N

Nagayev, Aleksey Ivanovich. Born in 1704 in Sertyakino, Russia, to a landed gentry family, Aleksey Ivanovich Nagayev entered the St. Petersburg naval academy, Morskaya akademiya, in 1715. He graduated with honors and acquired a tutoring position at the academy at age eighteen. In 1724, he was promoted to the rank of sublieutenant and was teaching navigation, charting, and map compilation.

Nagayev led the most crucial stage in the Russian charting of the Baltic. Between 1736 and 1740, he studied and corrected Russian maps and with Johann Ludwig von Pott Luberas charted the inshore waters in the Gulf of Finland. After serving as a naval line officer in various waters, Nagayev was commissioned by the Admiralteystv kollegiya to carry out official mapping and charting work. The Admiralteystv kollegiya gave him the task of compiling summary charts based on materials from Vitus Bering's Second Kamchatka Expedition (1732–42).

Nagayev was engaged in this task as a head of a commission attached to the Morskaya akademiya for all of 1745. The commission's major contribution was the *General'naya karta Rossiyskoy imperii* (1757), a general map of the Russian Empire including the northern and eastern shores of Siberia. Between 1748 and 1751 he carried out intensive surveys of the Baltic, which resulted in the publication of his atlas, *General'nyye i raznyye spetsial'nyye karty vsego Baltiskogo morya*, in 1750, based on the Swedish atlas of Nils Strömcrona.

Nagayev's most notable contribution to Russian cartography was the compilation of the navigational charts of the Baltic, engraved in 1752. Remarkable for their precision and quality, they were published as the *Atlas vsego Baltiyskogo morya* in 1757, an expansion of Nagayev's 1750 atlas. The 1757 atlas contained fifteen plates from the 1750 atlas, two from a 1714 Russian atlas, and twenty-seven entirely new maps. Elegantly and richly ornamented in the Baroque style, many of the cartouche engravings were clearly designed to glorify Russia's naval might (fig. 585).

Although published, these maps were for navy use and barely known to Western European seafarers; for reasons of security, the Russians tried to make sure no other navy obtained copies of the charts. Nagayev nevertheless enjoyed great esteem in Russian naval circles. The 1757 atlas was republished many times under the title *Lotsiya ili morskoy putevaditel'*.

After charting the Baltic, Nagayev returned to his work on the Kamchatka Expeditions, and in 1767 he presented a new manuscript chart of the northern Pacific Ocean, "Karta morskaya merkatorskaya," to the Admiralteystv kollegiya (Efimov 1964, 95, pl. 140). The overall accuracy of Nagayev's work was confirmed when the expedition of Pëtr Kuz'mich Krenitsyn and Mikhail Dmitriyevich Levashov reported back to St. Petersburg in 1771. Nagayev's chart, however, remained secret and unavailable even to the Akademiya nauk, whose charts published in 1756 and 1775 did not include all the findings derived from Russian exploration of the Pacific Ocean.

Beyond his charting achievements, Nagayev played an important role in Russian naval higher education. From 1752 onward he supervised reform in the Morskaya akademiya; organized the naval cadet corps, Morskoy shlyakhetskiy kadetskiy korpus; and directed that corps for eight years. During the Seven Years' War (1756–63), Nagayev headed the hydrographic survey of Prussia's coasts. The end of his career also was notable for his promotion to rear admiral, vice admiral, and, in 1769, full admiral, as well as for service on the Admiralteystv kollegiya. Nagayev died in 1781 at St. Petersburg.

ALEXEY V. POSTNIKOV

SEE ALSO: Marine Charting: Russia

BIBLIOGRAPHY

Alekseyev, A. I. 1959. *Admiral Nagayev*. Magadan: Knizhnoye Izdatel'stvo.

Berkh, V. N. 1836. *Zhizhneopisaniye Admirala Alekseya Ivanovicha Nagayeva*. Zhizhneopisaniya pervykh rossiyskikh admiralov, ili opyt istorii rossiyskogo flota. 4 vols. St. Petersburg: V Morskoy Tipografii.

FIG. 585. TITLE CARTOUCHE ON NAGAYEV'S MAP OF THE EASTERN PART OF THE GULF OF FINLAND. From Nagayev's *Atlas vsego Baltiyskogo morya*, 1757.

Size of the entire original: 61 × 82 cm; size of detail: ca. 23.0 × 28.5 cm. Image courtesy of the National Library of Scotland, Edinburgh.

Efimov, Aleksey Vladimirovich. 1964. *Atlas geograficheskikh otkrytiy v Sibiri i v Severo-Zapadnoy Amerike XVII–XVIII vv*. Moscow: "Nauka."

Goncharov, V. G. 1956. "Admiral Aleksey Ivanovich Nagayev—Vydayushchiysya russkiy gidrograf XVIII v." *Izvestiya Vsesoyuznogo Geograficheskogo Obshchestva* 88:187–89.

Kokkonen, Pellervo. 1997. "Practice of Marine Cartography and the Russian Representation of the Baltic Sea in the Eighteenth Century." *Fennia* 175:1–96.

Nationalism and Cartography. There are many definitions of nationalism, but most of them hold it to be an ideology or even a doctrine that makes the nation paramount and implies a national identity based on cultural, linguistic, or ethnic lines. The nation is seen to be the most natural and valid collectivity of humans beyond the family, and it should therefore be incorporated into a sovereign political unit, the nation-state (e.g., Leerssen 2006, 14, 79). The nation-state supported by cultural nationalism is a phenomenon associated primarily with the nineteenth and twentieth centuries (although there were precursors aplenty). Benedict Anderson (1991, 36) remarked that modern nationalism grew up only with the dissolution of the old certainties, such as revealed religion and royal divine right, which for Western Europe only occurred at the end of the eighteenth century. For the Enlightenment, therefore, we are looking not so much at modern populist nationalism, but the popularized later phases of state formation: the state was being imposed, and the state's political elites sought the support of the people of the nation rather than simply the endorsement of the monarch.

That maps could assist in and be harnessed for these purposes is not in doubt. Cartography has been particularly associated with the assertion of national unity at the expense of diversity within, the declaration of one state's territorial ambitions vis-à-vis another's, and overarching claims of empire (Wintle 2016). Christian Jacob (2006, 57, 240) thus called the map on the wall "the visual glue of a sense of national identity," and asserted that the mastery of space through maps "probably constitutes an essential stage in the process of acculturation of the individual in the formation of . . . a national identity." Maps have been employed to focus early forms of national loyalty since at least the sixteenth century, and not only by the state: the Jacobite movement in the early eighteenth century regularly used maps of Great Britain in its campaign for Stuart reinstatement (Barber and Board 1993, 78–79). Cartography can perform a "'nationalising' function" by standardizing locations in the map, and in charting both physical and human geography at the same time the map can unite a population with its natural surroundings (such as German forests, or maritime England) to express the nation (Cubitt 1998, 10–11). Maps, therefore, "have the power to transform discourses of national identity" (Daniels 1998, 128–29).

An obvious early example of this nationalism by means of cartography would be the famous *Leo Belgicus*, or lion in the shape of the Low Countries (the Seventeen Provinces), created during their struggle against the tyrant Spain. It was in print in various forms from 1579 well into the eighteenth century and represented "an *image* of the nation" (Hoenselaars 1993, 96; Van der Heijden 1990). Although the lion could be facing either left or right and its vague and changing boundaries demanded a considerable suspension of disbelief, there is no arguing with the power of the image to draw together scattered feelings of territorial nationhood and indeed to stimulate further ones. Such feelings of unity in the Seventeen Provinces of the Southern and Northern Netherlands (approximately an enlarged Benelux) were indeed necessary in the early stages of the Dutch Revolt against Spain, and then in the Eighty Years' War, which finally delivered a modern Dutch state of just seven northern provinces and their dependencies in 1648. The community was indisputably imagined rather than actual, but the *Leo Belgicus* maps were indubitably of assistance to the required imagination.

A seminal study on the functions of cartography in the consolidation and indeed generation of early feelings of national identity was Richard Helgerson's *Forms of Nationhood* (1992), which traced the spatial visualization of England in various narratives, including maps and atlases of the late sixteenth and early seventeenth centuries, principally those by Christopher Saxton, Michael Drayton, and William Camden. He was able to demonstrate a move in cartographic treatments away from a state envisaged in terms of the monarch, as emblematic of the nation, toward a conception in which the personification Britannia became representative of the nation. Britannia stood for loyalty to the land, landscape of the country, and people, as opposed to fealty toward the dynasty. Helgerson's work was influential in persuading scholars of national identity and of literature to pay attention to the discursive role of the visual and especially the cartographic media in "writing the nation" (Helgerson 1992, 298). He was careful to point out that, in the seventeenth century at least, neither France nor the Low Countries shared this particular trend. French maps continued to be an ode to the emblem of the state in the form of the monarch, while the Dutch were feeding "a nascent bourgeois republicanism" (Helgerson 1992, 146–47, 300). Were these different forms of cartographic nation building still current in the long eighteenth century? Certainly in the nineteenth century maps were used to help imagine or even create the nations: historical maps were employed to show the evolution of the nation, and the map of the nation as a logo was used on certain nationalist propaganda material (Anderson 1991, 174–75). But what happened during the Enlightenment?

In applying poststructuralist principles to the cartography of the eighteenth century, J. B. Harley asserted that maps of the European states "served still as a symbolic shorthand for a complex of nationalist ideas" (Harley 2001, 162). There were new conditions pertaining to Europe in the later seventeenth century and throughout the eighteenth. States were taking on new forms, with bureaucrats, enclosing landlords, soldiers, and colonizers all wanting maps for their various purposes. The business of making and selling maps was, more than ever, governed by factors of supply and especially demand in the cartographic marketplace. That demand generally increased from the political, military, landowning, and fiscal authorities (Pedley 2005). How did the relationship between cartography and emergent nationalism, modern or otherwise, fare under these changing conditions?

The major change was the continuing emergence of stronger, more centralized states that wanted more recorded information about both their internal and external affairs. There was a rising demand for clarity regarding geographical borders, especially after wars or other international disputes. The Treaty of Ryswick (1697), which ended the Nine Years' War between Louis XIV and much of the rest of Europe, traced the agreed borders on appended maps. Similarly, delegates who drafted the Treaty of Paris (1783) relied on late versions of John Mitchell's 1755 map of North America to define the border between the United States and Canada (Edney 2008, 70).

Probably the most obvious new form of cartography during the Enlightenment that affected the nation and national feeling was the national triangulation survey. French minister of state Jean-Baptiste Colbert had made active use of maps in his administration since the 1660s, and it was the highly centralized French state that led the way, encouraging the labors of the Cassini family. These great surveys created an unprecedentedly detailed image of the state, in which the nation could imagine its territoriality, especially in the revolutionary reorganization of French territory communicated through the *Atlas national* (1790–94) (see fig. 732). The Austrians followed suit in the Southern Netherlands, while Peter I invited the Delisle brothers, Joseph-Nicolas and Louis Delisle de La Croyère, to Russia to produce a great *Atlas Rossiyskoy* (1745) consisting of a general map and nineteen regional maps (see fig. 316). In Britain, a number of privately funded large-scale surveys were undertaken in the eighteenth century, as well as state-sponsored military ones, which foreshadowed the establishment in 1791 of what would become the Board of Ordnance's national survey. Sweden, Denmark, and Norway were fully surveyed in the course of the century, and Switzerland had its own *Atlas Suisse* (1796–1802). The German territories and the United Provinces were also included. The Napoleonic state embraced the ideology of the information-packed national survey, which resulted in the introduction of the *cadastre*, or land registry for the purposes of taxation, in most of the satellite states. Highly detailed surveys were launched, laboriously carried out, and then completed in the early part of the nineteenth century, for example, in the Netherlands by 1832. These surveys were undoubtedly, in the first place, functions of state building, which responded to the needs of new-style, highly centralized governments. These governments needed to visualize and assess everything within, alongside, and over their boundaries for the purposes of taxation, civil and military security, the law, and governance. At the same time, the resulting publications, unique in their completeness, detail, accuracy, and comparability across regions, allowed a visualization of the state in which the nation could project itself with unparalleled clarity.

A number of examples can serve to make the point. In Scotland, a series of surveys in the eighteenth century right up to 1830, made initially for military purposes, allowed the visualization of the Scottish nation in a context of "geography, Enlightenment and the public sphere"; it was further developed in the familiar direction of cultural nationalism in the remainder of the nineteenth century (Withers 2001, 112–57, esp. 142–57). In Russia, Peter I was a great patron and utilizer of cartography; his capture of the fortress of Azov in 1696, with its potential to allow access to the Black Sea, was commemorated in

FIG. 586. DETAIL OF MUSCOVY, DIVIDED BETWEEN "MOSCOVIE ASIATIQUE" TO THE EAST AND "MOSCOVIE EUROPE" WITH "RUSSIE MOSCOVITE" TO THE WEST, 1700. From Guillaume Delisle, *L'Europe dressée sur les observations de M.rs de l'Academie royale des sciences et quelques autres* (Paris, 1700).
Size of the entire original: 46 × 60 cm; size of detail: ca. 28 × 24 cm. Image courtesy of the Bibliothèque nationale de France, Paris (Cartes et plans, Ge D 12052).

a new map of those parts just five years later. In a campaign to "civilize" Russia, he turned Muscovy toward Europe rather than Asia, establishing for the first time for Russia the Ural Mountains as the border between the continents. This included his Western Muscovy, with its new capital in St. Petersburg on the Baltic, at the heart of Russia but nonetheless firmly and irretrievably within Europe. In a 1695 edition of Nicolas Sanson's world map, Muscovy had occupied a kind of no-man's-land between Europe and Asia, while Tartary (the eastern reaches of the empire) was definitely placed in Asia. A map of Europe by Guillaume Delisle, published in Paris in 1700, split Muscovy into a western and eastern part (fig. 586). Meanwhile, a map of Europe by Adam Friedrich Zürner, published by Petrus II Schenk later in the eighteenth century, had labeled Tartary as Siberia, which became the general usage (Wolff 1994, 191). The use of such new maps of the Enlightenment encouraged Peter I to rearrange the spatial manifestation of Russia from an extra-European identity to a Europe-facing, "civilized"

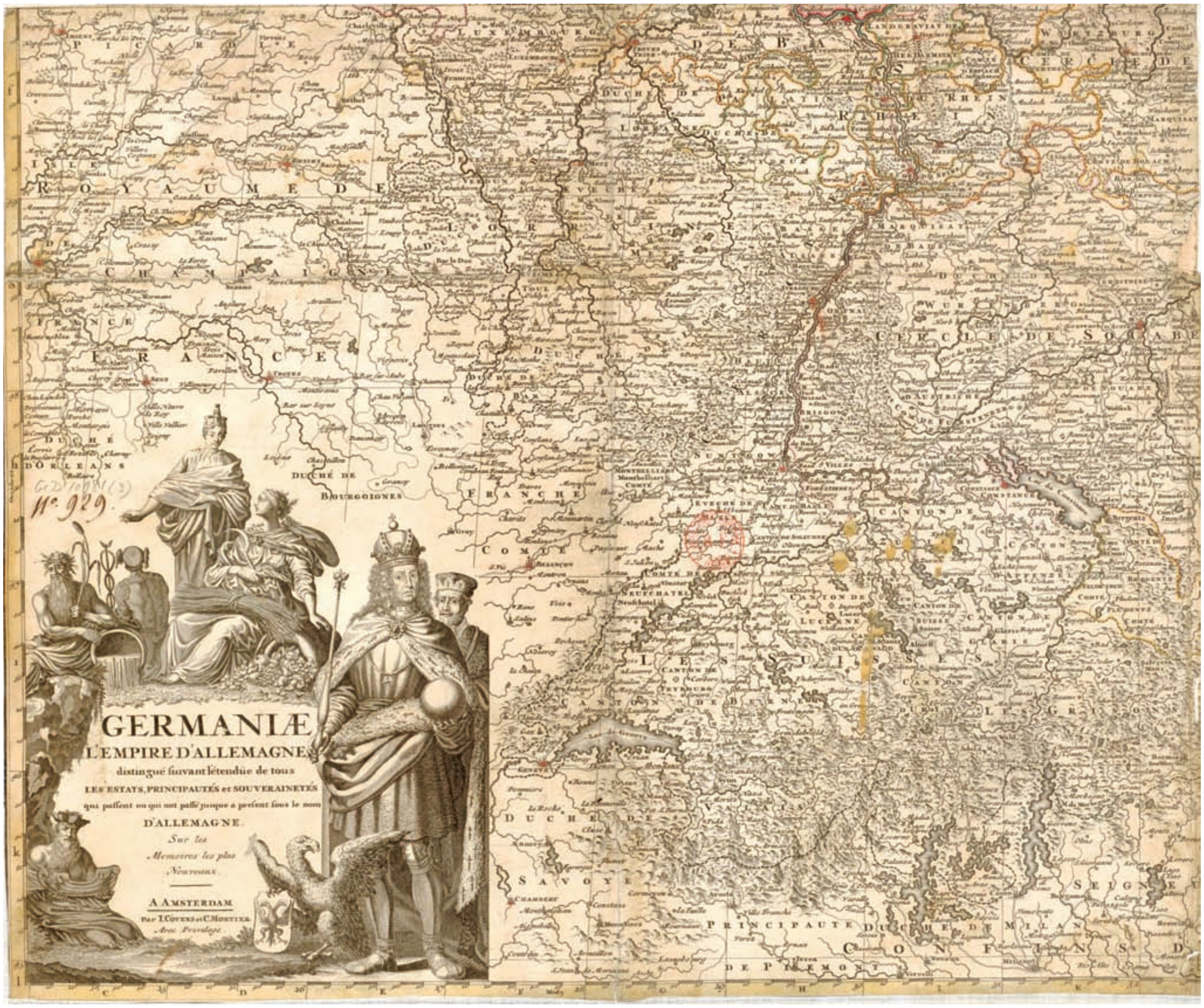


FIG. 587. DETAIL FROM JOHANNES COVENS AND CORNELIS MORTIER, *GERMANIÆ: L'EMPIRE D'ALLEMAGNE DISTINGUÉ SUIVANT L'ÉTENDÜE DE TOUS LES ESTATS, PRINCIPAUTÉS ET SOUVERAINETÉS* (AMSTERDAM, 1734). Size of the entire original: 50 × 60 cm; size of detail: ca. 24 × 30 cm. Image courtesy of the Bibliothèque nationale de France, Paris (Cartes et plans, Ge D 10981).

country with European culture and orientation. The nation of Russia had abandoned Tartary, prevaricated over Muscovy, and embraced Europe, switching its gaze from East to West in a few short decades, due not least to managed trends in cartographic practice.

The German lands were also an interesting case. In the nineteenth century, of course, unification of a large part of the German-speaking principalities (specifically excluding Austria) under the leadership of Otto von Bismarck would be achieved and ably assisted by maps composed for that purpose. In the period of the Enlightenment, however, the myriad states were effectively independent within the Habsburg-dominated Holy Roman Empire. A 1715 map published by Johannes Covens and Cornelis Mortier of Amsterdam was titled *Germaniæ: L'Empire d'Allemagne*. Although evidently referring to the totality of the German nation, the borders of the various statelets and principalities were clearly shown: nationalism may have been the aspiration in the cartouche, but it was not yet manifested on the map (fig. 587). Maps well up to the end of the eighteenth century continued to show the many German states, but more and more maps of Europe tended to demonstrate a new Europe of emergent nation-states, led by France and England, but with Germany and the Austrian Empire increasingly being shown as single units.

European nations also sought to assert their national pride and qualities in maps of other parts of the world where they had influence and therefore a chance to express their cultural nationalism. Increased accuracy and improved surveying methods meant that scientific authority could be expressed through maps in support of national claims abroad, especially in the North American colonies from the 1680s onward. British colonial maps of North America often showed the territory as empty and ripe for the taking by the nations of Europe (Harley 2001, 134–46). The process of "othering," or defining one's own (national) identity by making observations about alterity, or "otherness," was widespread in the mapping of the colonial areas of the world. In the Indian subcontinent, Britain's cartographic activities in the eighteenth century were not only extensive, bolstering imperial administration and control, but they also asserted the national identity by imposing order and science on the apparently unruly Indian landscape, replete with symbols of British national identity, as in the cartouche of James Rennell's 1782 map of the East India Company's claims in South Asia (fig. 588). Britannia is shown dispensing imperial order to the inhabitants of "Hindoostan" and receiving into her protection a "shaster" (*sastra*), or Hindu sacred legal code, from the pundits or Brahmins. Sepoys point out on a monument the names of the British victories that won her a place in India. A lion is at Britannia's back pawing a globe; symbols of the arts, architecture, and mapping (a palette, a mallet, and dividers) are strewn at her feet; and British merchant ships are seen in the background being loaded with sacks of trade goods. Britannia's spear rests on a bolt of cotton cloth, the economic key to the colonial relationship, and the surrounding wreath supports more Western arms and the opium poppy, essential to the lucrative trade with China. The caduceus of Mercury emphasizes the commercial theme of empire, and the scale bars elsewhere on the map symbolize the ordering of chaotic India by means of Western science. It is a most eloquent expression of imperial themes, especially tribute, but is also an embodiment of nationalist sentiment and identity through cartography in an imperial connection (Edney 1997, 12–15).

An equally cogent example was Napoleon Bonaparte's expedition of 1798–99 to Egypt. This military operation included a huge team of experts in many scientific, economic, and administrative fields (including mapmaking). He arrived with the express intention of bringing scientific civilization to the Orient: the duty to carry civilization underpinned a right to conquer the world and improve it. The economic success and excellent governance of the nation of France were being celebrated as national virtues, set against the rich but chaotic, external, Egyptian, and Oriental "other" (Godlewska 1995).

Finally, there were also changes in maps induced by

FIG. 588. CARTOUCHE FROM JAMES RENNELL, *HINDOOSTAN* (LONDON, 1782).
Size of the entire original: 81 × 80 cm; size of detail: ca. 28 × 22 cm. Image courtesy of the Geography and Map Division, Library of Congress, Washington, D.C. (G7625 1782 .R4).

variations in fashions, trends, and taste. Some of those alterations affected the way in which national feelings were or could be portrayed. For example, it began to be popular in the eighteenth century to use color to link countries together in a thematic way: all the territories owing allegiance to one monarch might be colored the same. Fads in the education of children could also be important. The use of maps to teach geography as a kind of game was well known in seventeenth-century France, and it caught on in England in a big way in the second half of the eighteenth century. Many jigsaw puzzles and board games were made in the form of maps of the British Isles; for example, John Wallis's 1794 *Wallis's Tour through England and Wales: A New Geographical Pastime* allowed children of all ages to follow a route around the territorialized nation, visualizing the national geography from a young age. Beyond that, the jigsaw could be used to emphasize national difference by producing a map of Europe or the world with pieces for each nation. One such map from 1766, *Europe Divided into Its Kingdoms* by John Spilsbury, permitted the pupil to detach each kingdom as a single piece. Interestingly from the point of view of nationalism, this map presented all of Italy as a single piece and similarly combined the Southern and Northern Netherlands. For Scotland, however, there was a piece separate from England and Wales, as there was for Ireland. The consistency of the geography is not the point: it is the suggestion that certain nations form states or kingdoms that was the invitation and encouragement to think in nationalist terms.

Not only in jigsaws and board games was this geography lesson in nationalism perpetrated. Embroidery samplers were also marshalled into the service of educating the female youth of the day. These samplers could be designed around a single nation, or a continent, such as Europe. The outlines were printed, usually on silk or satin, and sold to be embroidered as practice pieces or samplers. An anonymous English sampler (Cambridge, Fitzwilliam Museum, T.142-1938) probably from the 1780s, shows Germany, Italy, Hungary, and Poland as separate undivided territories, which in the late eighteenth century would not have accorded with the views of the crowned heads and their ministers. In comparison, the British Isles were divided into Scotland, England, and Ireland (Humphrey 1997, 104–5). Not all such samplers were the same, and some reflected more complex nonnational situations. However, a discourse was taking place in these cartographic forms created by new markets at the government, landlord, and consumer level, which enabled and indeed encouraged the consideration of nationalist feelings of loyalty and their visual territorialization.

There is little doubt that mapmaking was in the service of the state during the Enlightenment period, as it had been since the sixteenth century. The systematic way in which such service was commissioned and provided in much of the eighteenth century led to a major increase in accuracy and reliability and an emphasis on objectified territory rather than simply an allegiance to a dynasty or a religious figurehead. This could increase the weakness of a dynastic state like the Holy Roman Empire, which would indeed be finally abolished in 1806 at the hands of Napoleon. Many of the developments were products of and a support for the evolving European state, but they also allowed the subject of the nation to be aired, discussed, and contested. Truly modern, Romantic, cultural nationalism would have to wait for the nineteenth century, but its early forms were active in Europe throughout the modern period, especially in the age of Enlightenment, leaving room for the visualization of the nation as a people in a territory through the cartographic forms of the long eighteenth century.

