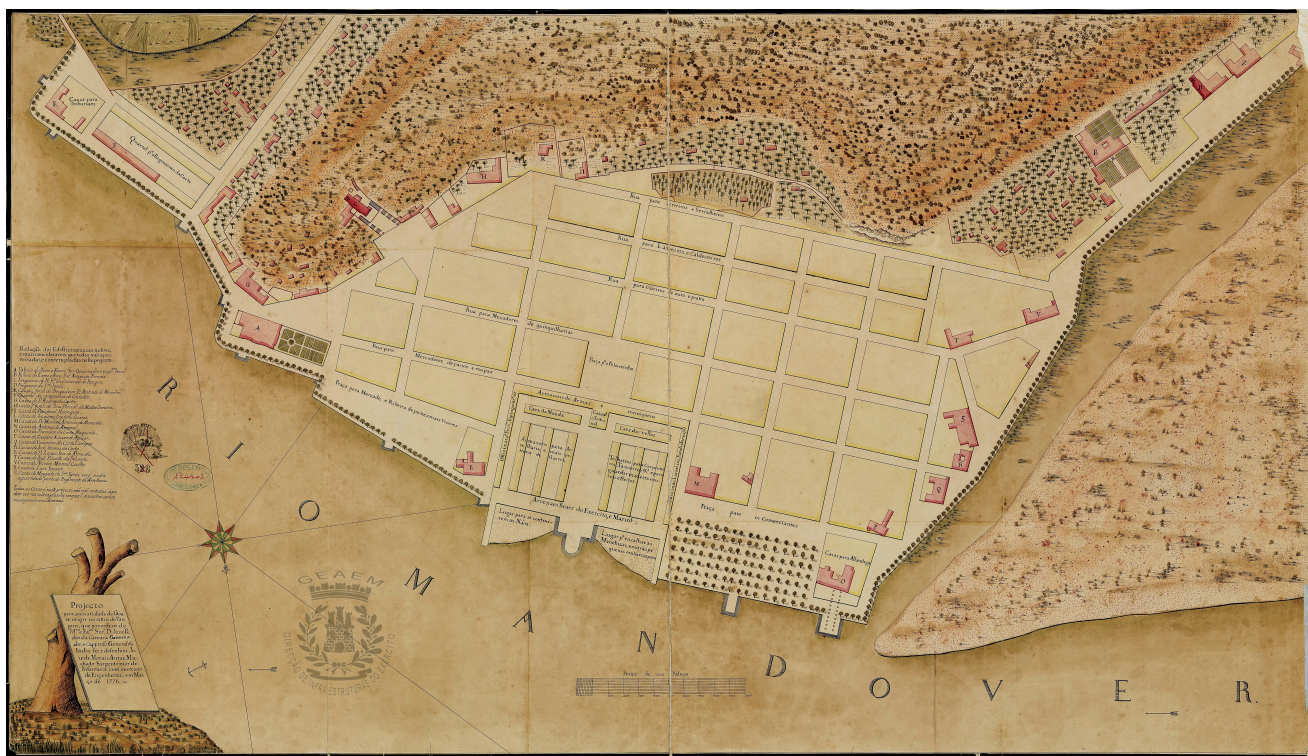
FIG. 924. PROJECT FOR THE NEW CITY OF GOA TO BE BUILT IN PANGIM. "Projecto para a nova cidade de Gôa se erigir no sittio de Pangim," 1776, by José de Morais Antas Machado; manuscript with watercolor.

Size of the original: 67 × 118 cm. Image courtesy of Portugal/Gabinete de Estudos Arqueológicos da Engenharia Militar/Direção de Infraestruturas do Exército, Lisbon (1236-2A-24A-111).

English, and French manuscripts and printed cartography: e.g., the manuscript work of Joannes Vingboons (ca. 1665, The Hague, Nationaal Archief, VELH 619; Zandvliet 2007, 1441–42) and Jacques-Nicolas Bellin, *Le Petit atlas maritime* (1764). The two mapping traditions—Portuguese and non-Portuguese—ran mostly parallel to each other during the eighteenth century. In the case of Macao, Portuguese plans influenced Chinese and Macanese cartography as witnessed in manuscript versions in Beijing, Zhongguo diyi lishi dang'an guan 中国第一历史档案館 (First historical archives of China), ca. 1678–1808, and in printed versions in Ruan Yuan 阮元, *Guangdong tongzhi* 廣東通志 (Comprehensive gazetteer of Guangdong), 1822, and Liang Tingnan 梁廷枏, *Yuehai guan zhi* 粵海關志 (An account of the Guangdong customs), ca. 1840.