MICHAEL WINTLE

SEE ALSO: Boundary Disputes and Cartography; Consumption of Maps; Games, Cartographic; Projections: Geographical Maps; Public Sphere, Cartography and the; Revolution, French; Samplers, Map

BIBLIOGRAPHY

Anderson, Benedict. 1991. *Imagined Communities: Reflections on the Origin and Spread of Nationalism*. Rev. ed. London: Verso.

Barber, Peter, and Christopher Board. 1993. *Tales from the Map Room: Fact and Fiction about Maps and Their Makers*. London: BBC Books.

Cubitt, Geoffrey. 1998. "Introduction." In *Imagining Nations*, ed. Geoffrey Cubitt, 1–20. Manchester: Manchester University Press.

Daniels, Stephen. 1998. "Mapping National Identities: The Culture of Cartography, with Particular Reference to the Ordnance Survey." In *Imagining Nations*, ed. Geoffrey Cubitt, 112–31. Manchester: Manchester University Press.

Edney, Matthew H. 1997. *Mapping an Empire: The Geographical Construction of British India, 1765–1843*. Chicago: University of Chicago Press.

———. 2008. "John Mitchell's Map of North America (1755): A Study of the Use and Publication of Official Maps in Eighteenth-Century Britain." *Imago Mundi* 60:63–85.

———. 2009. "The Irony of Imperial Mapping." In *The Imperial Map: Cartography and the Mastery of Empire*, ed. James R. Akerman, 11–45. Chicago: University of Chicago Press.

Godlewska, Anne. 1995. "Map, Text and Image, the Mentality of Enlightened Conquerors: A New Look at the 'Description de l'Égypte.'" *Transactions of the Institute of British Geographers*, new series 20:5–28.

Harley, J. B. 2001. *The New Nature of Maps: Essays in the History of Cartography*. Ed. Paul Laxton. Baltimore: Johns Hopkins University Press.

Heijden, H. A. M. van der. 1990. *Leo Belgicus: An Illustrated and Annotated Carto-Bibliography*. Alphen aan den Rijn: Canaletto.

Helgerson, Richard. 1992. *Forms of Nationhood: The Elizabethan Writing of England*. Chicago: University of Chicago Press.

Hoenselaars, Ton. 1993. "Europe Staged in English Renaissance Drama." In *Borders and Territories*, ed. Joep Th. Leerssen and Manet van Montfrans, 85–112. Amsterdam: Rodopi.

Humphrey, Carol. 1997. *Samplers*. Cambridge: Cambridge University Press.

Jacob, Christian. 2006. *The Sovereign Map: Theoretical Approaches in Cartography throughout History*. Trans. Tom Conley. Ed. Edward H. Dahl. Chicago: University of Chicago Press.

Leerssen, Joep Th. 2006. *National Thought in Europe: A Cultural History*. Amsterdam: Amsterdam University Press.

Pedley, Mary Sponberg. 2005. *The Commerce of Cartography: Making and Marketing Maps in Eighteenth-Century France and England*. Chicago: University of Chicago Press.

Wintle, Michael. 2016. "Emergent Nationalism in European Maps of the Eighteenth Century." In *The Roots of Nationalism: National Identity Formation in Early Modern Europe, 1600–1815*, ed. Lotte Jensen, 271–87. Amsterdam: Amsterdam University Press.

Withers, Charles W. J. 2001. *Geography, Science and National Identity: Scotland since 1520*. Cambridge: Cambridge University Press.

Wolff, Larry. 1994. *Inventing Eastern Europe: The Map of Civilization on the Mind of the Enlightenment*. Stanford: Stanford University Press.

Naudin Family. The Naudin brothers—Jean-Baptiste (d. 1743) and Jacques (1673/74–1744)—represent a first generation of engineers trained in the field, gaining experience during the War of the League of Augsburg (1688–97) and the War of the Spanish Succession (1701–14). Never integrated into the royal corps of engineers (Génie), the brothers focused their activity on topography.

Jean-Baptiste, known as Naudin l'aîné, served on the Rhine between 1688 and 1692, where he produced his first known maps, those of Philippsbourg (1688 and 1690) and Rheinfels (1692). Subsequent campaigns in Flanders allowed him to produce his first synthetic work, "Théâtre de la guerre en Flandres" (1700), a sumptuous collection of twenty-one manuscript maps (1:72,000) in the style of works produced by Pennier in the same period. During the War of the Spanish Succession, Jean-Baptiste participated in all the most important campaigns and battles, including Maubeuge (1705), Malplaquet (1709), Douai (1710), Bouchain and Le Quesnoy (1712), and Fribourg (1713). The long period of peace from 1713 allowed him to concentrate on producing his "Théâtre de la guerre en Allemagne," completed in 1726. The long topographic and military descriptions that accompany the approximately sixty manuscript maps and plans in the collection demonstrate its use as a practical work rather than a prestigious volume. From 1726, Jean-Baptiste devoted himself to directing a family workshop that employed at least four draftsmen. In 1733, he was appointed as supervisor of the Dépôt des cartes et plans of the ministère de la Guerre, a post retained until his death on 2 April 1743. The influential book, *L'ingénieur françois* (1695), which describes the application of geometrical principles to the representation of terrain, is attributed to Jean-Baptiste Naudin, among others.

Jean-Baptiste's younger brother, Jacques, was known first as Naudin le jeune, then Naudin cadet, and finally Naudin père. He began in the service of Maximilian II Emmanuel, elector of Bavaria, and last governor of the Netherlands under the Spanish regime. Jacques seems not to have participated in any military campaign, instead producing essentially topographic surveys in Flanders until the battle of Ramillies (1706), then in the Duchy of Lorraine as far as the area of the Hundsrück (Hunsrück Mountains) and the Duchy of Deux-Ponts (Zweibrücken). He returned to France for good and settled in Versailles with Jacques Denis, son-in-law of Jean-Baptiste, and his own son Jean-Jacques (d. 1752), who had worked with him from 1731 but did not join the royal corps of engineers until just before 1737. Jacques Naudin died in Versailles in 1744, where his son died in 1752, leaving little trace of his work.

The extent of the territory covered by the Naudin surveys at a scale of 1:28,800 was completely new and shows the concern of the royal government for obtaining dependable topographic coverage of the frontier provinces (fig. 589). Produced over more than thirty

FIG. 589. DETAIL FROM "CARTE TRES PARTICULIERE DU COURS ET DES ENVIRONS DE LA MEUSE DEPUIS S.T MIHEL JUSQUES A VNE DEMIE LIEÜE AU DESSUS DE DUN," 1:28,800. Compiled between 1739 and 1741 from the survey made in 1738 by Jacques Naudin and his relative Jacques Denis, this large manuscript map represents landscape in a manner geared to military needs: fortified towns shaded in pink, the varied colors and symbols for different types of ground, detailed distribution of woods and forests, elevation shown by hachuring, and all rendered at a scale allowing for strategic planning of the march.
Size of the entire original: 235 × 307 cm; size of detail: ca. 33 × 63 cm. Image courtesy of the Bibliothèque municipale de Metz (RES ROL 013).

years, the map quality is uneven. However, despite the numerous distortions resulting from the difficulty of assembling surveys, as well as numerous inexactitudes, they made an important contribution to the knowledge of the territory and its strategic use. They also contained a density of data not seen again for more than a century until the publication of the carte de l'État-Major.

MARIE-ANNE CORVISIER-DE VILLÈLE

SEE ALSO: Engineers and Topographical Surveys; League of Augsburg, War of the; Military Cartography: France

BIBLIOGRAPHY

Corvisier-de Villèle, Marie-Anne. 1995. "Les Naudin et la cartographie militaire française de 1688 à 1744." In *L'œil du cartographe et la représentation géographique du Moyen Âge à nos jours*, ed. Catherine Bousquet-Bressolier, 147–73. Paris: Comité des Travaux Historiques et Scientifiques.

Lemoine-Isabeau, Claire. 1984. *Les militaires et la cartographie des Pays-Bas méridionaux et de la principauté de Liège à la fin du XVII^e et au XVIII^e siècle*. Brussels: Musée Royal de l'Armée.

Wagner, Pierre-Edouard. 2003. "Les Naudin en Lorraine." In *Les Naudin entre Meuse et Vosges*, 7–32. Metz: Médiathèque du Pontiffroy.

Navigation and Cartography. The practical importance of marine charts rests on the role of navigators in the improvement of the art and science of navigation. As the entry on marine charting in the Enlightenment makes clear, the creation of charts to be used for navigation relied heavily on information provided by the navigators themselves. This situation contrasted sharply with that of terrestrial cartography at various scales: on land, potential users did not necessarily gather the data required for the mapmakers. At sea the navigator (whether naval officer, coastal pilot, or merchant sailor) provided and evaluated cartographic data as he corrected the document that his data had helped to create (fig. 590). Yet some of the navigators providing the data for marine charts did not necessarily use these charts and, in certain cases, did not want to use these charts, just as there were many sailors, mainly operating in the oral tradition of coastal navigation, who did not provide data and who did not use these charts. The use of charts and the fundamental ability to evaluate them as accurate (or not) was determined by the potential consumer's level of education and mathematical expertise and whether the type of sailing was oceanic or coastal, that is, out of sight of land or within sight of land.

The gathering of marine data, chart creation, and a chart's navigational use revolved around two basic questions concerning position: where am I, and where am I going? Accuracy was relative, and this relativity depended on the technical ability of the sailor to answer these questions at the time the chart was made. Yet while accuracy was never 100 percent complete, it was a necessary condition for the viability of the chart. However rich the chart's data were, to be useful for positioning the chart needed to incorporate specific observations taken from a ship: if the chart concerned open waters, the absolute positions of the sun and stars, and if the chart was prepared near land, the relative position of landmark bearings, which had to be connected to absolute positions in latitude and longitude. The contemporary user's ability to judge accuracy thus depended on personal training and instrumental and mathematical expertise to understand and use the observational data to good effect. This criterion of accuracy was all the more important (if not the only important criterion) since positioning was one of the main goals of chartmaking in the eighteenth century (Chapuis 1999, 98).

FIG. 590. DETAIL FROM ARCHIBALD HAMILTON'S MANUSCRIPT "BOOK OF DRAFTS AND REMARKS," 1763. In this decoration the sailor employs an octant with his log board in front of him, at his feet a compass, a lead and line and log and line, ready for deployment. From "Book of Drafts and Remarks, with Lattitude, Longetude, of Places, of the Variation of the Compass, of Sands Shoals Sounding Seamarks, Anchorage, Roads, Bays, Harbours, High Water, and Setting of Tides, With the Best Directions for Sailing into Ports, or Roads, of Wooding, Watering, of the Setting of Currents, and Winds that Prevail on Different Coast," by Archibald Hamilton, 1763.

Astronomical and geodetic positioning on marine charts was approximate and developed only as the methods and tools evolved. Positioning in navigation was similarly approximate. Even though positioning improvements were at the cutting edge of the science and technology of the period, translating the results into graphic representations and texts that could be both understood by a scientifically literate elite and assimilated by the less proficient required a certain incubation period. This time lapse needs to be considered when studying the history of a practice, like navigation, in relation to maps. It is not simply a matter of knowing when innovative theories emerged, but understanding how, where, and when the theories evolved into practice.

Preaching to his own parish of longitude seekers, the celebrated clockmaker Ferdinand Berthoud summed up succinctly the primary challenge that faced marine cartography and navigation, handmaidens of commerce, war, and science in the eighteenth century: to fix positions in order to be able to return to them at will. "Thus before anything else, the true positions of all the places on the globe that need to be known must be fixed on the charts so that they can be navigated" (Berthoud 1773, 344–45). The critical urgency and enormity of the problem is shown by the fact that by the middle of the century, the error in longitude of the North Atlantic passages still frequently corresponded to the equivalent of three good days of navigation or more (Chapuis 1999, 25–26, 50). At the same time, the *Connoissance des temps* of 1753 listed 220 astronomical positions in latitude and longitude for the entire world, and only slightly more than 30 of them were outside of Europe. The 1785 *Connoissance* listed 870 positions, proof of both the work accomplished in thirty-two years and the enormous task that remained (Chapuis 1999, 26–27). As Joseph-Bernard, marquis de Chabert, noted: "What security is it for the navigator to know the position of his vessel on the globe, to almost a half of a degree, if the charts on which he is obliged to report his position were never able, through common astronomical and nautical methods, to become images that represent the landscape before him and the dangers he should avoid with the same accuracy of half a degree?" (Chabert 1785, 12).

ROLE OF THE NAVY In this era of scientific inquiry, the theory and practice of navigation occupied a unique position (Chapuis 1999, 140–43). It depended on marine cartography to record its progress in time and space, as expressed by the Scottish hydrographer Murdoch Mackenzie the Elder: "The Lives and Fortunes of Sea-faring Persons, in great Measure, depend on the Accuracy of their Charts" (Mackenzie 1750, 3). Because global trade in this period was carried out primarily at sea, sailing was at the heart of the scientific and technical research on which the performance and security of sea crossings depended. For most regions, state-run navies assumed responsibility for the secure and free flow of trade and colonial expansion, for which an educated elite naval officer corps was an essential component. By the end of the 1780s, there were 4,000 to 5,000 officers in European naval fleets, of whom 2,500 were in the British and French navies (Acerra and Meyer 1990, 187; Meyer 1982, 38).

Of these officers, only a small number were at the forefront of the scientific movement. Most officers, especially in Great Britain and the Netherlands, were barely involved in the sciences. Between ca. 1740 and 1770, French commercial navigation surpassed that of other European countries in terms of scientific knowledge, particularly in the period after the foundation of the Académie de marine (Brest, 1752; reorganized 1769), which graduated a new generation of scientific state naval officers before the French navy assumed its excellent position among European navies considered as spearheads of scientific knowledge (Chapuis 1999, 136–37, 154–58; Rodger 2003, 5). The maps and theoretical works of study-based geographers and scholars were shunned by the vast majority of navigators, especially the English, who preferred practice at sea to the theory of nautical manuals (Rodger 2003, 15). Nonetheless, the publication of manuals expanded, and the debate between theory and practice remained lively during the period (Chapuis 1999, 137–41, 158).

The stumbling block for many navigators was mathematics, a major language of the Enlightenment with many nuances (Rodger 2003, 5–8). Astronomy and navigation were the two branches of inquiry that engaged many of Europe's most brilliant scientists and technicians (through intellectual curiosity) and states (through self-interest). Occasionally, sailing instruments were developed by sailors and artisans with little scientific knowledge, but many projects never came to fruition. As for patenting innovations, most inventors appealed to learned societies—such as the Royal Society of London, the Académie des sciences in Paris, or the Académie de marine in Brest.

In general, navigators worried less about whether charts were accurate—and in fact they were not, until the correction of their longitudes—than about whether sailors could navigate accurately enough to understand that they were not. Yet, it is clear that some navigators employed the scientific and technological developments of their day better than others. Only a small elite was actually able to assess charts effectively based on data collected through the new methods and latest instruments, especially marine chronometers. Chartmakers had to successfully determine absolute points (through astronomy) and local points (through trigonometry) and draw the coastline on the chart in the best way possible, before any evaluation could be made of how closely the best navigators (including these surveyors) approached such an accuracy (Chapuis 1999, 98).

MERCHANT MARINE In addition to state navies, maritime commerce also developed considerably by the middle of the eighteenth century. In 1764, England counted 8,100 merchant ships, accounting for 590,000 tons; in 1776, it had 9,400 vessels totaling 700,000 tons. Through the century, the transport capacity of the British merchant fleet increased five- or sixfold (Meyer 1975, 255–56). Great Britain was the leading maritime and commercial world power with about 10,000 ships, holding close to 1,500,000 tons by 1785. France was a distant second, with half the number of merchant vessels for a global tonnage of 730,000. Its long-haul merchant fleet grew from 186,000 tons in 1743 to 427,000 in 1787 (Taillemite 1987, 31), with the value of French foreign trade increasing threefold in constant pricing in 1716–20 and 1784–88 (Chapuis 1999, 188). In 1785, the English and French together controlled about 45 percent of the available commercial fleet in the Western world, followed by the Netherlands (1,800 ships, for 400,000 tons), Denmark and Norway (3,600 vessels, for 400,000 tons), Sweden (1,200 ships, for 170,000 tons), and Spain (150,000 tons) (Meyer 1975, 255; 1989, 372).

Although the demand for nautical documents did not increase in proportion to this increase of traffic, since not all navigators used them in the same way, many did request them, such as French fishermen along the banks of Newfoundland and those sailing off the northern coast of France, who used Dutch charts (Chapuis 1999, 189–90). The military, too, required good detailed charts to avoid disaster, evidenced by an entire squadron rendered powerless off the south coast of England for lack of good charts in August 1779 (Chapuis 1999, 245–46). The development of global fleets required more charts and nautical instructions for the protection of men and cargo. The ships of the East India Company seldom had a tonnage of more than five hundred before 1750, but in the 1770s ships with nearly eight hundred tons began to grow in number, with ships finally reaching more than a thousand tons (Fry 1970, 242–43n51; Parkinson 1937, 164). As the tonnage of merchant vessels increased, their draughts and maneuverability became more compromised, requiring charts with soundings. The experience of the trading companies contributed in major ways to meet the challenge of safe navigation with better charts.

NAVIGATIONAL PROBLEMS The example of soundings on charts illustrates the balance between supply and demand for data. In the eighteenth century, soundings were still rare on most marine charts, especially in the approaches. If charts did include soundings, such as the Verenigde Oost-Indische Compagnie (VOC) charts along the Asian coasts, the accuracy of their positions was very questionable. In fact, the precision of soundings was not the main problem of the time, since to make a sounding in deep waters (requiring a thicker line and a heavier weight), the boat usually had to be slowed down, even brought to a standstill; thus, the ability to sound was not permanent.

Magnetic declination was another observation derived from navigation and essential in the interaction with the chart. The difference between compass bearings and true bearings and their relationship in space was widely studied in the eighteenth century (Chapuis 1999, 60–62). Yet before 1815, except for a few pioneers such as Matthew Flinders (Chapuis 1999, 660–61), French and British officers were generally not aware of the problems of magnetic deviations resulting from ferrous quantities along the coasts (Rodger 2003, 15). Alexander Dalrymple and others who were well familiar with the inconsistencies of the compass in surveying pointed out the difficulties of obtaining an accurate reading given the constant movement of a ship (Dalrymple 1771, 3).

Similarly, charts and navigation had to incorporate the data from research on the global grid of longitude and latitude. Improvements in determining the length of a degree of latitude followed the geodetic surveys along the equator in South America and near the North Pole, in the Gulf of Bothnia (Lapland), in 1735–45 under the aegis of the Académie royale des sciences and on the Cape of Good Hope in 1750–52 (Chapuis 1999, 90–92). The length of a degree of latitude affected the length of the nautical mile and the division of the log line. Although the determination of longitude occupied Enlightenment science throughout the century, even with many misconceptions and errors—often the case when the landlubber dealt with matters of the sea (Chapuis 1999, 158, 163)—it was a concern that eluded a good portion of the maritime community (Chapuis 1999, 137). From the late seventeenth century, interest in nautical education increased throughout most of the maritime states of Europe with the exception of France, where almost no progress was made until 1770 as the solution to the longitude problem required a substantial increase in navigational manuals or their complete overhaul (Chapuis 1999, 152–53).

It is important to consider also a point of vocabulary, at least in French. From 1630–50 to around 1800, *hydrographie* essentially referred to the art of navigating, in the sense of fixing the position or setting the course, in other words the navigation. The term was directly related to navigational instruction within schools of hydrography, which were rechristened schools of navigation in October 1795. At the same time, *hydrographie* also denoted marine cartography, a usage only gradually employed after 1750 and not fully evident until the very beginning of the nineteenth century (Chapuis 1999, 38–40).

TWO TYPES OF NAVIGATORS In the eighteenth century, two main groups of navigators coexisted in Europe and along the east coast of North America. The first comprised those who practiced offshore or inshore navigation. Offshore navigators (*grand cabotage*) lost sight of land only for short periods, almost always frequenting the same coastline or making a short crossing in the Mediterranean or along the coasts of Northern and Western Europe; they still required great skill, especially in the face of rocks or shoals and fierce tidal currents that swept the Atlantic coast. Similar dangers affected those inshore navigators (*petit cabotage* or pilotage) who confined themselves to a particular "nautical garden," where each stone was known nearly by heart. In France, as in England and elsewhere, inshore pilots such as the Trinity House pilots who navigated the Thames estuary took a single practical exam, devoid of theory, which barely referenced nautical documents; their atavistic knowledge was transmitted orally from generation to generation (Chapuis 1999, 147–50). Offshore navigation required a better theoretical background as the captains' level of knowledge increased in the eighteenth century.

The second main group of navigators sailed in open waters and undertook lengthy ocean crossings toward the coasts of America, Africa, and Asia out of sight of land. Their theoretical training addressed the problem of positioning at sea and the random landings that resulted from it, not only overseas but also on the return to Europe, with the inherent dangers of unpredictable dead reckoning, inaccurate nautical documents, and the inclement weather that existed for much of the year. Within this group, a clear distinction existed between officers of the navy and those of the merchant marine. During the eighteenth century, deep-sea pilots gradually passed their expertise on to these officers. As the officers acquired the skills of celestial navigation and use of nautical documents, the oral knowledge of pilots was gradually replaced by charts. In France alone, where relevant legislation had been very strict since Jean-Baptiste Colbert (the death penalty, though rarely employed, could legally be exercised for navigation errors), the functions of deep-sea pilots were gradually removed and finally eliminated by an ordinance of 1 January 1786. At the same time,

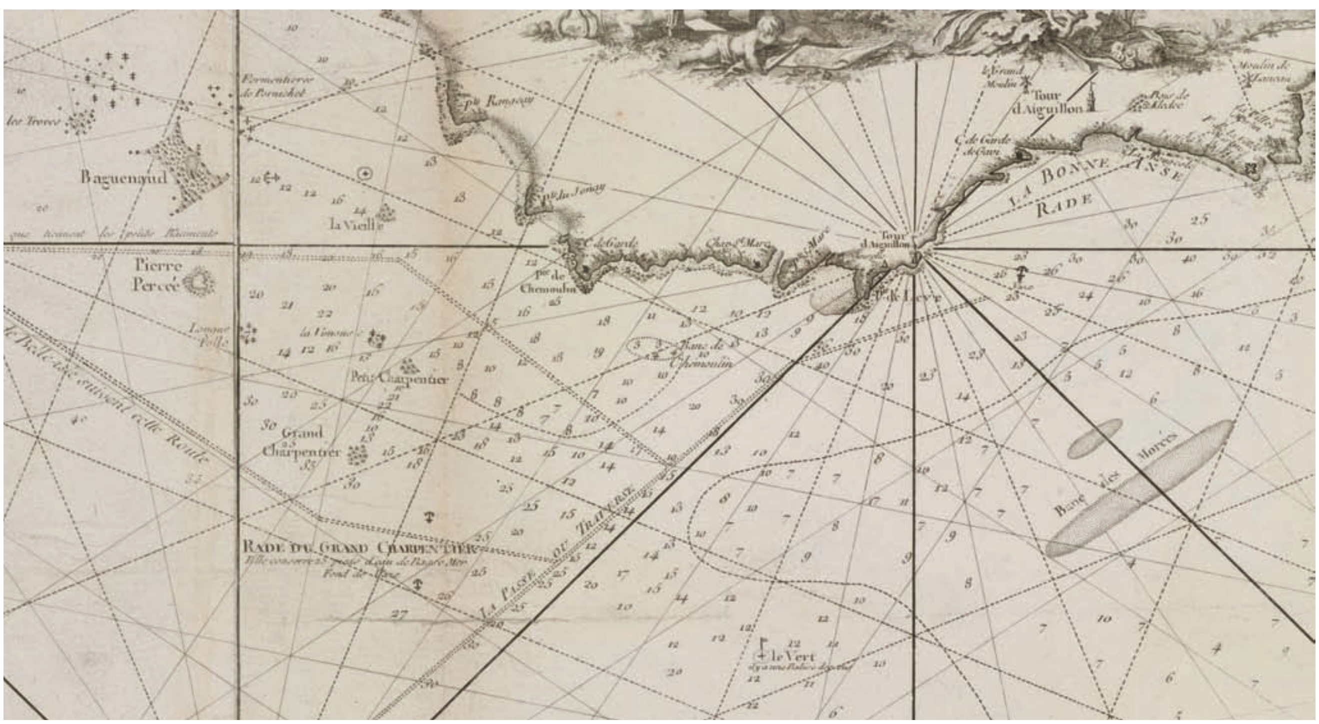


FIG. 591. DETAIL FROM MICHEL MAGIN, *CARTE GÉOMÉTRIQUE DE L'ENTRÉE DE LA RIVIERE DE LOIRE*, 1757. Engraved map, ca. 1:28,500. According to the author, this chart was one of the first to allow its user to function as a pilot in entering the estuary of the Loire. Magin incorporated one leading line, or line of alignment, on the chart for the navigator, using the two Tours d'Aiguillon as guides to enter safe waters, a representational device that was both modern and rare for the eighteenth century. Rocks, soundings, sea bottom, and beacons were based on local knowledge from pilots. An "Observations" text in an inset (not shown here) provided verbal information on tides, landmarks, and routes. Rhumbs are centered on some landmarks to make the bearings more fast. Size of the entire original: 66.0 × 99.5 cm; size of detail: ca. 20 × 37 cm. Image courtesy of the Bibliothèque national de France, Paris (Cartes et plans, Ge C 10084).

mooring or berthing assistants continued their job of bringing ships in and out of port (a practice that still exists), and coastal pilots continued to compensate for the deficiencies of nautical documents until the beginning of the nineteenth century, as new charts were slowly assimilated and used by navigators (Chapuis 1999, 146–47).

Through to the end of the eighteenth century, coastal pilots were employed throughout Europe, especially where the ocean floor was in constant flux due to currents and to alluvial depositions in estuaries (Chapuis 1999, 148–49). Even in the British Isles, Royal Navy officers hesitated to navigate without a pilot, their coastal experience not becoming sufficient until the end of the century (Rodger 2003, 15). Generally, only those with extensive knowledge of a region could enter a port with only their charts, their experience, and a mooring assistant. Nonetheless, some chartmakers were known to proclaim that their product could replace a local pilot, as Michel Magin claimed for his chart of the entrance to the Loire of 1757 (fig. 591). Magin drew a leading line on the chart for the navigator to follow to safe waters, a representational device that was both modern and rare for the eighteenth century. Magin was a naval engineer, a member of the Académie de marine, not a chartmaker, who was in charge of the hydrologic development of the Loire. His chart visually translated the knowledge he acquired from local pilots with whom he had daily contact, making it superior to the other charts by hydrographers of the period (Chapuis 1999, 134, 149).

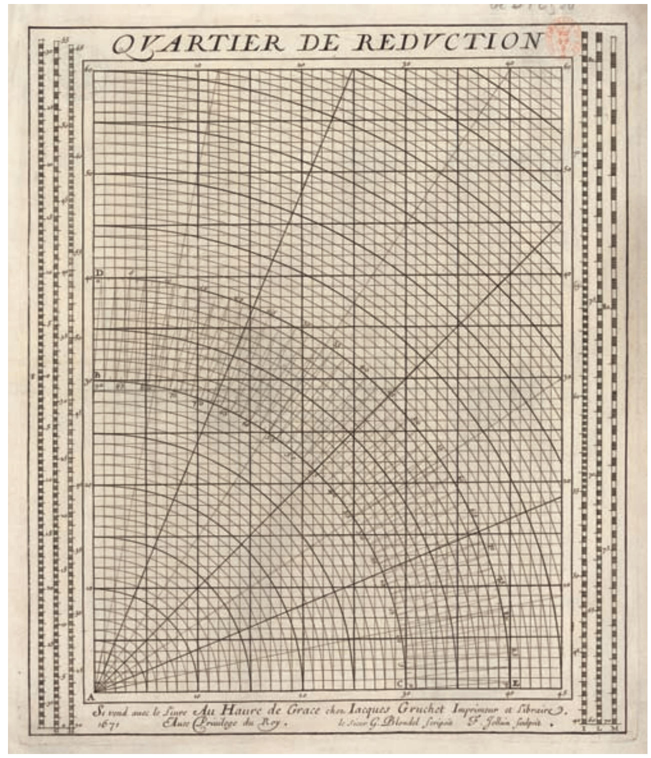


FIG. 592. ENGRAVED REDUCED QUADRANT OR *QVARTIER DE REDVCTION*, 1671. The reduction quadrant, printed on flat paper, provided a graphic solution to many navigation problems that involved trigonometry. A thread passed from the corner of the quadrant and along the divided arc, allowing the user to find sines, cosines, tangents, cotangents, secants, and cosecants when the radius is taken along its base, which is divided into sixty-five parts. This printed quadrant was sold at a bookseller in Le Havre.
Size of the original: 39 × 33 cm. Image courtesy of the Bibliothèque nationale de France, Paris (Cartes et plans, Ge D 12530).

COST AND INERTIA While charts increasingly found a place in the curriculum for teaching navigation, merchant seaman tended not to follow their professors' advice once their schooling was complete. Large-format atlases, such as *Le Neptune françois* and *The Atlantic Neptune*, were very expensive, as were the collections of the *Hydrographie françoise*. Jacques-Nicolas Bellin's *Le Petit atlas maritime* (five volumes) or the pilot books, which incorporated charts, were less expensive and more practical, but their small format did not allow for marking position on the chart. Instead, sailors used the reduction quadrant, or plotting chart, for this task (fig. 592), or even the ship's log, although this last method was discredited by scientific officers, such as Jean-Baptiste-Nicolas-Denis d'Après de Mannevillette, who was long familiar with helmsmen and their ways (Chapuis 1999, 51, 144–45).

The high cost of charts was a crucial problem. In France, the state willingly intervened to control costs in the Dépôt de la Marine (Chapuis 1999, 190–98), while in Britain, they were published commercially, allowing masters or captains to have their own charts made up or copied from other sources. Hydrographers such as J. F. W. Des Barres initially paid for the engraving and printing of his masterpiece, *The Atlantic Neptune*, before receiving government reimbursement (Hornsby 2011, 163–97). Similarly, Alexander Dalrymple had to turn to public subscriptions, despite the fiscal power of the East India Company (Fry 1970, 226–27).

Inertia, with its concomitant reluctance to embrace innovation, lay behind the slow adoption of the Mercator projection for marine charts well into the eighteenth century. It was developed, of course, in order to allow navigators to plot their compass bearings over long distances in a straight line, a critical process for maintaining estimated position at sea. Maintaining position near land was possible with the plane chart, used for very short distances on a large scale. The Mercator projection's effectiveness relied on the new mathematical tools of logarithms and integral calculus. Introduced in France only in 1693 and in Portugal in 1698, it was not widely used for navigation in Europe until well into the eighteenth century, even as late as between 1789 and 1794 in Spain, after the hydrographic reconnaissance of

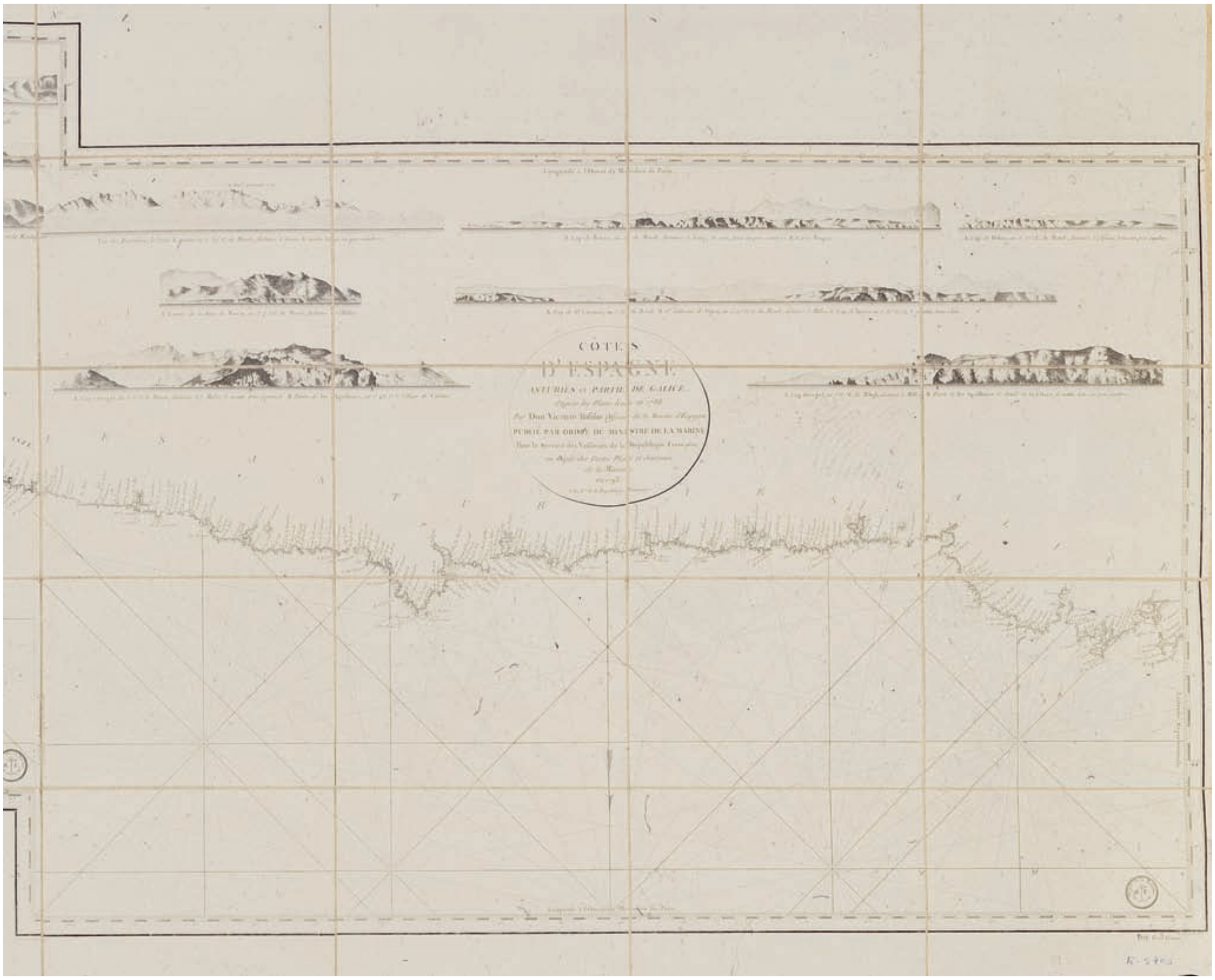


FIG. 593. DETAIL FROM THE RIGHT HALF OF VICENTE TOFIÑO DE SAN MIGUEL, *CÔTES D'ESPAGNE: ASTURIES ET PARTIE DE GALICE, D'APRÈS LES PLANS LEVÉS EN 1788* ([PARIS]: DÉPÔT DE LA MARINE, 1793). Engraved, ca. 1:3,085,000. Oriented with south at the top and extending between the latitudes of 43° and 44°, this plane chart shows a portion of Spain's northern coast. The combination of coast and views continued a type of representation on charts that remained highly valued in the eighteenth century. The Spanish hydrographer Tofiño de San Miguel adopted such a layout on this occasion by using views more frequently found during this period in pilot books.
Size of the entire original: 77 × 175 cm; size of detail: ca. 70 × 91 cm. Image courtesy of the Biblioteca nacional, Madrid (MV/3).

Alejandro Malaspina in the colonies. For most navigators, the Mercator chart competed with the usual plane chart and all the other tools, such as the ship's log or the reduction quadrant for keeping the estimated position in open seas before the solution to the longitude problem (Chapuis 1999, 52–53). The relatively reduced north-south dimension of a sea like the Mediterranean minimized the need for the increasing latitudes of the Mercator projection. Captains sailing there refused to use the first Mercator chart of the Mediterranean published by the Dépôt des cartes et plans de la Marine in 1737 (see fig. 206) (Chapuis 1999, 151–52, 170–71), instead swearing by plane charts and their traditional navigational techniques—forty-four years after the rejection of *Le Neptune françois* (1693), which had been rejected for the same reason by captains in France (Chapuis 1999, 103–6). Although the Dutch and English, by about the 1650s, occasionally used Mercator charts on the Atlantic run and the Dutch carried them on board the VOC ships, the Mercator projection was not in general use by navigators, especially if the plane chart still served for reaching a destination quickly and safely (fig. 593).

Thus, many navigators refused to use the very cartographic projection that provided the best graphic solution to rhumb lines: compass bearings and directions drawn in a straight line (Chapuis 2009, 34–41). The irony of this history is that sailors actually practiced orthodromy (the shortest distance between two points on the surface of a sphere, measured along the surface of this sphere), as generations of sailors had done before, often unwittingly without fully realizing that any shortest distance between two points in sight on the curved surface of the globe is in fact a portion of a great circle arc; only the most scientific navigator perfectly understood the mathematical theory of a great circle. Orthodromy was much more complicated to construct and implement at the scale of an ocean than to follow a constant course, making it difficult to employ in open sea waters until a later period when mechanical propulsion replaced the wind and the line of position allowed for more precise control of a great circle arc on a Mercator chart (see fig. 646).

IMPORTANCE OF SCALE Medium- and large-scale nautical charts in the eighteenth century were still a long way from replacing coastal pilots, and the sales numbers of the Dépôt des cartes et plans de la Marine reveal that marine charts were first and foremost tools for the open seas; their small scale was better at masking their substantial inaccuracies. Of the 4,184 charts and works delivered by the Dépôt des cartes et plans de la Marine to merchants on 28 February 1773, the strongest demand was for the descriptions of the straits of Santo Domingo (1,190 copies), a chart of the Atlantic Ocean (446 copies), charts of the Gulf of Biscay (240 copies), and charts of the Channel (202 copies). Demand for these sea charts exceeded that for more detailed maps, even though the primary danger for navigators was land. This low demand for larger-scale (detailed) charts may be explained by the preference of offshore navigators for pilot books, especially for their coastal views (see fig. 593). Interpreting a profile that could be compared to the coastline facing them was a more familiar technique than interpreting the zenithal view offered by maps (fig. 594). Practitioners of inshore navigation

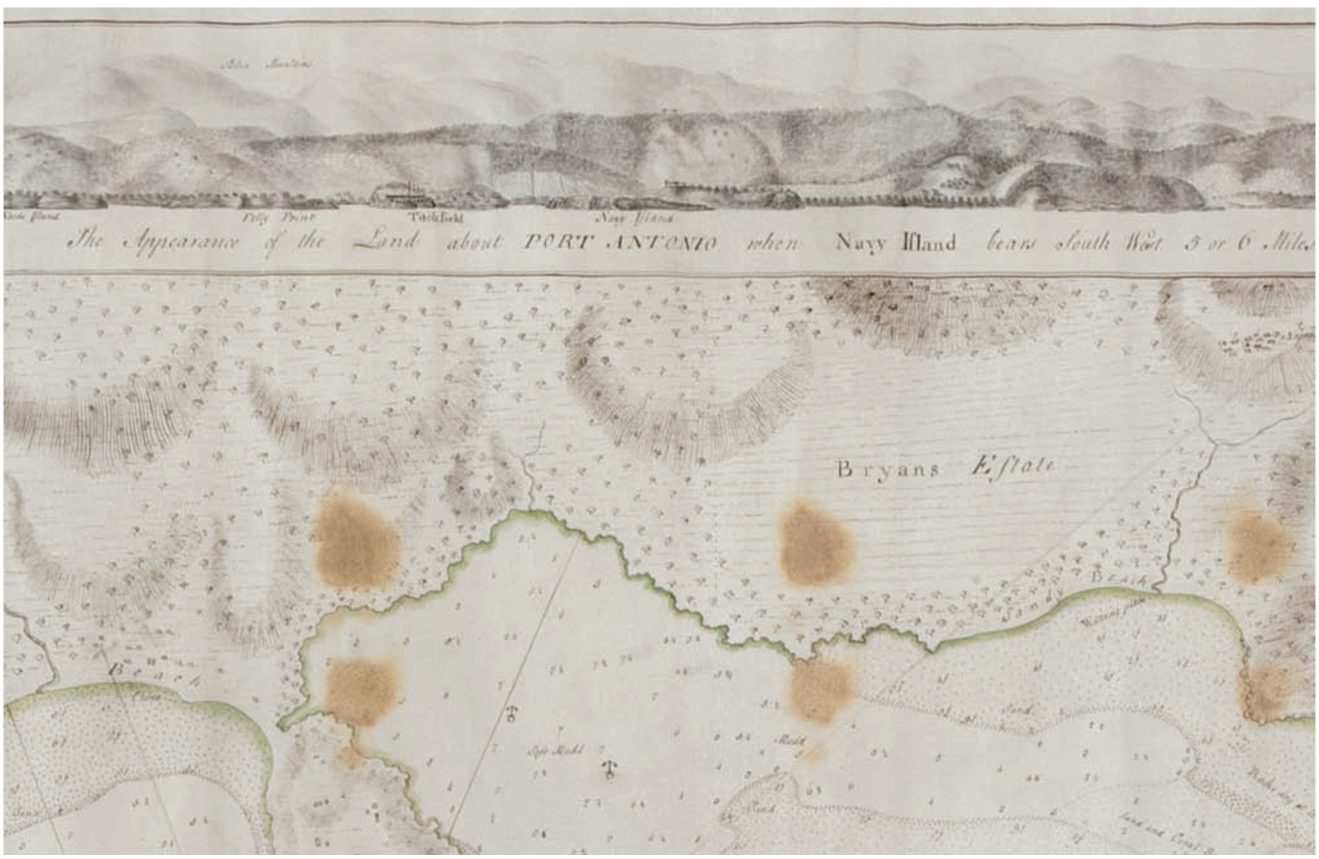


FIG. 594. DETAIL FROM CHARLES KNATCHBULL, "A PLAN OF THE HARBORS OF PORT ANTONIO IN THE ISLAND OF JAMAICA SURVEY'D A.D. 1770." Manuscript, ca. 1:60,000. The chart combines the large-scale elements of soundings, sea bottom description, anchorages, rocks, and other impediments, as well as the coastal view at the top of the chart and written directions at the bottom (not shown here), making it a graphic pilot book. The detail shows the rendering of coastline both planimetrically and with coastal view, preparing the sailor for landing with soundings, directions, and images.

Size of the entire original: 42.0 × 53.5 cm; size of detail: ca. 20 × 28 cm. Image courtesy of the William L. Clements Library, University of Michigan, Ann Arbor (Maps 8-I-1770 Kn).

relied on verbal knowledge (Chapuis 1999, 149–50). Finally, coastal pilots were not necessarily inclined to share their knowledge of coastlines with hydrographers, even though they became increasingly aware of their imminent obsolescence by the end of the eighteenth century. Manuscript large-scale charts, such as those used for coastal approaches, continued well into the 1700s and were copied for distribution.

Navigational errors gradually declined over the course of the eighteenth century, the result of the ability to maintain the estimated position more reliably, advances in education, and progress in celestial navigation. Methodological and instrumental development in celestial navigation was substantial in the eighteenth century, particularly from 1750 to 1775 (Chapuis 1999, 53–86). For the longitude question, the method of lunar distances and marine clocks encouraged the Atlantic test voyages and great circumnavigations, and allowed navies to correct their defective charts. These corrections offered a new positioning grid to navigators who were capable of locating themselves in two dimensions, and their number increased toward the end of the century in both state navies and in the merchant marine.

Yet troubles still arose for navigators returning to European coasts with tired crews, and ships confronted tricky meteorological conditions on the windward coastlines that were poorly marked. It was difficult to evaluate a chart if one did not know how to locate oneself on it accurately. The estimation error could play out in two ways since the disoriented navigator could attribute his confusion to his own estimation as well as to the chart itself. What use was a chart of the mouth of the Loire if one were in fact at the entrance to the Channel or off Ushant in a fog (Chapuis 1999, 177)?

COMPETENCE OF NAVIGATORS Nearly thirty years after finding a secure method for measuring time, still no more than a handful of sailors could calculate longitude using both lunar distances and marine watches. Charles-Pierre Claret de Fleurieu estimated their number to be fewer than a hundred for France in 1797, in the Marine and marine de commerce combined (Chapuis 1999, 653). For chartmaking, there were fewer than one-tenth as many: in 1791, Chabert stated that fewer than ten state officers knew how to use marine chronometers "for hydrography" in the latter half of the eighteenth century, or less than 1 percent of all active officers (Chapuis 1999, 306).

Around 1785, the precision attained by the great European observatories was within two seconds in latitude and, exceptionally, within fifteen seconds in longitude, as determined from the most precise terrestrial observations (Cassini, Méchain, and Legendre [1791], x–xi). These optimal values defined the limits of all other forms of observations not only for nautical applications, but also for geographical representation. In the improvised observatories of large scientific expeditions, astronomers sometimes recorded excellent results. The best navigators of the mid-1780s determined latitude at sea within one minute and longitude at sea from lunar distances within between fifteen and thirty minutes; Jean-François de Lapérouse reported a margin of error of twenty to twenty-five minutes (Milet-Mureau 1797, 2:47, 285). During a six-week crossing, longitudinal accuracy remained on the order of thirty minutes, as obtained by Étienne Marchand, officier de la marine de commerce, during his world tour from 1790 to 1792 (Fleurieu 1797–1800, 1:cxxxviii–526, 561, 2:3). Such accuracy was comparable to the best celestial navigation at the beginning of the twenty-first century within a minute of angle of both latitude and longitude. It was made possible by better instruments and improved measurement of lunar distances during the 1780s (Chapuis 1999, 304).

Between the voyages of Louis-Antoine de Bougainville (1766–69) and Lapérouse (1785–[88]), the observations of longitude by lunar distances gained thirty minutes of angle accuracy thanks to the lunar tables of *The Nautical Almanac* (1766), to more efficient instruments, and to the best reduction methods. Similar progress was made between the third voyage of James Cook (1776–80) and that of George Vancouver (1791–95), to a lesser degree between the voyages of Lapérouse and Joseph-Antoine-Raymond Bruny d'Entrecasteaux (1791–93). For the French, the reflecting circle of Jean-Charles Borda seemed to be the preferred measuring instrument for sailors (especially for lunar distances), astronomers, geodesists, and, not least, hydrographers. The English preferred their own exceptional sextants when at sea and their new theodolites when on land (Chapuis 1999, 305).

Yet the navigational skills of a military and civilian elite, so clearly evident on the large expeditionary voyages, were not paralleled in the mainstream of average officers, who were far from obtaining similar results. Given that inertia is a fundamental fact of the marine environment, the adoption of any new navigational and hydrographic technique requires an incubation time. It is not significant to remember the dates of the inventions if these inventions were not in wide-spread use, and especially if no one knew *how* to use them. At no other time did so many navigational innovations exist alongside so many archaisms, with so much scholarship masking so many deficiencies. What actions were taken to benefit the majority of navigators? European governments certainly tried to encourage the proliferation of the understanding of lunar distances and to simplify these calculations, since these practices had gained in accuracy since the 1770s, even though marine clocks were still largely inaccessible. In 1785, the French *ministre de la Marine* required the Académie royale des sciences to review the production of *Connoissance des temps* in order to bring its price down to a more affordable level for officiers de la marine de commerce who used it for lunar distances. While the cost of nautical documents impeded their diffusion in Europe, the cost control of charts sought by the French state in 1775 proved effective by 1791 (Chapuis 1999, 306).

CHALLENGE FOR THE NINETEENTH CENTURY The independent sailing of the navigator was the challenge of the next century, not only in open waters, but also near the coast, for landings as well as coastal navigation. If the eighteenth century had been the period of position fixing at sea in two dimensions, longitude and latitude, the nineteenth century would concentrate on the large-scale, even very large-scale, charts that would create high-definition hydrography, resulting in a complete overhaul of the littoral charts of Europe and North America to bring them to the same standard as that of land topography. Two goals stood out: to correlate sounding points to station points, themselves linked to the triangulation of the coasts, and to initiate bathymetric comprehensiveness, at least with selective representative soundings. A colossal task faced European hydrography at home and overseas.

Yet these vital tasks were not sufficient for the overall development of navigation and marine charts. In the wake of the European maritime elites of the period of the Enlightenment, entry-level navigators would also have to acquire two skills: to master the sea in all circumstances using the stars or landmark bearings, rather than with estimated position alone; and to develop a hydrographic understanding, that is, to be able to use a good chart at any scale for a given situation. For a sailor arriving on land from open sea, this succession of scales operated like a zoom from the smallest scale to the largest.

As the eighteenth century drew to a close, a demand grew for substantial and standardized markings and for more accurate charts, rich in detailed information, simpler and easier to read night and day: a steep challenge for hydrography to be met in the nineteenth century.