As is the case with topographical mapping, a number of manuscript maps made by the Portuguese in the East Indies during the first half of the eighteenth century represent fortresses, some of which are urban in character, that were besieged by local powers including Mombasa (ca. 1727), Bassein and Tana (1739), Alorna (1746), and São Tomé de Meliapor (ca. 1749) (Teixeira da Mota 1979, 10–21). New and substantially more rig-

orous representations appeared in the second half of the century under the influence of the "enlightened" government of Sebastião José de Carvalho e Melo, marquês de Pombal (1750–77), and as a consequence of the institutional and technical innovations introduced during those years, for example in Mozambique (plans of the island and town by Gregório Taumaturgo de Brito, ca. 1754, and various plans by Carlos José dos Reis e Gama, 1786–1802), in Diu (plan by João António Águia Pinto Sarmento, 1783), in Daman (plans by José de Morais Antas Machado and Pedro Paulo Rodrigues da Fonseca, 1774–78, and two other anonymous plans from the late 1700s), in Goa (water color map of the island by Faustino António Gomes da Silva, 1812–48), and in Macao (hydrographic and topographic plan by Joaquim Bento da Fonseca, 1808) (Teixeira da Mota 1979, 34–35, 40, 68–69; Graça 1986, 30).

In the wake of the great earthquake of Lisbon (1755) Pombal's government invested heavily in urban planning. Plans were also made in India to rebuild the capital of the Estado in Goa or relocate it to either Mormugão (plans lost) or Pangim (1776) (fig. 924). The ambitious designs made by the military engineers Machado and Sarmento in 1774–77 follow the techniques and con-

ventions of the Lisbon plans made in the 1750s (Rossa 1997, 44–47, 93–111).

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SEE ALSO: Portuguese East Indies

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*Urban Mapping in Russia.* The earliest surviving urban maps in Russia include plans and drawings of Russian fortresses. Dating to the early seventeenth century, plans of fortress towns on the frontier were considered essential to the construction of defensive lines. In the 1630s, for example, when the Voennaya kollegiya planned the Tula defensive line, it asked for drawings attached to reports about the projected fortifications. The Tula de-

fensive line drawings have not survived, but it is clear from the documents that the final plan represented the fortifications in great detail (Kuzin 1955, 141–42). It is unknown whether these were measured scaled plans or topographic drawings.

In the 1720s, Peter I's European geodesists turned their attention to towns and cities. Abandoning traditional bird's-eye views and drawings, they produced plans based on instrument surveys made to scale with more or less standard symbols. On the whole, eighteenth-century plans of Russian towns, fortresses, and villages, both manuscript and printed, can be divided into four groups: plans showing the actual geographical situation, an urban ensemble of parts and whole; plans showing proposals of how ensembles might develop, often detailing buildings; plans showing proposed designs approved by the emperor; and report plans showing urban development or redevelopment in progress. Two or more of these plans often were combined (Postnikov 1996, 41).

The vast majority of Russian fortress and town plans made during the century were commissioned by state entities with different needs such as the governing senate, Pravitel'stvuyushchiy senat; the war collegium, Voennaya kollegiya; and the main chancellery of artillery and fortification, Kantselyariya glavnoy artillerii i fortifikatsii. During the early instrumental surveys of the 1720s–40s, state geodesists drew up plans of the towns and cities in the areas they were mapping. In 1733, for example, Moisey Dmitriyevich Smetyev and Aleksey Zhikhmanov presented the senate with a 1:42,000 plan of the town of Kashin showing churches and distinguished homes (Goldenberg and Postnikov 1990, 46). Although the majority of plans remained in manuscript, a handful were published by the Akademiya nauk, for example, a 1737 two-sheet plan of St. Petersburg at ca. 1:12,600, annotated in Russian and German (Postnikov 1996, 49, fig. 26), and a 1741 plan of Moscow engraved in copper (fig. 925). The Russian printing facilities at the time were poor and concentrated mainly in the Morskaya akademiya and Akademiya nauk, which published charts for the navy and small-scale maps and atlases. The only private publishing house specializing in educational and translated foreign maps and atlases belonged to Vasiliy Onufrievich Kipriyanov. Town plans remained mainly manuscript documents for use in governmental offices. The sale of printed plans was very small.

Under Catherine II, governmental urban mapping was enforced in an effort to establish measured and scaled urban plans of all the towns of the Russian Empire. Catherine II's general land survey, General'noye mezhevaniye, which began in 1765, made urban surveys a crucial part of the state's largest and most comprehensive cartographic project to date. The *uyezd* and *guberniya*