OLIVIER CHAPUIS

SEE ALSO: Longitude and Latitude; Marine Chart; Marine Charting; Pilot Book; Projections: Marine Charts; Sounding of Depths and Marine Triangulation

BIBLIOGRAPHY

Acerra, Martine, and Jean Meyer. 1990. *L'empire des mers: Des galions aux clippers*. [Paris]: Nathan.

Berthoud, Ferdinand. 1773. *Traité des horloges marines, contenant la théorie, la construction, la main-d'œuvre de ces machines, et la maniere de les éprouver, pour parvenir, par leur moyen, a la rectification des cartes marines, et a la détermination des longitudes en mer*. Paris: Musier.

Cassini (IV), Jean-Dominique, Pierre-François-André Méchain, and Adrien-Marie Legendre. [1791]. *Exposé des opérations faites en France en 1787, pour la jonction des observatoires de Paris et de Greenwich*. Paris: Institution des Sourds-Muets.

Chabert, Joseph-Bernard, marquis de. 1785. *Sur l'usage des horloges marines, relativement à la navigation, & sur-tout à la géographie*. Paris: Imprimerie Royale.

Chapuis, Olivier. 1999. *À la mer comme au ciel, Beautemps-Beaupré & la naissance de l'hydrographie moderne (1700–1850): L'émergence de la précision en navigation et dans la cartographie marine*. Paris: Presses de l'Université de Paris-Sorbonne.

———. 2007. *Cartes des côtes de France: Histoire de la cartographie marine et terrestre du littoral*. Douarnenez: Chasse-Marée.

———. 2009. *Du bon usage de la carte marine et du GPS*. Paris: Voiles et Voiliers.

Dalrymple, Alexander. 1771. *Essay on the Most Commodious Methods of Marine Surveying*. London: [N.p.].

Fleurieu, Charles-Pierre Claret de. 1797–1800. *Voyage autour du monde, pendant les années 1790, 1791, et 1792, par Étienne Marchand*. Édition in 4°. 4 vols. Paris: Imprimerie de la République.

Fry, Howard T. 1970. *Alexander Dalrymple (1737–1808) and the Expansion of British Trade*. Toronto: For the Royal Commonwealth Society by the University of Toronto Press.

Hornsby, Stephen J. 2011. *Surveyors of Empire: Samuel Holland, J. F. W. Des Barres, and the Making of "The Atlantic Neptune."* Montreal and Kingston: McGill-Queen's University Press.

Mackenzie, Murdoch. 1750. *Orcades: Or a Geographic and Hydrographic Survey of the Orkney and Lewis Islands in Eight Maps*. London: Murdoch Mackenzie.

Meyer, Jean. 1975. *Les Européens et les autres: De Cortés à Washington*. Paris: Armand Colin.

———. 1982. "Le contexte des grands voyages d'exploration du XVIIIe siècle." In *L'importance de l'exploration maritime au siècle des Lumières (A propos du voyage de Bougainville)*, ed. Michel Mollat du Jourdin and Étienne Taillemite, 17–39. Paris: Éditions du Centre National de la Recherche Scientifique.

———. 1989. *L'Europe des Lumières*. Le Coteau: Horvath.

Milet-Mureau, Louis-Antoine Destouff. 1797. *Voyage de La Pérouse autour du monde*. 4 vols. Paris: Imprimerie de la République.

Parkinson, C. Northcote. 1937. *Trade in the Eastern Seas, 1793–1813*. Cambridge: University Press.

Rodger, N. A. M. 2003. "Navies and the Enlightenment." In *Science and the French and British Navies, 1700–1850*, ed. Pieter van der Merwe, 5–23. Greenwich: National Maritime Museum.

Taillemite, Étienne. 1987. "La mer au XVIIIe siècle." In *La mer au siècle des encyclopédies*, ed. Jean Balcou, 17–38. Paris-Geneva: Champion-Slatkine.

Neptune du Cattegat et de la mer Baltique. Charles-Pierre Claret de Fleurieu, the encyclopedic intellect of the French navy, began the great cartographic project of his life in 1785 when he sharply attacked Nicolas-Gabriel Le Clerc, who had just published two maps of the Baltic Sea that proved unreliable for sailors (Chapuis 1999, 207–11). Fleurieu's deep interest in the Baltic reflected its strategic and economic importance for northern Europe; its complex hydrography with numerous reefs, shoals, and other dangers fascinated the marine geographer. Fleurieu believed it was vital for France to have its own maps of the Baltic that would synthesize maps published by states bordering the sea ([Fleurieu] 1794, 1). From August 1785, Fleurieu enlisted the services of the young Charles-François Beautemps-Beaupré to work on the atlas, which he published in his *hôtel particulier*, away from the Dépôt des cartes et plans de la Marine, but using funds from the Marine (Chapuis 1999, 284). Fleurieu envisioned a three-part work: maps assembled in an atlas (the *Neptune du Cattegat et de la mer Baltique*), nautical instructions, and a never-completed Description géographique et historique, militaire, politique et commerciale (Pastoureau 1992, 38). With his new assistant, and the aid of Pierre-François-André Méchain for foreign astronomical data (Chapuis 1999, 966n252), Fleurieu concentrated on compiling the best sources from all countries, whether printed or manuscript, often of high quality, since a number of geodetic projects from the end of the seventeenth century had focused on the Baltic Sea (Chapuis 1999, 284–85, 298).

On 17 March 1788, Fleurieu composed the preface to the *Fondemens des cartes du Cattegat et de la Baltique*, which did not appear until 1794. This very technical work was entirely devoted to justifying the astronomical and geodetic positions of the *Neptune du Cattegat et de la mer Baltique*. The accumulation of such a dense array of data demonstrates the importance of the project to the mathematical training of Beautemps-Beaupré for positions determined both astronomically and by triangulation (Chapuis 1999, 285). On each sheet, an inset titled "Fondemens de la carte" provided information on the multiple sources and the determination of points. Beautemps-Beaupré prepared and drew the maps under the direction of his cousin, Jean-Nicolas Buache (Chapuis 1999, 285). This eighteenth-century maritime compilation atlas, comprising all scales from general map to detailed plans, was one of the best of the period for its demonstrable rigor of construction.

Fleurieu planned seventy sheets, including sixty-six maps ([Fleurieu] 1794, 42). In fact, without counting two undated sheets and three views of coasts and ports, over a period of five years Beautemps-Beaupré prepared sixteen unfinished plans (usually lacking only insets) and forty-three finished maps. The expedition of Joseph-Antoine-Raymond Bruny d'Entrecasteaux distracted Beautemps-Beaupré from February 1791 until his return to Paris on 30 August 1796. From September, he worked

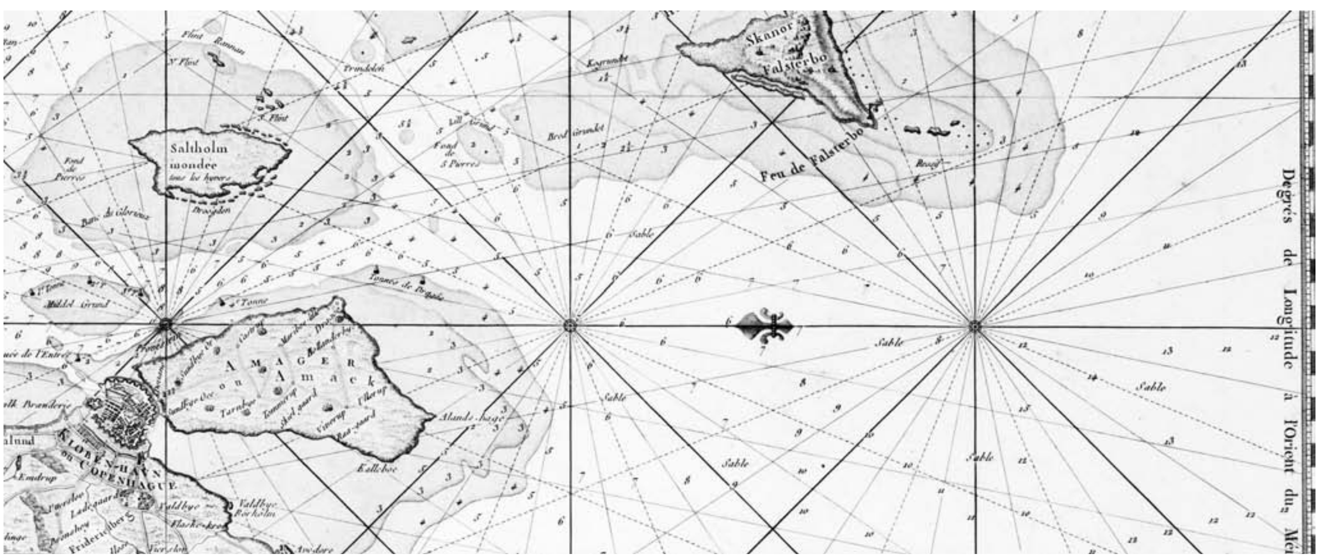


FIG. 595. DETAIL FROM *CARTE RÉDUITE DU SUND . . . DRESSÉE ET GRAVÉE 1786*, BY CHARLES-PIERRE CLARET DE FLEURIEU [COMPLETED BY CHARLES-FRANÇOIS BEAUTEMPS-BEAUPRÉ] ([PARIS: DÉPÔT GÉNÉRAL DE LA MARINE], 1809). Map engraved in one sheet, ca. 1:160,000. This map from the *Neptune du Cattegat et de la mer Baltique* is oriented with north to the left; the longitude scales, based on the Paris meridian, are thus along the left and right edges of the map with the latitude scale at the bottom of the sheet. The numerous soundings were compiled from work on land by Danish, Swedish, and Russian officers and thus not trigonometrically determined at sea. An inset (not shown) provides the basic data used for compilation. Although it has no legend, the nature of the bottom is clearly indicated; stippling marks are used for the sandbars; crosses show rocks and small isles covered and uncovered by tides. Buoys, important for the entrance to Copenhagen harbor, are also shown. Finally, the map demonstrates the fine linework resulting from new procedures for chart engraving established by Fleurieu from 1773 and executed in his own workshop during the late 1780s.
Size of the entire original: 60 × 89 cm; size of detail: ca. 15.5 × 37.5 cm. Image courtesy of the Bibliothèque nationale de France, Paris (Cartes et plans, Ge CC 1208, carte 26).

to complete the general maps for the *Neptune* but informed Fleurieu that he could not continue much longer with the project, as he knew that the surveying methods he had just developed with d'Entrecasteaux would render this type of *cartographie de cabinet* completely obsolete from a methodological point of view. Aware of this development, Fleurieu did not take offense at his collaborator's frankness and continued alone.

Following Fleurieu's death, Beautemps-Beaupré personally oversaw the engraving of the project's final plates in autumn 1810, even though the much-delayed appearance of the *Neptune* was officially dated 1809. There were thirty printed exemplars, often unbound and conserved in individual sheets, like the one held in the Bibliothèque nationale de France, which includes sixty-three maps and plans and three views (fig. 595) (Fleurieu 1809). The diffusion of the work remained limited despite the 177,325 francs spent by Fleurieu and the Marine for the plates. These copies became obsolete with the projects in the Baltic during the French Revolutionary Wars and the First Empire, and they were then voluntarily destroyed (Chapuis 1999, 286, 967n259). Simultaneously Fleurieu's great dream and personal failure, the *Neptune du Cattegat et de la mer Baltique* nonetheless had great didactic value. It provided experience to Beautemps-Beaupré after his work preparing the maps of Jean-François de Lapérouse. It also gave Fleurieu the opportunity to renovate instruments and perfect methods of engraving and printing in his private workshop (Chapuis 1999, 286, 297–98). His most notable contributions were to develop the *chassis*, or framework, of graduated longitude and latitude points upon which the meridians and parallels were based ([Fleurieu] 1794, 22), and to train engravers, who anticipated the brilliant school of French marine engraving of the nineteenth century.

OLIVIER CHAPUIS

SEE ALSO: Atlas: Marine Atlas; Fleurieu, Charles-Pierre Claret de; Map Trade: France; Marine Charting: France

BIBLIOGRAPHY

Chapuis, Olivier. 1999. *À la mer comme au ciel, Beautemps-Beaupré & la naissance de l'hydrographie moderne (1700–1850): L'émergence de la précision en navigation et dans la cartographie marine*. Paris: Presses de l'Université de Paris-Sorbonne.

[Fleurieu, Charles-Pierre Claret de]. 1794. *Fondemens des cartes du Cattégat et de la Baltique*. Paris: Imprimerie Nationale Exécutive du Louvre.

———. 1809. *Neptune du Cattegat et de la mer Baltique: Recueil*. Paris: [Dépôt général de la Marine].

Pastoureau, Mireille. 1992. "Le monde en cartes: L'apport de Fleurieu." In *Fleurieu et la Marine de son temps*, ed. Ulane Bonnel, 31–39. Paris: Économica.

Neptune françois *and* Hydrographie françoise. In 1662, during the reign of Louis XIV, Jean-Baptiste Colbert sent Louis-Nicolas de Clerville, *commissaire général des fortifications*, to survey the coasts of France. However, the imprecision of the resulting maps forced Colbert to have the work redone. La Favolière, *ingénieur des fortifications* from 1670, labored along the coasts of Poitou, Aunis, and Saintonge between 1670 and 1677; the hydrographic portion of his work surpassed all previous efforts. North of the Loire and along the coasts of Brittany, the works from about 1670 by Denis de La Voye, *ingénieur de la Marine*, were the best of that region (Chapuis 1999, 101). Nonetheless, strategic considerations kept the maps of La Voye and La Favolière secret for nearly twenty years. Finally, their work along with that of other authors including Clerville was finally assembled into a collection of coastal maps of France, bound in an atlas with the coat of arms of Colbert, which served as the foundation of *Le Neptune françois* for the part covering the French Atlantic coast and northern Brittany.

Le Neptune françois was the first maritime work (and one of the first geographic atlases) to benefit from the astronomical observations produced by the Académie des sciences (Chapuis 1999, 102), even if these results were integrated after the fact, added nearly ten years after the maps of La Voye and La Favolière were completed. Astronomers Jean Picard and Philippe de La Hire surveyed along the coasts of France between 1679 and 1682 at the request of the Académie, of which they were members (Débarbat and Dumont 2002, 241). They built upon the work of Jean-Dominique Cassini (I), one of the proponents of *Le Neptune françois*, by adopting his method of using the eclipses of the satellites of Jupiter to make astronomical observations. The positions determined by Picard, La Hire, and Cassini constituted to some degree the foundational framework for the French maps in the *Neptune*, as did the map of France presented to the Académie des sciences in 1684 and published in 1693 (see fig. 625). However, despite much updating, *Le Neptune françois* benefited from no formal geodetic framework. For the Mediterranean maps, most of the astronomical work fell to Jean-Mathieu de Chazelles, former assistant to Cassini I at the Paris Observatory and professor of hydrography at Marseilles; as a collaborator on the *Neptune*, he had mapped the English Channel and served as cartographic editor under general editor Charles Pène. In 1701, Chazelles proposed to the Académie a second volume of *Le Neptune françois* dedicated exclusively to the Mediterranean. It never appeared, although Joseph-Bernard, marquis de Chabert, tried to renew the effort in 1753.

Le Neptune françois first appeared in print in Paris in 1693, with a frontispiece drawn by Jean Berrin and magnificently engraved by Pierre Lepautre, depicting the god Neptune watching over sailors, explaining why the word *neptune* was used henceforth to designate a maritime atlas. By employing the arms of France and the radiant rising star, the frontispiece also bore witness to the prestigious character of the work by evoking the maritime glory of the Sun King, whose palace at Versailles was home to many statues of Neptune scattered throughout the landscape. Finally, the frontispiece of the atlas also reminded the beholder that state power directed the cartography of national territory.

The *Neptune*'s use of small-scale maps, together with its nearly double elephant format and correspondingly high price, explained its poor reception by the general public. For nearly fifty years its notes and copperplates were forgotten, giving the impression that French hydrography had been abandoned in the first half of the eighteenth century (Chapuis 1999, 103, 106). A particular problem for the *Neptune* was its use of the Mercator projection, which had not won over French sailors, a situation that would continue into the eighteenth century (Chapuis 1999, 151–52). However, the *Neptune* gained more recognition abroad than in France. The Dutchman Pieter Mortier promptly produced three pirated editions in French, English, and Dutch (Koeman 1970, 4:423–31). Mortier's French version was falsely attributed to the extraordinarily prolific publisher Alexis-Hubert Jaillot, whose name alone could sell books in Paris. Despite the assertions of Jacques-Nicolas Bellin (Pène 1753, 3), the false French copy by Mortier was not filled with errors, but it did suffer from a rigid style of engraving (Pastoureau 1984, 352). However, the consumer could not always distinguish the original from the copy, even upon close examination. The interest the *Neptune* excited in Europe was less surprising because the foreign portions, which encompassed European coasts from Norway to Gibraltar, were based on compilations from sources published in the countries concerned.

One of the atlas's most innovative aspects, inspired by La Voye's manuscript maps, was the depiction of safe water channels alongside traditional danger markings, the foreshadowing of a style of representation that would take hold only in the nineteenth century. Similarly, the charts of the *Neptune* displayed inset legends that synthesized the work of Colbert's engineers (heretofore kept secret) and established uniform conventional signs. The large-scale charts of the French coasts in the *Neptune* were standardized at a scale of ca. 1:100,000, quite large for the period (Chapuis 1999, 104). Overall, the work was clearly superior to the majority of marine charts available at the end of the seventeenth century. Soundings were provided for low tide during the period of greatest tides, establishing another charting tradition: ever since the *Neptune*, the zero point on official French marine charts, the reference point for all soundings, has corresponded to the lowest possible sea (i.e., the maximum coefficient of spring tide, or 120).

Therefore, the *Neptune* was conceived as a model atlas, but it did not have an early impact. At a time when geodesy was only taking its first steps between Paris and Amiens, geodetic methods were not employed along the coasts. Sailors would have to wait much longer for the positive effects of triangulation. Although the first state to elaborate a large geodetic framework for terrestrial space, France missed the opportunity to apply similar methods to its hydrography. The central authorities envisioned only the terrestrial applications of this advanced technique, revealing an essentially continental preoccupation. Because *Le Neptune françois* was to remain, for lack of any superior work, the indispensable reference until 1800 and later (much later, for certain maps), only a very few French marine charts relied on the eighteenth-century geodetic network of France. By employing a ritualized but obsolete model, the *Neptune* immobilized French hydrography (Chapuis 1999, 110). For example, the *5^{e} carte particuliere des costes de Bretagne* (fig. 596) remained the official image of the tip of Brittany until 1822 (Chapuis 1999, 614).

For the second edition of the *Neptune* (1753), Bellin added lines of latitude and longitude to the charts of Brittany (eight of twenty-nine charts in the original edition), after the fact and in a completely artificial manner (fig. 597) (Chapuis 1999, 104–10). In the *Neptune*'s third edition (1773), which Bellin prepared just before his death, worn plates yielded paler and paler products. Joseph Sauveur's general map of Brittany, compiled from detailed maps of the province, was the only new plate (Chapuis 1999, 833). In 1775, the Dépôt des cartes et plans de la Marine planned a general map on a uniform scale of France's western coast. The thirty-six overlapping sheets would allow navigators to move from one section of coast to another without problematic breaks. According to a ministerial decision (13 December 1775), this very ambitious program, Nouveau neptune françois, was to survey the coast from Dunkirk to Spain. This first modern hydrographic mission along the French coast (Chapuis 1999, 257–62) began with work by Louis-Bon-Jean de la Couldre de La Bretonnière and Pierre-François-André Méchain in Picardy and Normandy during the spring of 1776. However, although the surveys relied on a modest triangulation (which was entirely redone by Charles-François Beautemps-Beaupré scarcely half a century later), the American Revolutionary War brusquely interrupted the survey in 1778, and the few Norman charts surveyed did not appear until the French Revolution.

In contrast with the *Le Neptune françois*, the *Hydrographie françoise* was not an atlas at all but rather a collection of maps printed and distributed by the Dépôt des cartes et plans de la Marine under Bellin's direction. As individual maps were published, numerous versions of these collections appeared: the idea was that a *neptune*

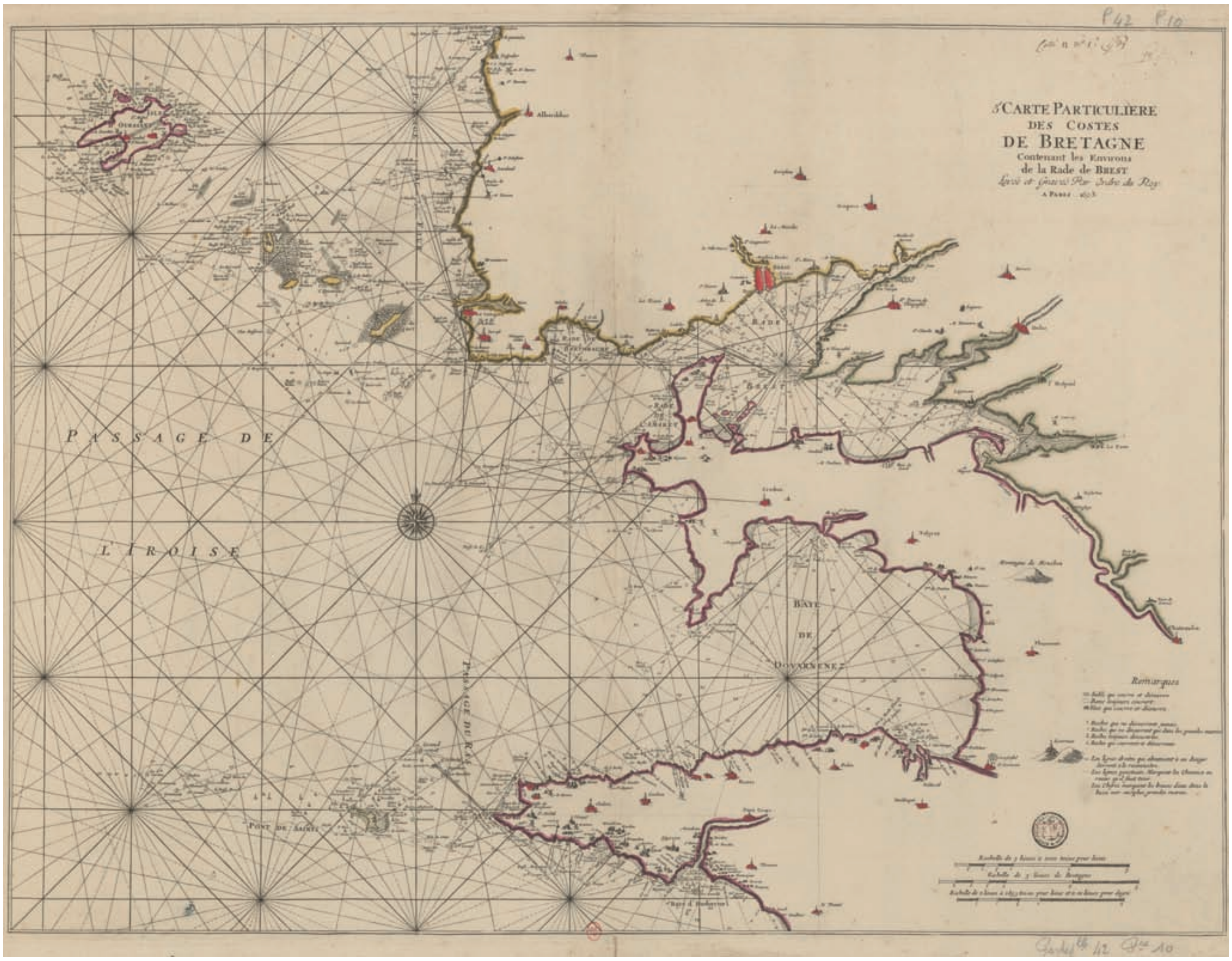


FIG. 596. DENIS DE LA VOYE, *5E CARTE PARTICULIERE DES COSTES DE BRETAGNE CONTENANT LES ENVIRONS DE LA RADE DE BREST* ([PARIS, 1693]). Engraved on one sheet, ca. 1:100,000. This map from the first French edition of *Le Neptune françois* (1693) remained the official image of the tip of Brittany until 1822. This original edition of 1693 was indistinguishable from the Dutch copy published by Mortier, except for the titles, which in Mortier's edition mention "Jaillot" and "Paris" in order to sell them. For the second edition of 1753, Jacques-Nicolas Bellin simply added scales of latitude and longitude to the existing copperplates; the third edition (1773) remained otherwise identical.
Size of the original: 63 × 87 cm. Image courtesy of the Bibliothèque nationale de France, Paris (Cartes et plans, Ge SH 18 PF 42 P 10).

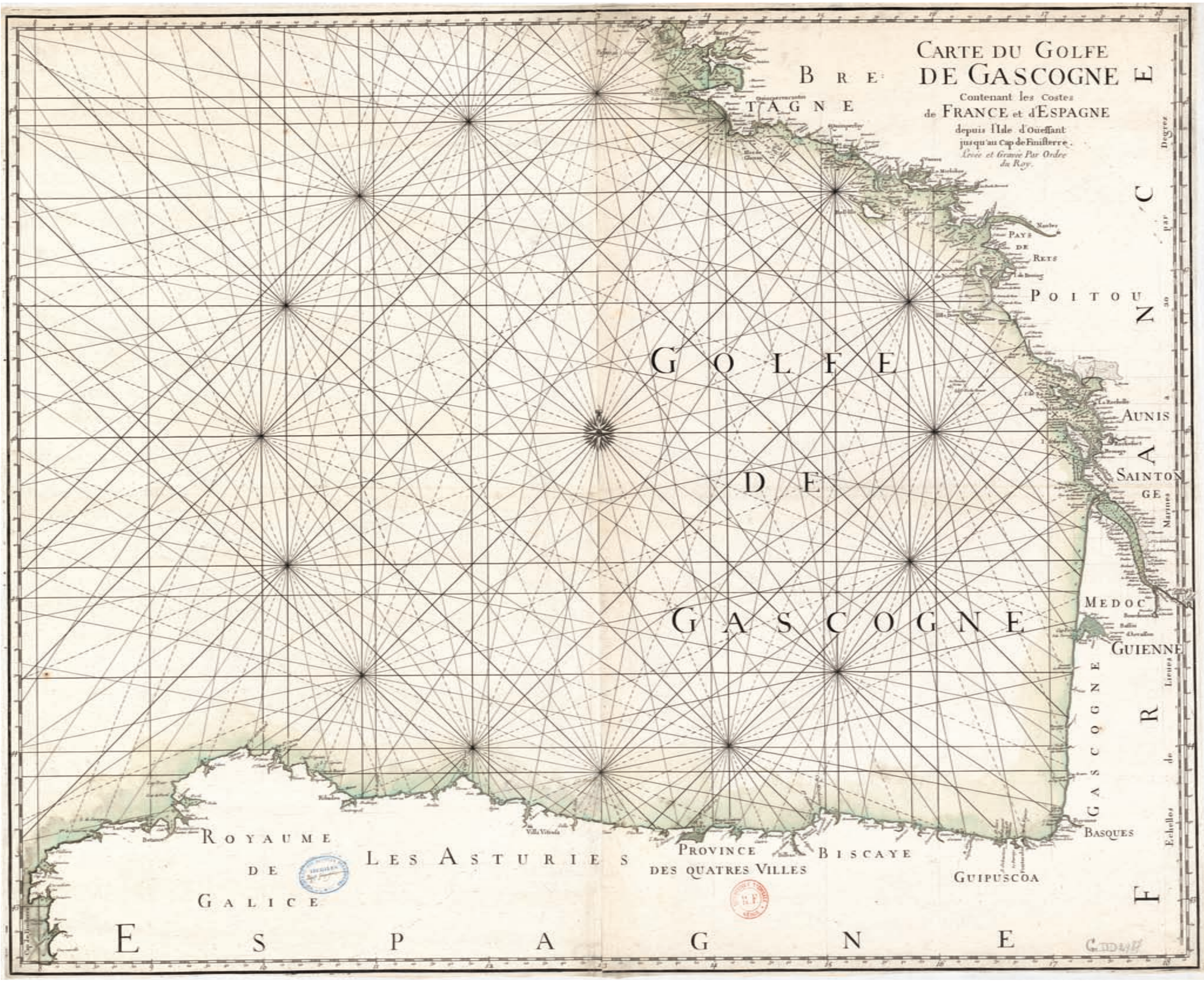
could be put together from the Dépôt's stocks upon request, based upon the needs of ships in the Marine. Several of these *atlas factices*, held in the Département des cartes et plans at the Bibliothèque nationale de France, display the standard elements. The first collection appeared in 1756 with a frontispiece printed by Didot; later, some maps from 1757 and a few from 1759 were integrated. The Dépôt des cartes et plans de la Marine established a subsequent version in 1765, with maps from 1766 and a 1773 frontispiece added later. The version most representative of the state of the collection at Bellin's death (1772) was that produced by the printing works of the ministère de la Marine at Versailles that same year. More recent maps were continually added to the collection until 1806, but always under the title *Hydrographie françoise* (Chapuis 1999, 833–34).

OLIVIER CHAPUIS

SEE ALSO: Atlas: Marine Atlas; Bellin, Jacques-Nicolas; Map Trade: France; Marine Charting: France

BIBLIOGRAPHY

Chapuis, Olivier. 1999. *À la mer comme au ciel, Beautemps-Beaupré & la naissance de l'hydrographie moderne (1700–1850): L'émergence de la précision en navigation et dans la cartographie marine*. Paris: Presses de l'Université de Paris-Sorbonne.


CARTE DU GOLFE
DE GASCOGNE
Contenant les Costes
de FRANCE et d'ESPAGNE
depuis l'Isle d'Oüessant
jusqu'au Cap de Finisterre.
Levée et Gravée Par Ordre
du Roy.
BRETAGNE
POITOU
PAYS DE RETS
AUNIS
SAINTONGE
MEDOC
GUIENNE
GASCOGNE
BASQUES
FRANCE
GOLFE DE GASCOGNE
ROYAUME DE GALICE
LES ASTURIES
PROVINCE DES QUATRES VILLES
BISCAYE
GUIPUSCOA
ESPAGNE
Echelles de Lieues Marines par Degrez

Débarbat, Suzanne, and Simone Dumont. 2002. "Le rôle des astronomes français dans la cartographie des côtes aux XVII^e et XVIII^e siècles." In *Défense des côtes et cartographie historique*, ed. Jean-Pierre Bois, 233–54. Paris: Éditions du CTHS.

Koeman, Cornelis. 1970. *Celestial and Maritime Atlases and Pilot Books*. Vol. 4 of *Atlantes Neerlandici: Bibliography of Terrestrial, Maritime, and Celestial Atlases and Pilot Books Published in the Netherlands Up to 1880*. Amsterdam: Theatrum Orbis Terrarum.

Pastoureau, Mireille. 1984. *Les atlas français, XVI^e–XVII^e siècles: Répertoire bibliographique et étude*. Paris: Bibliothèque Nationale, Département des Cartes et Plans.

Pène, Charles, ed. 1753. *Le Neptune françois ou recueil des cartes marines levées et gravées par ordre du roy*. 2d ed. Paris: Imprimerie Royale.

Neptune oriental, Le. *Le Neptune oriental, ou routier general des cotes des Indes orientales et de la Chine, enrichi de cartes hydrographiques tant génerales que particulieres, pour servir d'instruction à la navigation de ces differentes mers* was the first nautical atlas published in France devoted to sailing to the China Sea via the Indian Ocean. By the second half of the eighteenth century, the progress of scientific methods in marine charting and French trade prospering in the East Indies had made this navigation possible.

The author of *Le Neptune oriental*, Jean-Baptiste-Nicolas-Denis d'Après de Mannevillette, was an officer and captain in the service of the Compagnie des Indes from 1724 to 1760. His interest in navigation stemmed from his early days of sailing with his father, who commanded a vessel for the Compagnie des Indes, and from his studies with Guillaume Delisle (Chapuis 1999, 249; Briot 1990, 161–62). Like other Compagnie pilots, he collected nautical material (charts, memoirs, logbooks, sailing directions) during his voyages that could help update existing charts. He was one of the first French sailors to use Hadley's quadrant (1736, in the China Sea) and lunar distances for longitude (with the astronomer Nicolas-Louis de La Caille in 1750, en route to the Cape of Good Hope) (Haudrère 1997, 57). When the Compagnie des Indes opened a hydrographic office in Lorient in 1762, d'Après de Mannevillette became its director. He stayed on as keeper of the collections after the dissolution of the company in 1770. This office merged with the Dépôt des cartes et journaux de la Marine in 1780, after d'Après de Mannevillette's death. He had become a corresponding member of the Académie des sciences in 1743 and of the Académie de marine in 1752. He was seen as a European authority on matters regarding the Indian Ocean, advising ministers and sailors (such as Yves-Joseph de Kerguelen-Trémarec) in preparing expeditions. He exchanged data and charts with the British hydrographer Alexander Dalrymple, who helped him sell his atlas in England.

Jean-François Robustel published the first edition of the *Neptune* in Paris in 1745. The twenty-six folio charts (two at small scale on a Mercator projection and twenty-four *cartes plates carrées*, i.e., equirectangular projection), engraved by Guillaume Dheulland, covered the area from Ethiopia on the Arabian Sea to China. The sailing directions were published separately in a quarto volume. A general chart of the Indian Ocean and a map of the southeastern coast of Africa were added in 1753. Guidelines for sailing from France to the Cape of Good Hope, *Mémoire sur la navigation de France aux Indes*, were published with maps of the Cape Verde Islands and the Cape in 1765 and reprinted with new information in 1768. The general chart of the Indian Ocean was revised in 1771. A few copies of the 1745 atlas were also reprinted.

A second edition of *Le Neptune oriental*, printed in Brest by Malassis in 1775, contained fifty-six folio charts (of which nine were small-scale reductions) engraved by Guillaume-Nicolas Delahaye with sailing directions from France to China (fig. 598). A separate version of the text in a quarto volume was published simultaneously as *Instructions sur la navigation des Indes orientales et de la Chine, pour servir au Neptune oriental*. The *Supplément au Neptune oriental* with eighteen folio charts and an adequate commentary appeared in 1781, after the author's death.

Charts from *Le Neptune oriental* were also published in English: the earliest versions were prepared by William Herbert for his *A New Directory for the East Indies* in 1758. Thomas Jefferys published the translated text of the *Mémoire sur la navigation* as *Directions for Navigating from the Channel to the East Indies* (1769). Charts from *Le Neptune* also served as sources for the charts in *The East-India Pilot or Oriental Navigator*

(*facing page*)
FIG. 597. CHARLES PÈNE, *CARTE DU GOLFE DE GASCOGNE CONTENANT LES COSTES DE FRANCE ET D'ESPAGNE* ([PARIS, 1753]), MAP 13. Second edition, engraved on one sheet, ca. 1:903,400. Based on and very similar to the original edition of *Le Neptune françois* (1693), this edition adds scales of latitude and longitude (without reference to the original meridians, other than that of the Île de Fer) and a network of rhumb lines, but it is the only map to present the true meridians and parallels. On the other plates in the *Neptune*, the principal rhumb lines of the north-south and east-west axes, in thick lines, give the illusion of meridians and parallels, which they are not. To this edition of 1753 (which appeared also in the *Hydrographie françoise* in the same year), Bellin later added scales of longitude with reference to the meridians of Paris, London, Cape Lizard, and Tenerife (for comparison see fig. 539).
Size of the original: 73.9 × 91.5 cm. Image courtesy of the Bibliothèque nationale de France, Paris (Cartes et plans, Ge DD 2987 [773 B]).

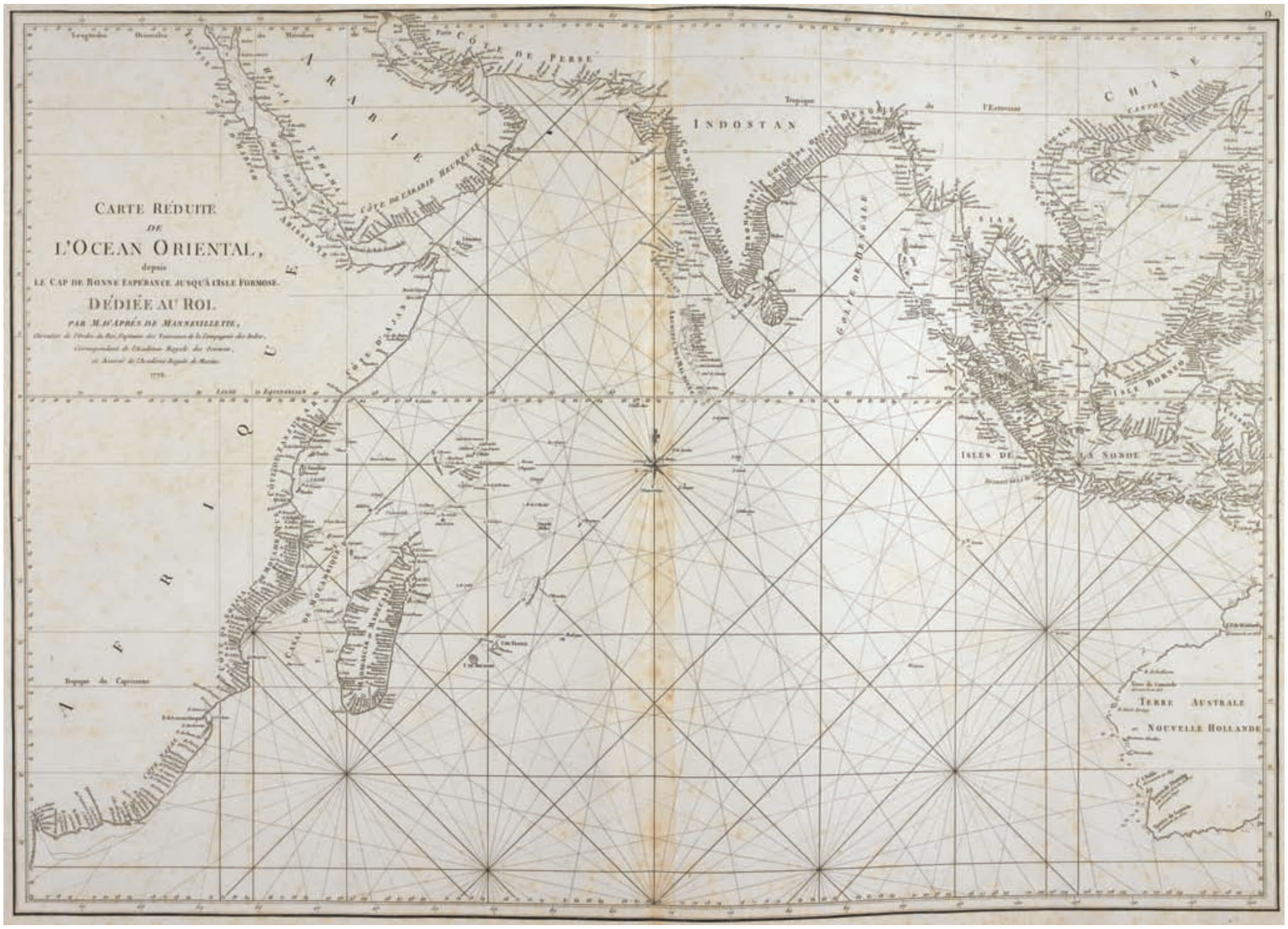


FIG. 598. JEAN-BAPTISTE D'APRÈS DE MANNEVILLETTE, *CARTE RÉDUITE DE L'OCEAN ORIENTAL, DEPUIS LE CAP DE BONNE ESPÉRANCE JUSQU'À L'ISLE FORMOSE*, 1775. Engraving and etching on copperplate. This chart shows the contribution of *Le Neptune oriental* to the knowledge of the Indian Ocean in the early 1770s, but was soon outdated.
Size of the original: 50.5 × 70.0 cm. © The British Library Board, London (Cartographic Items Maps K.MAR.VI.4).

(Sayer and Bennett from 1782; Laurie and Whittle after 1794) and for the collection of charts and plans by Alexander Dalrymple, published from 1774.

The publication of this atlas began as the work of a private individual but very soon became an institutional production. The Compagnie des Indes, which did not have a hydrographic office of its own, financed the first edition and recouped the investment by selling it mainly to Compagnie officers, deducting the price from their salaries to ensure payment. After a shipwreck at the Cape in 1762, the Compagnie des Indes asked its own hydrographer, d'Après de Mannevillette, to write instructions for sailing from France to the Indian Ocean. Prepared in 1764, the instructions were printed under the supervision of the astronomers Alexandre-Gui Pingré and Pierre-Charles Le Monnier, with the ministry of the Marine bearing all the printing costs. About three hundred copies seem to have been acquired by the Compagnie des Indes for its ships' service (Filliozat 2002, 211–15).

The second edition of *Le Neptune oriental* was published at a time when the Dépôt des cartes de la Marine claimed the monopoly for publishing nautical charts and instructions (Chapuis 1999, 251). Financed by subscription, the *Neptune* was approved by the Académie de marine just before the law of 1773 came into effect, which prohibited private publications of charts and rutters. The Dépôt de la Marine took advantage of this law to lay claim to the collections in Lorient and the original plates of the charts, offering compensation by purchasing 120 copies for the Marine (Chapuis, 1999, 251–52; Filliozat 2002). The *Supplément* was published at the personal expense of d'Après de Mannevillette's brother under the supervision and with financial help of the Dépôt de la Marine, which sold the maps and instructions until 1847. *Le Neptune oriental* can, therefore, be regarded as one of the first French official nautical publications. Jacques-Nicolas Bellin based several of his charts on information from the first edition of the *Neptune*, such as the plan of Africa's southeastern coast in 1755. But the second edition was ultimately merged with the collection and publications of the Dépôt de la Marine.

Technically, the two editions of *Le Neptune oriental* reveal the evolution of French marine charting; the second edition exhibits finer etching and detail: in it, wind roses were added by the engraver only on the seas and not on land; and greater care was given to mark the soundings and dangers along the coasts. All the maps use the meridian of Paris as the prime meridian, a practice introduced by Bellin in 1737 (Bellin 1739, 2). But unlike Bellin, who was a land-locked hydrographer, d'Après de Mannevillette employed astronomical observations and surveys, usually taken from the ship, as much as possible on his charts. For the 1745 edition, he had only eight exact positions in the Indian Ocean, but the second edition boasts twenty-four (Chapuis 1999, 251). He himself made observations at Mauritius, La Réunion, Madagascar, Mergui (Beik), and Canton. D'Après de Mannevillette also used a few surveys made by pilots of the Compagnie des Indes and even better observations made by officers of the Marine in the 1760s and 1770s. He also employed observations made by English officers, especially of the Chagos Archipelago, which were sent to him by Dalrymple. As keeper of the charts and journals of the Compagnie des Indes, with a reputation as the specialist of the Indian Ocean, d'Après de Mannevillette could ask officers to check or to survey places, as in the case of Jean-François de Trobriand in the archipelagos and isles northeast of Madagascar in 1772 (fig. 599). To ensure safe navigation, d'Après de Mannevillette did not hesitate to have charts reengraved when the newer data became available between 1775 and 1780 (fig. 600).

Le Neptune oriental reflects French interests in the Indian Ocean. The sources of the 1745 edition are *The English Pilot, the Third Book, Describing . . . the Oriental Navigation* for the Indian Ocean and China Sea, and Dutch charts for the Gulf of Siam and the southeastern part of the Indian Ocean, completed by information from the logbooks of sailors in the Compagnie des Indes. The 1775 edition shows more of the western part of the Indian Ocean between Africa and India, as the French focused on developing Mauritius and La Réunion as their main ports of call and naval bases for trade and operations during wars in the East Indies. To this end, during the 1760s and 1770s, they supported explorations in the archipelagos between Madagascar and India to try shorter routes. A hydrographic office

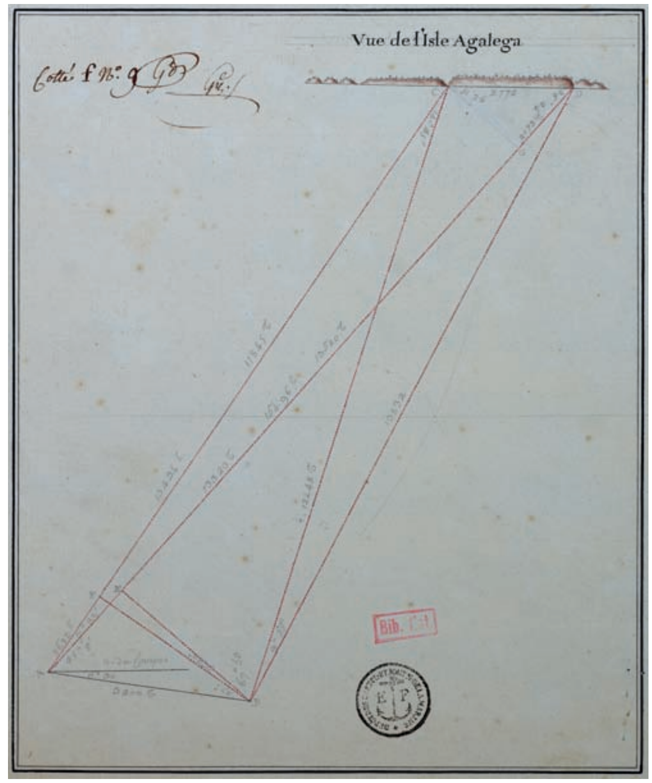


FIG. 599. JEAN-FRANÇOIS DE TROBRIAND, "VUE DE L'ISLE AGALEGA," 1773. Manuscript map. Such surveys made from the ship by a few officers of the Marine were sent to d'Après de Mannevillette to help him correct *Le Neptune oriental*.
Image courtesy of the Bibliothèque nationale de France, Paris (Cartes et plans, Ge SH PF 222 div. 7 P 4 D).

was set up in 1771 at Port-Louis, with Michel Sirandré (1724–ca 1789) ordered to collect all the data brought in by these explorations and send them to France. D'Après de Mannevillette used these data, asking Sirandré, Dalrymple, and other sailors for more details; he published the results immediately, calling for more explorations. His work is the summary of European hydrographic knowledge of the East Indies around 1780, developed from a few available astronomical observations, available surveys, and many logbooks.

MANONMANI RESTIF-FILLIOZAT

SEE ALSO: Atlas: Marine Atlas; Compagnie des Indes (Company of the Indies; France); Dalrymple, Alexander; Marine Charting: France

BIBLIOGRAPHY

Bellin, Jacques-Nicolas. 1739. *Observations sur la construction de la carte de l'Océan Méridional pour servir aux vaisseaux du roi, dressée au Dépôt des cartes, plans & journaux de la Marine*. In Bellin's *Recueil des mémoires qui ont été publiés avec les cartes hydrographiques*. [Paris]: [Bellin].

Bonnichon, Philippe. 1982. "Éléments de connaissances géographique de l'Océan Indien en France au temps de Bougainville." In *L'Importance de l'exploration maritime au siècle des Lumières (A propos du*

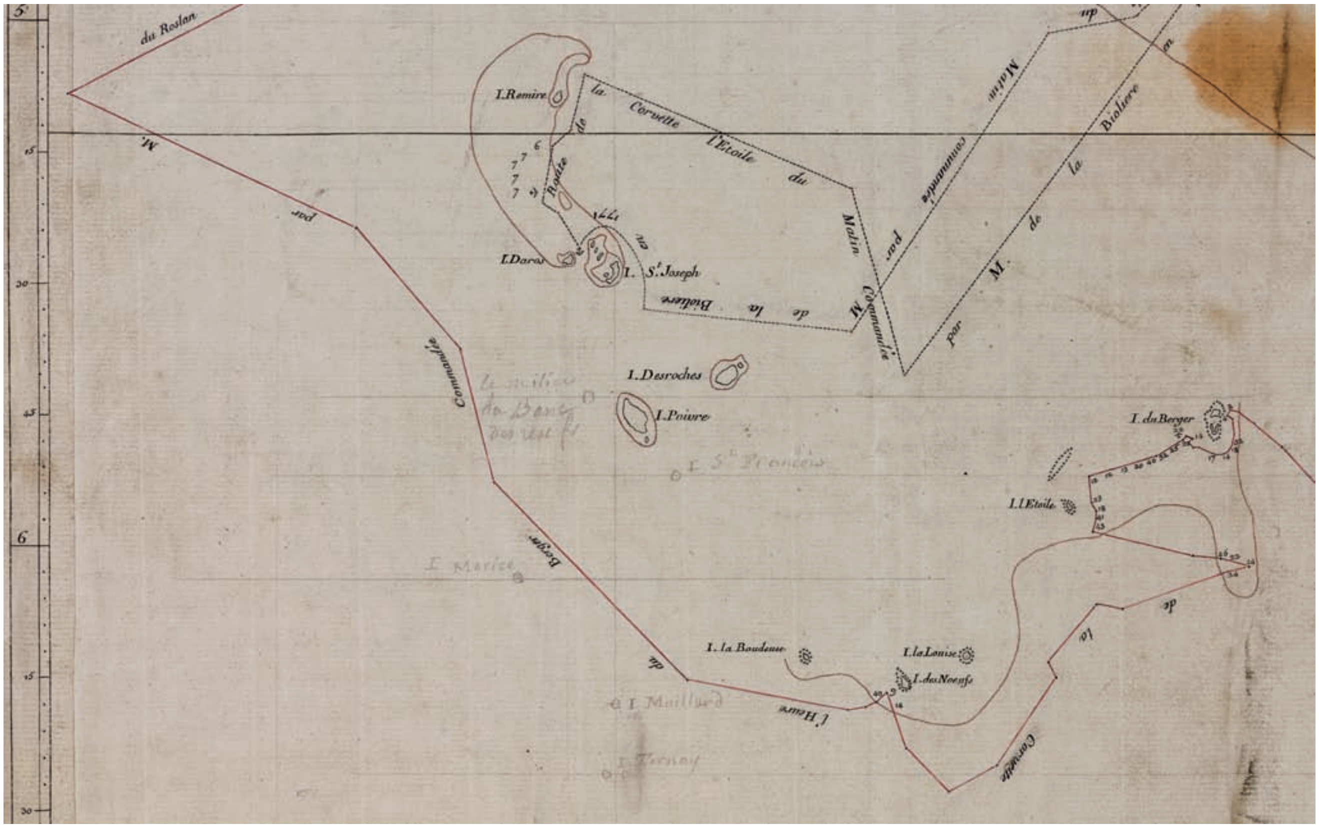


FIG. 600. DETAIL FROM JEAN-BAPTISTE D'APRÈS DE MANNEVILLETTE, "CARTE DE L'ISLE MAHÉ OU SEYCHELLE AVEC LES ILES CIRCONVOISINES DECOUVERTES," CA. 1775. This manuscript draft for the printed map of the same title, which would be published in the *Supplément au Neptune oriental* (1781), improves on the map of the same area published in 1775 by the author's incorporation of observations from recent navigations, soundings, and location measurements of the Amirante Islands, southwest of Mahé in the Seychelles.
Image courtesy of the Bibliothèque nationale de France, Paris (Cartes et plans, Ge SH 18 PF 222 div. 2 P 4 D).

voyage de Bougainville), ed. Michel Mollat du Jourdin and Étienne Taillemite, 123–47. Paris: Éditions du Centre National de la Recherche Scientifique.

Briot, Claude. 1995. "J. B. D. N. d'Après de Mannevillette: Hydrographe de la Compagnie des Indes auteur du *Neptune oriental*, 1707–1780." In *Les Normands et la mer: XXVe Congrès des Sociétés historiques et archéologiques de Normandie*, 160–67. Saint-Vaast-la-Hougue: Conseil Général de la Manche; Musée Maritime de l'Ile Tatihou.

Chapuis, Olivier. 1999. *À la mer comme au ciel, Beautemps-Beaupré & la naissance de l'hydrographie moderne (1700–1850): L'émergence de la précision en navigation et dans la cartographie marine*. Paris: Presses de l'Université de Paris-Sorbonne.

Filliozat, Manonmani. 2002. "L'Océan oriental: Connaissances hydrographiques françaises aux XVIIe et XVIIIe siècles." MS thesis, École pratique des Hautes-Études, IVe section, Paris.

———. 2003. "J.-B. d'Après de Mannevillette et la cartographie de la nouvelle route des Indes." *Bulletin du Comité Français de Cartographie* 175:6–16.

Haudrère, Philippe. 1997. "Jean-Baptiste d'Après de Mannevillette et les progrès de la connaissance de l'Océan Indien au XVIII^e siècle, d'après les routiers et les cartes françaises." *Revue Française d'Histoire du Livre*, n.s. 94–95:53–62. Special issue, *La découverte géographique à travers le livre et la cartographie*, ed. Christian Huetz de Lemps.

Saunier, Éric, ed. 2008. *Autour de d'Après de Mannevillette: Savant navigateur havrais au siècle des Lumières*. Le Havre: Centre Havrais de Recherche Historique.

Netherlands, Republic of the United. The political division of the Seventeen Provinces was settled with the Treaty of Münster (1648), which ended the Eighty Years' War of the Dutch Republic against Spain, an event that simply consolidated the actual situation existing since the end of the sixteenth century (Koeman and Van Egmond 2007, 1247, fig. 43.1). Seven of the Seventeen Provinces formed a confederation under the name Republic of the Seven United Provinces in 1588 but were not officially recognized by Spain until 1648: Holland, Zeeland, Utrecht, Friesland, Groningen, Overijssel (with Drenthe), and Gelderland (without the southern portion known as the Upper Quarter). The conquered areas of Flanders, Brabant, and Limburg were governed by the Republic as Generality Lands (Staats-Vlaanderen and Staats-Brabant), while Drenthe had its own admin-

FIG. 601. *EXACTISSIMA BELGII FŒDERATI TABULA CUM ANNEXIS DIVISA IN PROVINCIAS* (AMSTERDAM: R. & I. OTTENS, AFTER 1725); LATER EDITION OF THE 1702 MAP BY CASPAR SPECHT. Copper engraving; ca. 1:450,000. The regions with solid coloring are the seven provinces, whose arms are shown at left. Staats-Vlaanderen and Staats-Brabant, at the bottom center, are left uncolored and only indicated by the names Flandria Batava and Brabantia Batava.
Size of the original: 50.5 × 60.0 cm. Image courtesy of the Universiteitsbibliotheek Amsterdam (Bijzondere Collecties, OTM: HB-KZL 33-35-16).

istration but lacked full sovereignty. The area of the Republic comprised more or less the territory of the present-day Netherlands, minus the southern part of the present Province of Limburg, which was added in 1815 (fig. 601).

Each province was governed by the States, a sort of parliament whose composition was arranged differently in each province, but usually consisted of representatives of the cities, regions, and *ridderschappen* (councils of the nobility). The Generality Lands, being governed directly by the Republic, lacked these bodies. The government of the Republic was formed by the States General, consisting of representatives of the provincial councils. The responsibilities of the States General were navigation, administration of conquered areas, the promotion of colonial expansion, and religion. The States General met in The Hague, the capital of Holland, which thus became de facto capital of the Republic. Originally the monarch was represented in the various provinces by a governor, or *stadhouder*. When the States General refused in 1581 to recognize Felipe II of Spain as their monarch, the post of *stadhouder* as representative of the monarch became unnecessary. However, the function was maintained as the military commander of the Republic.

The southernmost of the Seventeen Provinces, unlike the United provinces, continued to be ruled after 1648 by the king of Spain and were known as the Royal Netherlands or Spanish Netherlands. After the War of the Spanish Succession (1701–14), in 1715 these provinces were assigned to the Austrian branch of the House of Habsburg, hence the name Austrian Netherlands. The provinces of Brabant (without the northern part), Flanders (without the northern part), Hainaut, Artois, Namur, Luxembourg, Limburg (Limbourg), Mechelen, and Antwerp represent the territory of most of present-day Belgium and Luxembourg, except for the Prince-Bishopric of Liège, which was part of the Holy Roman Empire. The cartography produced in the Southern Netherlands is covered elsewhere in this volume.

In 1795 the French army invaded the Republic and was aided by a popular uprising that supported revolutionary France. *Stadhouder* Willem V fled to England and the States General dissolved itself, leaving the newly declared Bataafsche Republiek virtually a puppet state of France. Instead of restoring the old situation, in 1815 the United Kingdom of the Netherlands was formed, consisting of the territories of the Republic of the United Netherlands, the Austrian Netherlands, and the Prince-Bishopric of Liège. *Stadhouder* Willem V's son became king of the new kingdom as Willem I.

The institutions that initiated or influenced cartographic production in all its modes were civic, military, and commercial. The Republic was a confederation; the central government took no part in the domestic administration of the provinces. Except for military purposes toward the end of the eighteenth century, mapping large parts of the country was not initiated by the central government. Some of the provinces carried out their own surveys; for others, large overview maps were produced by commercial publishers.

Cities were one center of cartographic impulse. In the seventeenth century, the Republic was a highly urbanized society, expressed cartographically through the publication of special town atlases (especially Joan Blaeu's *Tooneel der steden*, 1649) (Koeman et al. 2007, 1333–38) and the manufacture of large city maps with decorative borders. The highly urbanized province of Holland saw its power concentrated in cities such as Dordrecht, Haarlem, Delft, Leiden, Amsterdam, Gouda, and Rotterdam (to list them in their medieval hierarchy). The governing boards of these cities had large wall maps of their cities made for public display. In addition, cities undertook large-scale survey projects for purposes of taxation, civil engineering, and urban expansion.

The *waterschappen* (water management boards), also called *hoogheemraadschappen*, were organizations found in the western part of the Republic, especially the province of Holland, responsible for the dikes and waterways in their area with a focus on flood prevention, for which they required accurate large-scale maps, many of which were printed (Koeman and Van Egmond 2007, 1263–68). In addition, *waterschappen* maps were sometimes used to determine taxes based on the location and/or size of a property. The importance of the fluvial network and maintenance of dikes led to some particularly innovative river mapping under the leadership of Cornelis Velsen and Nicolaas Samuelsz. Cruquius. The *waterschappen* were the major mapping agencies undertaking administrative mapping mainly in Holland. Private landowners and universities also undertook large-scale property surveying to determine landownership, assess tithes, plan for expansion, and resolve boundary and judicial disputes. Military cartography was institutionalized in Holland with a *fortificatiemeester* (master of fortifications) in 1579, and in the Republic as whole, with the corps of military engineers established in 1604 (Koeman and Van Egmond 2007, 1271–90). Their primary responsibilities were the preparation of fortification plans and topographical mapping, principally for the purpose of planning defensive flooding. Both bodies commissioned maps by private surveyors and by military engineers, and most of their work remained in manuscript. By the end of the eighteenth century, military topographical mapping began to reach the same standards as the maps of the French *ingénieurs géographes*.

Commercial cartography was perhaps the most visible and dominant form of mapping in the Netherlands and was centered almost exclusively in Amsterdam where dozens of publishers produced and sold maps, charts, pilot guides, wall maps, atlases, and globes independent of any government interference (except for a single privilege granted by the States of Holland and the States General). Although foreign competition had played little role in the first half of the seventeenth century, by late in the century Paris mapmakers vied for the market. Amsterdam publishers responded by copying French maps and atlases, with Pieter Mortier and his successors in the firm of Covens & Mortier especially prominent. The major publishers active in the late seventeenth century were Nicolaas I Visscher, his son Nicolaas II, and Frederick de Wit. While they published maps in a larger format than their predecessors, they happily included in their atlases the smaller Blaeu and Johannes Janssonius maps from the previous century for regions of which they had no maps themselves. The eighteenth century was dominated by Covens & Mortier; other major publishers were the brothers Reinier and Josua Ottens and Petrus II Schenk. Significant foreign competition came from the German firms Homann in Nuremberg and Seutter in Augsburg. Many eighteenth-century Dutch atlases consist of a mixture of maps from various Amsterdam and German publishers. The Amsterdam publishers produced some 2,000 atlas volumes from the late sixteenth century to the end of the eighteenth century, containing over 12,000 atlas maps (excluding sea atlases and charts), as well as over 250 wall maps and 30 globe pairs (Van der Krogt 1993, 1997–).

Marine charting was also produced within the commercial sector, outside of government control. From the second half of the seventeenth century, a group of Amsterdam publishers including Hendrik Doncker, Pieter Goos, the Lootsman family, and Johannes I van Keulen and his successors dominated the Dutch market for charts, continuing throughout the eighteenth century and into the nineteenth, although their charts were largely derivative. The Van Keulens also produced manuscript charts for sale, and after 1743 were the official chartmakers for the Verenigde Oost-Indische Compagnie (VOC, East India Company), which prohibited publication of its charts. The VOC and the West-Indische Compagnie (WIC, West India Company) managed the mapping activities for the Dutch interests in the East and West Indies and the routes to their overseas territories. Both companies functioned without active government intervention; without state support, a scientific approach to maritime surveying and systematic charting was slow to emerge. A commission was established only in 1787 to tackle the question of longitude and to publish a nautical almanac. A careful survey of the Dutch coast did not begin until the end of the eighteenth century.

Mapping and map production in the Republic of the United Netherlands in the eighteenth century was characterized, in all respects, by private initiative and minimal or no national and provincial government involvement, a situation that would change radically in the nineteenth century.

PETER VAN DER KROGT

SEE ALSO: Administrative Cartography; Geographical Mapping; Map Collecting; Map Trade; Marine Charting; Military Cartography: Netherlands, with Topographical Surveying; Property Mapping; Thematic Mapping; Urban Mapping; Verenigde Oost-Indische Compagnie (VOC; United East India Company; Netherlands); West-Indische Compagnie (WIC; West India Company; Netherlands)

BIBLIOGRAPHY

Koeman, Cornelis, and Marco van Egmond. 2007. “Surveying and Official Mapping in the Low Countries, 1500–ca. 1670.” In *HC* 3:1246–95.

Koeman, Cornelis, et al. 2007. “Commercial Cartography and Map Production in the Low Countries, 1500–ca. 1672.” In *HC* 3: 1296–1383.

Krogt, Peter van der. 1993. *Globi Neerlandici: The Production of Globes in the Low Countries*. Utrecht: HES.

———. 1994. “Commercial Cartography in the Netherlands with Particular Reference to Atlas Production (16th–18th Centuries).” In *La cartografia dels Països Baixos*, 73–140. Barcelona: Institut Cartogràfic de Catalunya.

———. 1997–. *Koeman's Atlantes Neerlandici*. Multivolume. 't Goy-Houten: HES.

Netherlands, Southern. Cartography in the Southern Netherlands, the small region more or less conterminous with today's Belgium, was produced by a variety of mapmakers living in the region, including works they might have made outside the country. The tumultuous period from ca. 1650 to 1780 saw Spanish, Austrian, Dutch, English, French, German, and Italian armies, at times allied, at other times opposed, crisscross the country in battle. Between 1568 and 1713, the Southern Netherlands experienced nearly continuous war, interrupted now and then by only forty years of peace. As Europe's battlefield, it was a temporary home to military mapmakers from many nations, often personally related, who were frequently surveying the open country to create topographical and fortification maps that survive in abundance, in both manuscript and print.

Such political upheaval stemmed from the region's geography, whose only natural boundary is the North Sea (the Rhine River being further east). Two rivers pass through the region, flowing from the south to the northeast and then west toward the North Sea: the Escaut or Scheldt, which passes through Tournai toward Antwerp, and the Meuse or Maas, which runs through Namur and the Principality of Liège. Both the rivers and the relatively flat landscape helped trade develop in an east-west direction and also helped invading armies.

Politically, the area was squeezed between France to the south, the Republic of the United Netherlands to the north, Great Britain across the Channel to the west, and a cluster of German principalities to the east. From 1648 (Peace of Westphalia) to 1697, the area shrank, slowly at first, and then dramatically during the reign of Louis XIV of France, to the benefit of the United Provinces and France, as it lost Artois, the western and northern parts of Flanders, and one third of Hainaut and also of Brabant (Van der Essen 1927). By the end of the seventeenth century, the Southern Netherlands with the Principality of Liége roughly corresponded in shape and size to modern Belgium and included the counties of Flanders, Artois, Hainaut, and Namur, the city of Tournai, and the duchies of Brabant, Luxembourg, and Limburg. The Principality of Liège remained independent until the period of the French Revolution.

This rich geography and political history also gave the region a variety of names. From the fifteenth century, the region of the Seventeen Provinces was simply called Bourgogne (Burgundy) or l'États bourguignons, a name used as late as 1659, when the duchy itself had been lost for nearly two centuries. The estates of Burgundy consisted of the Pays Haut (or Pays par-deçà), which included the inland areas, and the Pays Bas (or Pays par-delà, Nederlanden, or Low Countries), for the area nearer the North Sea. The Pays-Bas espagnols generally meant the southern part of the Low Countries after its return to Spain's authority (1555); it was synonymous with the Pays-Bas méridionaux or, as often termed in English on contemporary maps, the Catholic Provinces of the Low-Countries. The name Flandres was also used (Flandre in the singular means the county of Flandre).

Frequent war caused the government to change hands several times, producing a somewhat eclectic cartographic tradition. In the sixteenth century, the Seventeen Provinces were under the sovereignty of the Habsburgs. After Charles V's abdication in 1555, the Habsburg Spanish branch ruled the country (Spanish Netherlands, 1556–1713), and after the War of the Spanish Succession, the Habsburg Austrian branch assumed control (Austrian Netherlands, 1714–95). France also vied for influence by taking possession of the *duché* (duchy) de Bourgogne in 1582, leaving the *comté* (county) de Bourgogne to the Habsburg heirs until 1678, when it was conquered for the French by Louis XIV. The succession of national jurisdictions gave the region multiple languages, with two dialects usually spoken—Romance (French) and low-German (Flemish). German was and is still used in the eastern Principality of Liège and in the Duchy of Luxembourg, while French, the language of society, spread rapidly during the eighteenth century.

The reigning sovereign exerted the principal influence on the development of cartography. In the sixteenth century, Charles V ordered the survey of provinces and important towns—projects resulting in a rich documentation, not least the maps of the southern provinces by father and son Jacques and Jean Surhon. Charles V's son, Felipe II of Spain, continued this tradition by ordering over two hundred town maps by Jacob van Deventer and relied on his *géographe royal*, Christiaan Sgrooten, to compile three huge manuscript atlases after van Deventer's death in 1575, of which atlases two survive (Koeman and Van Egmond 2007, 1260–63, 1272–77).

If sovereigns did not directly commission maps, they fostered them indirectly. Felipe II's daughter, the Archduchess Isabella Clara Eugenia, sovereign from 1598 with her husband Archduke Albert VII and sole Gouvernante générale (governor general) des Pays-Bas from 1621, protected intellectuals and artists, such as Michel Coignet, editor of Abraham Ortelius's *Epitome* (1601) (Koeman et al. 2007, 1332); his son-in-law, Guillaume Flamen, *ingénieur des Archiducs*, who authored more than twenty fortress maps between 1603 and 1621 (Bracke 2007); and Pierre Vernier, engineer from the Franche-Comté, who invented a new quadrant equipped with a graduated mobile sector (vernier), allowing a much more accurate reading of a sighting. Royal intervention and support were equaled in the Austrian period under the reign of both Archduchess Maria Elisabeth, daughter of Leopold I, and her brother, Charles Alexandre, duc de Lorraine, brother-in-law to the Empress Maria Theresa. Maria Elisabeth created the Jointe des terres contestées in 1740 to examine territorial disputes with the Principality of Liège and to gather documents, including maps, to defend and support various claims and to instruct boundary commissioners. The Jointe's jurisdiction later expanded to include disputes with France. Charles Alexandre supported several cartographic initiatives, the most important being the Ferraris Survey of the entire region based on principles similar to those of the Cassini survey.

After the sovereign, the military was the most significant promoter of mapping efforts. Receiving orders directly from the *gouverneurs généraux* and their headquarters, military engineers during the Spanish period were artillery officers with engineering training and cartographic responsibilities who drew maps of towns and fortifications, surveyed border areas, and, at the request of a city, furnished maps of rivers for studying problems of flooding or for public works projects like canals and bridges (Koeman and Van Egmond 2007, 1275–88).

Military engineers initially learned their craft from a family member or an older officer on site. Requisite knowledge in mathematics could be provided by Jesuit colleges. From the last quarter of the seventeenth century, specialized training was offered at the Academia Real y Militar del Ejército de los Países Bajos (or, in much of the literature, Academia Real y Militar de Bruselas) founded in 1675 under the direction of Sebastián Fernández de Medrano, a Spanish military engineer from Toledo (Barrios Gutiérrez 1983, 23, 25). Fernández de Medrano came to the Spanish-controlled Netherlands in 1667 as a reserve officer and served under military engineer Salomon van Es, designer of the fortress of Charleroy (1666). A self-taught mathematician, Fernández de Medrano authored numerous influential illustrated texts on artillery, engineering, architecture, geography (with maps), geometry, and other applied sciences (Rodríguez Villa 1882). Twenty to thirty student-officers or pupils from various parts of Europe could attend the academy for one or two years to study arithmetic, practical geometry, fortification, geography, artillery, and tactics. The academy had a long-range impact, even after its closure in 1706, through the influence of its pedagogy and curriculum on one of Fernández de Medrano's students and collaborators, Jorge Próspero de Verboom. Verboom served in the Spanish army in the Pays-Bas before being transferred to Spain in 1702, where he built the citadel of Barcelona, improved other Spanish defenses, and helped create the Spanish Cuerpo de Ingenieros, stocked

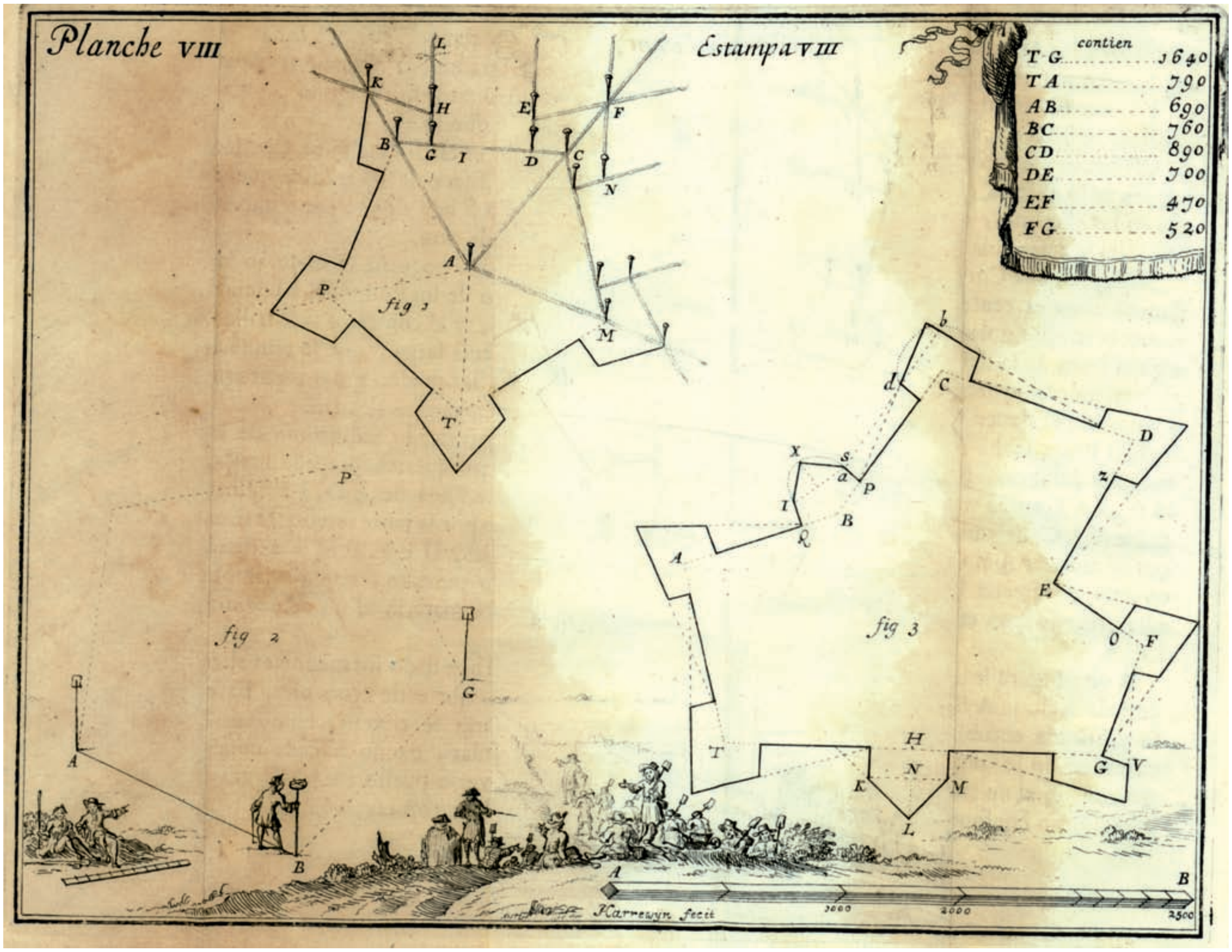


FIG. 602. MILITARY ARCHITECTS USING SURVEYING TECHNIQUES FOR LAYING OUT THE WALLS OF A FORTIFICATION. From Sebastián Fernández de Medrano, *El architecto perfecto en el arte military* (Brussels: L. Marchant, 1700), pl. VIII (with vignette).

Size of the original: 13.5 × 18.0 cm. Image courtesy of the Special Collections Library, University of Michigan, Ann Arbor (UG 460 .F36 1700).

with personnel lured from the Low Countries, many of them tutored by Fernández de Medrano. Verboom's proposal for an academy of mathematics in Barcelona in 1712 resulted in the physical establishment of the Real Academia Militar de Matemáticas de Barcelona in 1720 with a curriculum based on that of Fernández de Medrano in Brussels, which provided more on-site experience than theoretical training (Lombaerde 2011, 153–60; Galland Seguela 2008, 29–37, 55–56).

Other publications connected with the Spanish military were published in Brussels and Antwerp well into the eighteenth century and track the evolution of the military engineer and his cartographic skills. The *Tratado de la artilleria* (1613; French and German translations, 1614) by Diego Ufano, captain of the artillery in Antwerp's castle, incorporated plans of fortifications and cities to illustrate the use of artillery in siege warfare. Fernández de Medrano's books were even more clearly designed for engineering and geography: *El ingeniero* (1687; French, 1696) was written in Spanish, not Latin, and as the author explained in his "Preface" to his own French translation of 1696, *l'Ingenieur pratique*, it was organized and written in a simple style "in such a way that the most ignorant and dullest can understand it easily" (unpaginated). The work was reprinted until the 1790s. Fernández de Medrano provided details about surveying with various instruments, advising an engineer preparing a siege to have an exact plan of the fortress plus a map of its surroundings within a one-hour perimeter, just as Sébastien Le Prestre, marquis de Vauban, had recommended (fig. 602). Another director of the Academia Real y Militar de Bruselas, Nicolas Bernard d'Hucher, wrote the *Leçons mathématiques* (1755–65), dedicated to the *gouverneur général* Charles Alexandre; its summary of what was absolutely necessary for an engineer made it the perfect handbook for a military cartographer.

The Treaty of Utrecht (1713) gave the Southern Netherlands newfound sovereignty. The military academy founded by Fernández de Medrano reopened that year under the name Académie militaire de fortification et de mathématique, headed by a local military engineer, Léonard Hartman. In 1732, the court in Vienna initiated the creation of a Corps du Génie and a Corps d'Artillerie des Pays-Bas, which remained distinct from their Austrian equivalents until 1772. Called upon in various theaters of war, Low Countries military engineers made maps of Central Europe during the period.

From the seventeenth into the early eighteenth century, cultural exchanges between Flanders, northern Italy, and Spain created an intellectual and technological symbiosis between the three centers of the Spanish Empire. Low Countries engineers were appreciated abroad, mainly for their knowledge of water problems and fortifications. The exchange of engineering skills and ideas also influenced aspects of town planning in the Southern Netherlands, Spain, and Spanish America (Lombaerde 2011).

As in France, civil engineers, though not so titled, served alongside the military engineers; they were by and large local surveyors, trained within families. A professional corps des Ponts et Chaussées was not created until the end of the eighteenth century. Local surveyors, whose presence as *arpenteurs* or *geometra* is recorded as early as the late twelfth century and whose trade was regulated from the mid-fifteenth century, were often employed on infrastructure projects in the service of the governing sovereign, the local communities, the military, or a combination of all three (Wellens 1985; Watelet 1995; Janssens 2006). They also worked with military engineers on boundary limits in preparation for or to accompany treaty negotiations (Van der Haegen, Daelemans, and Van Ermen 1986, 277–90).

While military engineers created large- and medium-scale maps and plans that focused on fortifications and artillery sieges, military infrastructure (roads, bridges, engineering works), and battle preparation and commemoration, local surveyors produced another range of large-scale cartography that was used in litigation, estate management, and provincial government administration and infrastructure management (Kain and Baigent 1992, 39–44; Watelet 1995) (fig. 603). Tithe maps and estate maps (of private individuals or religious orders), grounded in earlier practices, provide examples of large-scale property mapping from the seventeenth and eighteenth centuries; the 230 maps (dating from 1593 to 1606) of the estate of Charles (III), duc de Croÿ, by the surveyor Pierre de Bersaques and his sons stand out as an early example of maps used for the collection of feudal dues (Duvosquel 1985–96).

FIG. 603. JACOBUS THOMAS ROELANTS, MAP OF THE REGION FROM LIERRE TO LOUVAIN, 1734. The map incorporates an image of a civilian geometer-engineer using the triangulation method to determine the meridian line along which the road between the two cities is to be built. Manuscript, ink and watercolor on paper.
Size of the original: 42.0 × 27.3 cm. © National Archives of Belgium (Cartes et plans manuscrits, Première Série, inv. No. 207).

Efforts by the various states within the area encompassed by the Southern Netherlands to create maps as administrative tools centered on the problem of land assessment and taxation. Brabant relied on local surveyors (*arpenteurs jurés* or *gesworen paelder*, sworn assessors) who were governed by state regulations (established in 1451, revised in 1657 and 1705) to produce cadastres with accompanying maps (Kain and Baigent 1992, 40–41; Wellens 1985, 44). Yet in the Duchy of Luxembourg and Limbourg, little was done in the way of cadastral mapping; the Austrian empress Maria Theresa ordered the compilation of a cadastre in 1752, but no maps were made. On the other hand, in the small area of the Limburg Kempen (south of Eindhoven, north of Liège), where constant warfare had ravaged the countryside and inhabitants were unable to pay taxes based on outdated land values, local communities organized surveys and maps to petition for reform in the 1760s and 1770s (Kain and Baigent 1992, 42–44; Molemans 1988).

As elsewhere in Europe, early modern urban mapping in the Southern Netherlands reflected a desire for the decorative as well as the accurate, whether on the part of the municipality itself or a noble patron. The painter and surveyor Pierre Pourbus produced the "Franc de Bruges," measuring nearly twelve square meters, to hang in the city council room at the request of the municipality in 1571 (Koeman and Van Egmond 2007, 1252–53). Bird's-eye views of important towns were published in several sheets, such as that of Brussels, produced at the initiative of Martin de Tailly, "capitaine de Bruxelles" (*Brvxella Nobilissima Brabantiæ Civitas*, 1640) (Lebeer 1956, 158–63; Danckaert 1989, 31, 35–39). Yet eighteenth-century initiatives for urban mapping did not follow the pattern of other European cities as constant warfare and the terms of the Barrier Treaties following the War of the Spanish Succession continued the fortification of towns or their rebuilding after bombardment, requiring continuous military initiatives. The impetus of either civic pride or commercial incentive was lacking. In this way, the military treatises published in Brussels and Antwerp on architecture and fortification influenced early eighteenth-century urban design, especially invoking the grid plan (Danckaert 1968; Lombaerde 2011). The urban plans published by Brussels printer and mapseller Eugène Henry Fricx as part of his *Table des cartes des Pays Bas et des frontieres de France* were based on military surveys. Fricx's *Plan de la ville de Brusselles* (fig. 604) was the last large-scale plan of this city published by a Flemish printer until the *Plan topographique de la ville de Bruxelles et de ses environs* (1:5,100) by Louis André Dupuis in 1777, which was constructed from data generated by the Ferraris Survey of the Austrian Netherlands. When Joseph II ended the Dutch military presence in 1782, urban fortifications were considered less necessary and their removal in the early nineteenth century began to reshape the urban landscape. Large-scale urban mapping for purposes of celebration or evocation of a historic past waited until the beginning of the nineteenth century.

Fricx's aforementioned *Table des cartes des Pays Bas* (1704–12) was the first general map of the Southern Provinces, devised on a large scale (ca. 1:115,000) and printed on twenty-four sheets, many of them engraved by Jacques Harrewyn, who had also engraved the illustrations for Fernández de Medrano's work. Known unofficially as the *Carte de Fricx* or *Carte des Pays Bas*, the combined map was based mostly on the surveys and manuscript maps of French military engineers and complemented by British and Austrian surveys. Although published initially in French, the map was completed when the Southern Netherlands were under Austrian rule and was published in several editions, both in the Austrian Netherlands and in the neighboring countries. It provided the initial information for many maps of the region produced during the eighteenth century and was still carried by some at the Battle of Waterloo in 1815 (Bracke 2012).

Compared with the previous period, the eighteenth century was peaceful for the region, which suffered only six years of war on its territory after 1713. The sovereign central government was in Vienna, but the governors general sent to Brussels were generally well chosen and remained in charge for long periods. Prosperity slowly returned and with it the need for intellectuals to have a place to meet and exchange ideas. Under the dynamic and enlightened minister plenipotentiary Charles de Cobenzl, the Société littéraire was created in 1769, becoming the Académie impériale et royale des sciences et belles-lettres de Bruxelles in 1772, with letters patent from Empress Maria Theresa. The new institution was dedicated to matters useful for humanity and industry and encouraged astronomical research with application to geodesy, such as the work of astronomer Nathaniel Pigott. The energy of the academy was matched by general support for a map of the region to be produced under the leadership of Joseph Jean François de Ferraris. A new climate of cartographic openness emerged as well. Discussions surrounding the publication of the Ferraris Survey defeated the idea that maps should be secret, as they had been during the Renaissance, by arguing for greater access and holding that all European military headquarters already owned excellent maps of the Netherlands. Like the *Carte des Pays Bas*, the Ferraris map was copied many times by foreign editors, some using his name and others not. It provided basic information for many maps in the nineteenth century, including the official topographical maps produced under the auspices of the Dépôt de la Guerre.

The year 1780 was crucial for the Southern Provinces, marked by the death of Maria Theresa. Her son, Joseph II, applied his deeply imbued Enlightenment ideas with such eagerness and haste that soon his subjects rebelled. The situation in the Principality of Liège was similar. François-Charles de Velbrück, *prince-evêque* from 1772 to 1784, also espoused Enlightenment principles and realized many beneficent and altruistic reforms, but his autocratic enlightened despotism encouraged opposition there too.

From 1650 to 1780, the cartographic documentation of the Southern Provinces is rich, though less so in Belgium itself, where maps were plundered at each invasion. Many of these maps have been preserved, however, in neighboring countries (Lemoine-Isabeau et al. 1985).

FIG. 604. EUGÈNE HENRY FRICX, *PLAN DE LA VILLE DE BRUSSELLES, VILLE NOBLE*, 1712. Sheet number 60 from Fricx's *Carte des Pays Bas*. The city is shown in plan, with major monuments depicted three-dimensionally, and the environs topographically. Street names are written in Flemish, but the legend for monuments and squares is in French. Engraved by Jacques-Gérard Harrewyn.

Size of original: 50.2 × 59.6 cm. Image copyright Royal Library of Belgium, Brussels (Cartes et plans, II 63.204 [60] D).

From about 1750, topographical maps of the entire country were drawn in France, Austria, and the Austrian Netherlands. At about the same time, military strategy shifted slowly from siege warfare to battle maneuvers in the open field. While Fernández de Medrano and Vauban advised engineers to possess good maps of towns and their surroundings in the seventeenth century, by the nineteenth century, Napoleon was able to prepare for his campaign with a veritable sea of large-scale topographical maps (ca. 1:50,000) showing the extent and nature of the terrain.

CLAIRE LEMOINE-ISABEAU

SEE ALSO: Austrian Monarchy; Ferraris Survey of the Austrian Netherlands

BIBLIOGRAPHY

Barrios Gutiérrez, Juan. 1983. "La Real y Militar Academia de los Países Bajos." *Revista de Historia Militar* 54:19–35.

Bracke, Wouter. 2007. "La production cartographique de Guillaume Flamen." In *Mélanges offerts à Hossam Elkhadem par ses amis et ses élèves*, ed. Frank Daelemans et al., 329–51. Brussels: Archives et Bibliothèques de Belgique/Archief- en Bibliotheekwezen in België.

———. 2012. "Eugène-Henri Fricx en de Spaanse Successieoorlog: Une affaire de cartes." In *Quotidiana: Huldealbum Dr. Frank Daelemans*, 2 vols., ed. Ria Jansen-Sieben, Marc Libert, and André Vanrie, 1:197–224. Brussels: Archives et Bibliothèques de Belgique/ Archief- en Bibliotheekwezen in België.

Cámara, Alicia, ed. 2005. *Los ingenieros militares de la monarquía hispánica en los siglos XVII y XVIII*. Madrid: Ministerio de Defensa, Asociación Española de Amigos de los Castillos, Centro de Estudios Europa Hispánica.

Dainville, François de. 1956. *Cartes anciennes de l'Église de France: Historique, répertoire, guide d'usage*. Paris: J. Vrin.

Danckaert, Lisette. 1968. *Plans et vues de dix-neuf villes belges*. Brussels: Bibliothèque Albert Ier.

———. 1989. *Bruxelles: Cinq siècles de cartographie*. Tielt: Lannoo; Knokke: Mappamundi.

Duvosquel, Jean-Marie. 1985–96. *Albums de Croÿ*, 26 vols. (grand in-4o). Brussels: Crédit Communal de Belgique.

Essen, Léon van der, ed. 1919. *Atlas de géographie historique de la Belgique*, fasc. 5, *Carte X: La Belgique en 1786 (Les Pays-Bas autrichiens)*. Brussels and Paris: Librairie Nationale d'Art et d'Histoire; G. Van Oest.

———, ed. 1927. *Atlas de géographie historique de la Belgique*, fasc. 4, *Carte VIII–IX: La Belgique au XVIIe siècle (1648–1713)*. Brussels and Paris: Librairie Nationale d'Art et d'Histoire; G. Van Oest.

Galland Seguela, Martine. 2008. *Les ingénieurs militaires espagnols de 1710 à 1803: Étude prosopographique et sociale d'un corps d'élite*. Madrid: Casa de Velázquez.

Haegen, H. van der, Frank Daelemans, and Eduard van Ermen. 1986. *Oude kaarten en plattegronden: Bronnen voor de historische geografie van de Zuidelijke Nederlanden (16de–18de eeuw) = Cartes et plans anciens: Sources pour la géographie historique des Pays-Bas méridionaux (XVIe–XVIIIe siècles)*. Brussels: Archives et Bibliothèques de Belgique.

Hucher, Nicolas Bernard d'. 1755–65. *Leçons mathématiques, a l'usage de l'Academie militaire et civile aux Pays-Bas*. 3 parts. Brussels: Chez Jean Leonard.

Janssens, Luc. 2006. "Kaarten op bestelling: De beroepsgroep der land- en edificiemeters in het hertogdom Brabant en de Landen van Overmaas (1680–1795)." PhD diss., Katholieke Universiteit Leuven.

Kain, Roger J. P., and Elizabeth Baigent. 1992. *The Cadastral Map in the Service of the State: A History of Property Mapping*. Chicago: University of Chicago Press.

Koeman, Cornelis, and Marco van Egmond. 2007. "Surveying and Official Mapping in the Low Countries, 1500–ca. 1670." In *HC* 3:1246–95.

Koeman, Cornelis, et al. 2007. "Commercial Cartography and Map Production in the Low Countries, 1500–ca. 1672." In *HC* 3:1296–1383.

Lebeer, Louis. 1956. "Recherches relatives au plan de Bruxelles de 1640 et 1748, dit plan de Tailly." *Annales de la Société Royale d'Archéologie de Bruxelles* 48:157–200.

Lemoine-Isabeau, Claire. 1984. *Les militaires et la cartographie des Pays-Bas méridionaux et de la Principauté de Liège à la fin du XVIIe et au XVIIIe siècle*. Brussels: Musée Royale de l'Armée.

Lemoine-Isabeau, Claire, et al. 1985. *Cartographie belge dans les collections espagnoles XVIe au XVIIIe siècle*. Brussels: Crédit Communal.

Lombaerde, Piet. 2011. "*Castrametatio* and the *Grid* in the Spanish Habsburg World: Contributions from the Low Countries, 1550–1750." In *Early Modern Urbanism and the Grid: Town Planning in the Low Countries in International Context, Exchanges in Theory and Practice, 1550–1800*, ed. Piet Lombaerde and Charles van den Heuvel, 129–60. Turnhout: Brepols.

Molemans, Jos. 1988. "Achtergronden van het ontstaan van het 18de-eeuwse kadaster in de Limburgse Kempen." In *Erschliessung und Auswertung Historischer Landkarten = Ontsluiting en gebruik van historische landkaarten*, ed. Hanns Peter Neuheuser, 223–53. Cologne: Rheinland-Verlag.

Rodríguez Villa, Antonio. 1882. *Noticia biográfica de Don Sebastian Fernandez de Medrano*. Madrid: Manuel G. Hernandez.

Schonaerts, Roger, and Jean Mosselmans. 1976. *Les géomètres-arpenteurs du XVIe au XVIIIe siécle dans nos provinces*. Brussels: Bibliothèque Royale Albert Ier.

Watelet, Marcel, ed. 1995. *Le terrain des ingénieurs: La cartographie routière en Wallonie au XVIIIe siècle*. Namur: MET; Brussels: Racine.

Wellens, Robert. 1985. "Documents relatifs aux géomètres-arpenteurs des Pays-Bas conservés aux Archives générales du Royaume à Bruxelles (XVIe–XVIIIe siècles)." In *Het archiefwezen in België na de Tweede Wereldoorlog*, by Carlos Wyffels, Robert Wellens, and Ernest Persoons, 43–64. Brussels: Algemeen Rijksarchief en Rijksarchief in den Provincien.

New France. New France (Nouvelle France) refers to the territories in North America claimed by France under the Ancien Régime; it was the name given by Giovanni da Verrazzano to the interior of the continent along whose coast he explored (Lestringant and Pelletier 2007, 1463). These territorial holdings corresponded neither to contemporary notions of nation and frontier, nor even to the nineteenth-century concept of colony. In reality, the borders of New France were the object of constant warfare and negotiation, both with the Amerindian peoples, whose only choice was to tolerate the European presence, and with England and Spain, the other European presences in that region.

At its greatest extent between 1699 and 1713, New France encompassed a territory covering about one third of North America, including French Canada (Quebec, Trois-Rivières, Montreal, and the Pays d'En-Haut, or the Upper Country around the Great Lakes), Acadia (modern-day New Brunswick and Nova Scotia), a portion of the coast of Hudson Bay, the island of Newfoundland,

FIG. 605. CLAUDE BERNOU (ATTRIBUTED), "CARTE DE L'AMERIQUE SEPTENTRIONALE ET PARTIE DE LA MERIDIONALE," CA. 1681. As a functionary in the Marine under the ministry of Jean-Baptiste-Antoine Colbert, marquis de Seignelay (son of Jean-Baptiste Colbert), the abbé Bernou probably produced this manuscript map in conjunction with a memoir supporting the advantages of French exploration and colonization of the interior of North America (Pelletier 1984). Size of the original: 147 × 163 cm. Image courtesy of the Bibliothèque nationale de France, Paris (Cartes et plans, SH 18e Pf 122 div 2 p 0 RÉS).

and French Louisiana. This last territory extended from the Great Lakes to the Mississippi delta, the French having claimed all the lands watered by the Mississippi and Missouri Rivers and their tributaries, as well as the coastal zone comprising the present-day states of Louisiana, Alabama, and Mississippi and a small part of Texas. These five colonial possessions, gathered under the authority of a governor general based in Quebec, came under the supervision of the *secrétaire d'État à la Marine* (fig. 605). However, in spite of their common administrative dependency, the geographic, historic, and political importance of these five claims was neither homogeneous nor comparable (Pelletier 1984). They are best described successively and chronologically.

Newfoundland, though the smallest of these colonies, was important because of its major cod-fishing industry.

As the easternmost territory of the North American continent, it was a region frequently shown on early European maps of North America and its coastline. In 1635, the English granted the right to land and dry cod on the shores of Newfoundland. The French settled in Placentia Bay (la baie de Plaisance), where a fortification was built and a garrison installed. Thirty years later, the colony had grown to about seven hundred people when warfare destroyed both the French (1690) and English (1696) settlements. By the terms of the Treaty of Ryswick (1697), France gained the Bays of Placentia, Hermitage, and Fortune, as well as the islands of Saint-Pierre and Miquelon, allowing continued cod and salmon fishing. However, the Treaty of Utrecht (1713) forced France to cede its possessions in Newfoundland to England; only the islands of Saint-Pierre and Miquelon were returned under the Treaty of Paris (1763). Today, they remain the vestige of what was once New France. The importance of Newfoundland attracted a cartography that concentrated on its complex coastline of multiple inlets and small islands; its interior held little interest for mapmakers at either large or small scale.

In the seventeenth and eighteenth centuries, French Canada was one of the most profitable French colonies because of two major activities: fishing and fur trading. Because the Treaty of Tordesillas (1494) between the Spanish and the Portuguese applied only to lands already discovered, Francis I charged Jacques Cartier with an official expedition to explore the interior of this part of New France. Over the course of two voyages, Cartier traveled up the St. Lawrence River as far as Montreal, where he encountered the Iroquois Indians and thought he had found the mythic Northwest Passage in the St. Lawrence River system. Cartier was followed by Pierre Du Gua de Monts, Jean de Biencourt de Poutrincourt, and Samuel de Champlain, who systematically explored the Canadian coasts from Cape Cod to Lake Huron (1603–9) and whose maps had a singular impact on European understanding of this hydrographic network (Heidenreich 2007, 1538–47). Champlain founded Quebec in 1608, and soon evangelizing missionaries and unauthorized fur traders (*coureurs des bois*) came into contact with the Amerindian population in the Pays d'En-Haut. Daniel Greysolon Dulhut explored the territories to the west of the Great Lakes and Minnesota (1678), while Antoine de Lamothe Cadillac founded the small city of Detroit (1701), situated between Lakes Erie and Sainte Claire, at the edge of Louisiana and of the Pays d'En-Haut. Little defended by the king, these fragile settlements were continuously threatened by the English. The Canadian colony nonetheless established itself over time, and historically it constituted the richest, most populated, and most powerful colony in New France. The results of survey work by French observers based in Canada, such as the map of North America by Jean Baptiste Louis Franquelin (see fig. 244) and those of military engineers, aided the creation of general medium- and small-scale geographical maps, which began to appear and visualized the huge vastness of the land and the importance of the water network. Several cities established there brought French culture to the New World: Quebec, Trois-Rivières (1634), and Montreal (1642), cities that became well known by their cartographic descriptions.

South of the Gulf of St. Lawrence, the present-day peninsula of Nova Scotia was the first coast on which Du Gua de Monts settled in 1604, first at the Saint Croix River, then at Port Royal in 1605. Following Verrazzano's nomenclature, he named the peninsula Acadia (Acadie). This initiative proved short-lived, and James I of England (VI of Scotland) granted privileges in 1621 over Acadia to the Scottish courtier Sir William Alexander, earl of Stirling, who rechristened it Nova Scotia, but without managing to establish a permanent settlement there. Finally, Canadians of French origin, most from the Poitou-Charentes, settled permanently in Acadia, having negotiated a treaty with the Micmac Indians. The territory gradually encompassed the Magdalen Islands (Les Îles de la Madeleine), Prince Edward Island (Île-St-Jean), and Cape Breton Island (Île Royale), as well as the south coast of New Brunswick (la Gaspésie). In 1654, Louis XIV named Nicolas Denys governor of Acadia. After the English capture of Port Royal in 1690, Acadia passed briefly to nominal English rule, but the Treaty of Ryswick returned it to France. The English captured Port Royal again in 1710 and recovered all of Nova Scotia under the Treaty of Utrecht. Thereafter, Cape Breton was the only part of Acadia to remain in French hands, and in 1719 the French fortified its capital, Louisbourg.

Meanwhile, inhabitants of Acadia, now under English rule, widely refused to take the oath of allegiance to the English monarch, resistance that cost them dearly. In 1755, the British lieutenant governor ordered his military commander Robert Monckton to deport the Acadians to the English colonies in America and destroy their homes. Many of those who did not die during the expatriation (Le Grand Dérangement) hid or fled, some to the Antilles, others to France. Many populated Louisiana (and were called Cajuns, as are their present-day descendants). Still others went to the islands of Saint-Pierre and Miquelon, to the Magdalen Islands, to Maine, or to Quebec. Those who returned to Acadia enjoyed neither voting rights nor government representation until 1830. Although the English seized Louisbourg in 1745, the Treaty of Aix-la-Chapelle (1748) restored it to France (the English captured it again in 1758 and soon after destroyed its fortifications). The treaty ended the War of the Austrian Succession and returned European claims in North America to the status quo ante bellum as established by the Treaty of Utrecht (1713). This caused particular problems for the French and the English, both claimants to the area known as Acadia, or Nova Scotia. A boundary commission was established to study the claims and establish a boundary. The memorials of their negotiations reveal their attitude toward maps as evidence of proof of sovereignty (Pedley 1998).

French Louisiana was the southernmost and largest area of New France, initially explored by French Canadians from the banks of St. Lawrence or the Pays d'En-Haut. In 1673, the geographer Louis Jolliet and the Jesuit missionary Jacques Marquette together explored the Mississippi River, which René Robert Cavelier de La Salle later followed to its mouth. La Salle concluded that the St. Lawrence river system, the Great Lakes, and the Mississippi did not lead to China; he christened the lands Louisiana (1682), claiming them on behalf of Louis XIV. La Salle's diaries of his explorations provided much of the data that was transformed into a basic cartography of the region by the Delisle workshop, as seen in Guillaume Delisle's manuscript "Carte de la Nouvelle France" of 1696 (see fig. 202).

The effective and energetic colonization of this territory began only with Pierre Le Moyne d'Iberville, who constructed three forts in the region: Maurepas (1699, across the bay from modern-day Biloxi), La Boulaye (1700, south of modern New Orleans), and Fort Louis on the Mobile River (1702, eventually relocated to modern Mobile in 1711). As an immense agricultural territory that was difficult to protect, Louisiana attracted few colonists, and African slaves soon became the majority population. For the few explorers and engineers who ventured there, the vast swamps, hot climate, and danger of living on land inhabited by a number of indigenous nations frequently hostile to the European ways created obstacles to cartographic work; printed maps, created after 1750 by Paris geographers who never visited Louisiana, such as Jacques-Nicolas Bellin, display the extent of their knowledge of the region at small scale (fig. 606).

Outside of Canada and the Mississippi region, several French exploratory efforts contributed to knowledge of the Amerindian world: Louis Juchereau de Saint-Denis

FIG. 606. JACQUES-NICOLAS BELLIN, *CARTE DE L'AMERIQUE SEPTENTRIONALE DEPUIS LE 28 DEGRÉ DE LATITUDE JUSQU'AU 72*, 1755. Following the "Remarques" at upper left, the outlines of the colonial possessions are marked with blue (France), yellow (Britain), and red (Spain). Size of the original: 64.0 × 97.5 cm. Image courtesy of the Bibliothèque nationale de France, Paris (Cartes et plans, Ge DD 2987 [8534 B]).

FIG. 607. FRANÇOIS LE MAIRE, "CARTE NOUUELLE DE LA LOÜISIANE," 1716. Le Maire was a secular priest serving as a missionary in Louisiana who sent to France manuscript maps, such as this one, that included the locations of Indian nations, settlements, and the route followed by Louis Juchereau de Saint-Denis in 1714, as well as routes used by the English, the Spanish, and the Cherokee. Nicolas de Fer used Le Maire's work to prepare his *Partie meridionale de la riviere de Missisipi* (1718), as did Guillaume Delisle for his *Carte de la Louisiane et du cours du Mississipi* (1718).
Size of the original: 47 × 58 cm. Image courtesy of the Bibliothèque nationale de France, Paris (Cartes et plans, Ge D 7883).

in the region of Natchitoches (1714–15), Jean-Baptiste Bénard de La Harpe along the tributaries of the Mississippi River (1719), Étienne Véniard de Bourgmont in the region of the Kansas and Missouri Rivers (1723–24), several members of the Gaultier de La Vérendrye family west of Lake Superior and in the upper valley of the Missouri (late 1720s to 1740s), and the Mallet brothers, Pierre Antoine and Paul, who reached Santa Fe from the north (1739) (Mapp 2011, 194–257). Meanwhile, the fur trade in the interior and efforts at family agriculture near the coasts experienced continual competition from English colonists and menace from their soldiers. In addition, continuous conflict in the interior with Amerindians necessitated the dispatch of troops from France. While the paths and tracks used by the Indians and the Canadian traders were well known, as was the topography of the villages and their environs, they were only recorded in manuscript relations and on manuscript maps whose distribution was confidential, although some information made its way to the marketplace (fig. 607).

Despite setbacks, French cities dotted this vast territory, many of them enduring as capitals of American states in the nineteenth century; after the founding of Detroit in the north (1701), Mobile was moved and reconstructed (1711). In 1721–22, the engineer Adrien de Pauger established New Orleans as the capital of Louisiana, providing a model of classical urbanism unequalled before the founding of Washington, D.C. Pauger's map of the city (1721) showed a regular grid and symmetrical layout, based on the plan of New Biloxi (1720) prepared either by Pauger or by his chief engineer, Louis Pierre Le Blond de la Tour.

Nonetheless, a series of disappointments followed: hoped-for mines proved unprofitable, the fur trade was less active than in Canada, efforts to grow indigo and tobacco were badly run, and sugar and cotton were belatedly introduced. In this colony of slaves, small bosses, and vain or corrupt administrators, where no one wanted to emigrate or establish themselves permanently, the king made investments commensurate with his very meager profits. In a final burst of energy, French fur traders founded Saint Louis in 1764, but the Treaty of Paris (1763) had already ceded the western half of Louisiana to Spain and the eastern half to the English. After 1776, the United States progressively took control of English Louisiana, while the Spanish portion, briefly becoming French once more in 1800, was sold to the United States in 1803. The sale marked the end of New France as a colonial entity. Just before this event, the *Voyage dans l'Amérique septentrionale* of General Georges-Henri-Victor Collot, with manuscript maps prepared by Joseph Warin, published posthumously in 1826, gave a portrait of the Ohio and Mississippi valleys. This detailed journal and cartography foreshadow the expedition of Meriwether Lewis and William Clark through old Louisiana to the West (1804–6).

GILLES-ANTOINE LANGLOIS

SEE ALSO: Administrative Cartography; Boundary Surveying; France; French West Indies; Geographical Mapping; Northwest Passage; Property Mapping; Topographical Surveying; Urban Mapping; Utrecht, Treaty of (1713)

BIBLIOGRAPHY

Creagh, Ronald, ed., with John P. Clark. 1994. *Les Français des États-Unis, d'hier à aujourd'hui*. Montpellier: Éditions Espaces 34; CIRCAN, Université de Montpellier III.

Dujardin, Justine. 2008. "Cartographier la Louisiane française au XVIII^e siècle." Thèse diplôme d'archiviste-paléographe, Ecole nationale des chartes, Paris.

Giraud, Marcel. 1953–2012. *Histoire de la Louisiane française*. 5 vols. Paris: Presses Universitaires de France (vols. 1–4); L'Harmattan (vol. 5). In English, *A History of French Louisiana*, Baton Rouge: Louisiana State University Press, 1974–.

Heidenreich, Conrad E. 2007. "The Mapping of Samuel de Champlain, 1603–1635." In *HC* 3:1538–49.

Langlois, Gilles-Antoine. 2003. *Des villes pour la Louisiane française: Théorie et pratique de l'urbanistique coloniale au 18^e siècle*. Paris: L'Harmattan.

Lestringant, Frank, and Monique Pelletier. 2007. "Maps and Descriptions of the World in Sixteenth-Century France." In *HC* 3:1463–79.

Litalien, Raymonde, Jean-François Palomino, and Denis Vaugeois. 2007. *Mapping a Continent: Historical Atlas of North America, 1492–1814*. Trans. Käthe Roth. Sillery: Septentrion.

Mapp, Paul W. 2011. *The Elusive West and the Contest for Empire, 1713–1763*. Chapel Hill: For the Omohundro Institute of Early American History and Culture by the University of North Carolina Press.

Pedley, Mary Sponberg. 1998. "Map Wars: The Role of Maps in the Nova Scotia/Acadia Boundary Disputes of 1750." *Imago Mundi* 50:96–104.

Pelletier, Monique. 1984. "From New France to Louisiana: Politics and Geography." In *The Sun King: Louis XIV and the New World*, ed. and trans. Steven G. Reinhardt, 85–95. New Orleans: Louisiana Museum Foundation.

Niebuhr, Carsten. Surveyor, explorer, and orientalist Carsten Niebuhr was born on 17 March 1733 in Lüdingworth near Hanover in Germany. After working as a peasant farmer in his early years, Niebuhr went to Göttingen in 1757 to study mathematics and land surveying while supporting himself as a lieutenant with the Hanoverian engineer regiment (Hannoveraner Ingenieurcorps Verwendung). Niebuhr married in 1773, lived in Copenhagen, and held a post in the Danish military service. In 1778 he accepted a position in the civil service of Holstein and resided at Meldorf, where he died on 26 April 1815.

In 1758, Niebuhr was invited to join an expedition dispatched by Frederik V of Denmark for the scientific exploration of Egypt, Syria, and Arabia. In preparation, he was given two years of special training in mathematics and astronomy by Tobias Mayer, who saw the expedition as a means to test his newly developed method to determine longitude by lunar distances (Kejlbo 1990, 258); indeed, Niebuhr succeeded in demonstrating the utility of the method (Baack 2013).

On 7 January 1761, an expedition of six left Copenhagen for Cairo via Istanbul. After spending a year in Egypt, the expedition ascended the Nile, visiting Suez and Mount Sinai. From there they went to Jeddah on the Red Sea, continuing down the west coast of the Arabian Peninsula by open boat as far as Luhaiya in northern Yemen. For eight months in 1763 the expedition traversed Yemen, before boarding a boat to Bombay from Mocha on 21 August. All but Niebuhr died of malaria either in Yemen or Bombay between May 1763 and February 1764. Niebuhr continued to travel alone, working his way home through Iran, Iraq, Syria, Cyprus, Palestine, and Turkey, finally returning to Copenhagen on 20 November 1767. Niebuhr published the results as a general report, *Beschreibung von Arabien* (1772), and a two-volume travel account, *Reisebeschreibung nach Arabien und andern umliegenden Ländern* (1774–78); a third volume, including an account of his astronomical observations, was posthumously published as *Reisen durch Syrien und Palästina* (1837).

In addition to his surviving manuscripts (now in the Kongelige Bibliotek, Copenhagen) and a host of large-scale local maps, town plans, and panoramas, three maps proved especially important. His map of the Nile Delta shows the positions of more than three hundred towns and villages, which correspond closely with the positions determined by French cartographers following Napoleon's invasion thirty-seven years later (Kejlbo 1990, 260–61, 272–73; Baack 2013, 145–47). Niebuhr's astronomic observations and notes on the many coral beds in the Red Sea were combined in a new groundbreaking chart that opened up the northern part of these waters

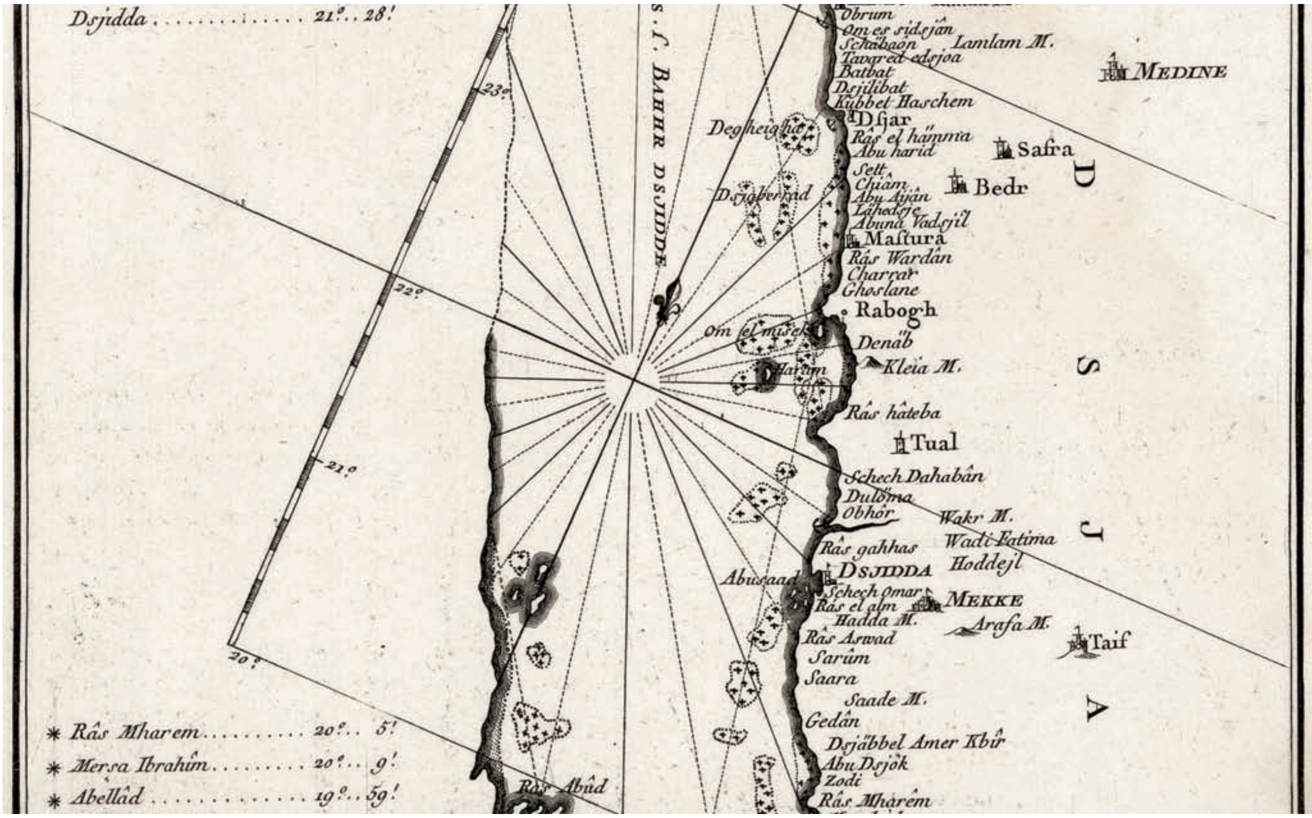


FIG. 608. DETAIL FROM CARSTEN NIEBUHR'S CHART OF THE RED SEA. Based on field observations in 1762–63, *Mare Rubrum seu Sinus Arabicus* was published in Niebuhr's *Beschreibung von Arabien* (Copenhagen: Möller, 1772), pl. XX. This detail includes part of the list of locations whose latitudes he had observed, marked on the map by asterisks.

Size of the entire original: 78.5 × 22.5 cm; size of detail: ca. 13.5 × 22.5 cm. Image courtesy of the Bibliothèque nationale de France, Paris (Cartes et plans, Ge C 11291).

to European sailors (fig. 608) (Kejlbo 1990, facing 240, 276–78; Baack 2013, 147–48). Finally, Niebuhr's map of Yemen became the authoritative cartographic image of that region for more than a century (see fig. 353).

CHRISTOPHER JACOB RIES

SEE ALSO: Geographical Mapping: Enlightenment; Longitude and Latitude

BIBLIOGRAPHY

Baack, Lawrence J. 2013. "'A Practical Skill that Was Without Equal': Carsten Niebuhr and the Navigational Astronomy of the Arabian Journey, 1761–7." *Mariner's Mirror* 99:138–52.

Kejlbo, Ib Rønne. 1990. "Carsten Niebuhrs kartografiske opgaver." In *Den Arabiske Rejse, 1761–1767: En dansk ekspedition set i videnskabshistorisk perspektiv*, ed. Stig T. Rasmussen, 239–302. Copenhagen: Munksgaard.

Nolli, Giovanni Battista. Giovanni Battista Nolli was born in 1701 in Valle Intelvi, Como, Italy, and died in Rome in 1756. His native region had produced master builders and surveyors since the Middle Ages, and this background encouraged him to join the Habsburg Milanese cadastral surveys of 1718–24, in which he specialized in land surveying and qualified as a *geometra*, a title of which he was proud. He worked in other public and private cadastral campaigns in Savoy (1728–34), northern Italy, and the Republic of Venice. In 1735–36, he moved to Rome, where he created his masterpiece, which came to be known as the *Nuova pianta di Roma* (1748). Nolli also worked as a land surveyor, engineer, and architect, redesigning the church of Santa Dorotea (1750) and other minor projects (Bevilacqua 1998; 2004, 24–26).

In 1736, supported by mathematician, antiquarian, and cartographer Diego de Revillas—who later involved Nolli in the study of the ancient Roman fragments of the *Forma urbis Romae*—Nolli was commissioned by an association of antiquarians and other scholars to conduct a complete survey of the whole city and its ancient monuments. He used the newly improved and much-appreciated instrument, the *tavoletta Praetoriana* (*planchette* or plane table), developed by Johann Jakob Marinoni for the Milanese *censimento*, the cadastral survey of the Duchy of Milan under Habsburg rule.

The thorough survey of Rome (1736–38) was later published with private financing in 1748. Although described

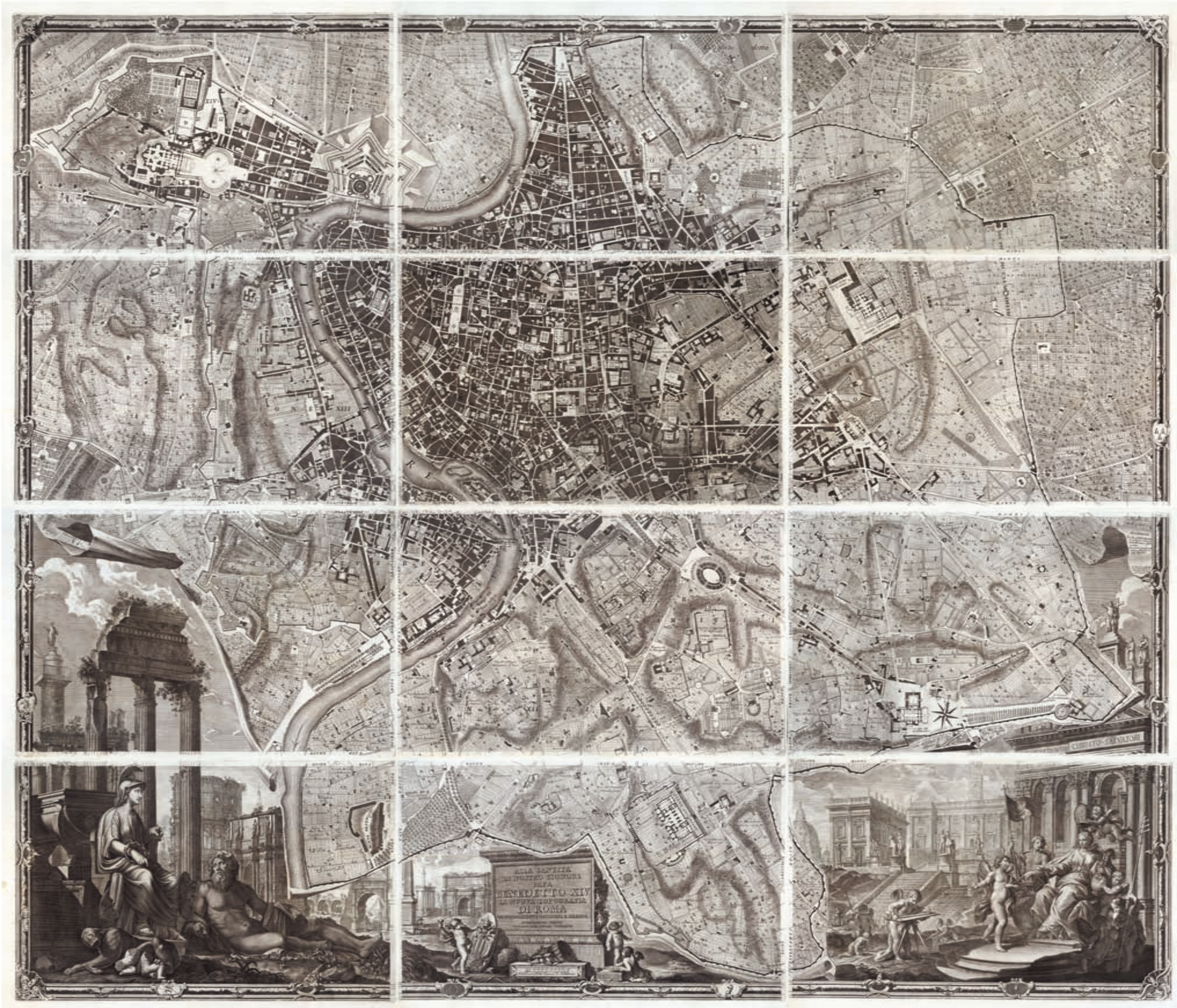


FIG. 609. GIOVANNI BATTISTA NOLLI, *NUOVA PIANTA DI ROMA*, 1748. Engraving in twelve sheets, ca. 1:2,900. Size of the original: ca. 176 × 210 cm. Image courtesy of the Stephen S. Clark Library, University of Michigan, Ann Arbor (G 1989 .R7 N65 1748).

FIG. 610. SHEET 8 FROM GIOVANNI BATTISTA NOLLI, *NUOVA PIANTA DI ROMA*, 1748. The broad scope of the map is apparent in the depiction of the remains of the Circus Maximus and the Flavian Amphitheatre (Colosseum) and part of the Tiber River, together with churches and privately owned vineyards, gardens, and villas on a background of carefully rendered topography.
Size of the sheet: 43.5 × 69.0 cm. Image courtesy of the Stephen S. Clark Library, University of Michigan, Ann Arbor (G 1989 .R7 N65 1748).

in the first publishing contract as a map for antiquarian study, with multicolored layers of print to show urban changes from the Middle Ages to modern times, its scope evolved into a large and scientifically reliable map of Rome. The large-scale *Nuova pianta di Roma* (fig. 609) was published together with a one-sheet reduction, a reproduction of Leonardo Bufalini's plan of 1551, a frontispiece, and a four-page double index of the 1,281 items indicated in the plan. Fewer than two thousand copies were printed; they were sold by an association and then rather slowly due to its high price, to an increasingly enthusiastic international public. Besides being an exact survey of the urban area, its technical precision includes meticulous plans of all major ancient Roman monuments and remains, the plans of more than three hundred churches, and the plans of entrances, courtyards, and staircases of hundreds of Rome's patrician palaces (fig. 610). Its engraving—brilliantly carried out by a group of well-known artists, including Nolli's son Carlo and the young Giovanni Battista Piranesi—is framed by a rich *capriccio* of monuments and allegorical figures of ancient and modern Rome.

Nolli's plan of Rome is considered one of the masterpieces of eighteenth-century urban cartography and influenced later Italian and Western European productions by setting new technical and artistic standards. Its encyclopedic rendering of all aspects of the urban fabric through captions and symbols has made Nolli's plan an icon. Greatly appreciated up to the present, the *Nuova pianta di Roma* is still used as a teaching example by artists and urban planners (Latini 2004).

MARIO BEVILACQUA

SEE ALSO: Academies of Science: Italian States; Cities and Cartography; Urban Mapping: Italian States

BIBLIOGRAPHY

Bevilacqua, Mario. 1998. *Roma nel secolo dei Lumi: Architettura erudizione scienza nella pianta di G. B. Nolli "celebre geometra."* Naples: Electa Napoli.

———. 2004. "Nolli Piranesi Vasi: Percorsi e incontri nella città del Settecento." In *Nolli Vasi Piranesi: Immagine di Roma antica e moderna*, ed. Mario Bevilacqua, 18–29. Rome: Artemide.

Latini, Antonio Pietro. 2004. "Nollimap." In *Nolli Vasi Piranesi: Immagine di Roma antica e moderna*, ed. Mario Bevilacqua, 65–71. Rome: Artemide.

North, Magnetic and True. In the seventeenth and eighteenth centuries, it was possible to use a magnetized needle suspended at its center of gravity to measure two angles that together defined the local character of the earth's magnetic field. The first angle is magnetic inclination, or dip, and is the angle between the earth's magnetic field and the horizontal plane at the point of observation. The second angle is magnetic declination, the difference between true and magnetic north, as given by the magnetic compass, and varies considerably from place to place; it is measured horizontally east or west from the true meridian. Common practice among mariners in England and France was to use "variation" to designate declination. However, after 1768 the best maritime writers in France used only "declination" and reserved the term "variation" for the annual change in magnetic declination at a given location, as was the practice of physicists (Fleurieu 1773, 1:lviii). Nevertheless, other professors, even excellent ones like Étienne Bézout, still used "declination" and "variation" interchangeably (Chapuis 1999, 716). Some scholars still hoped to be able to determine longitude by exploiting the fact that magnetic declination varied as a function of the place and time of observation; at a given moment, all the points of equal magnetic declination on the surface of the globe could be connected on maps of magnetic declination by isogonic lines (Chapuis 1999, 58–62).

The notion of magnetic deviation was not fully integrated into navigation at this time. At least in practice, this stemmed from the lack of recognition of the disturbances due to magnetic bodies on board ship. This did not stop William Wales, the astronomer serving with James Cook, from noticing that these disturbances varied with the heading of the ship (Ritchie 1967, 75). It was not until 1814 that Matthew Flinders published on the curves of variation and noted that for a given compass placement on board ship, the deviation changed not only as function of the displacement of magnetic bodies on the ship (still made of wood), but also according to the heading of the vessel itself (Chapuis 1999, 660). These problems with magnetism were well-defined only after 1815 and were not completely resolved until much later through adjustment of the magnetic compass.

Given the absence of magnetic indications on nautical documents, various astronomical methods were commonly used to determine magnetic declination on board ship, whether near land or in the open sea (Bouguer 1753, 91–94). Used by Charles-François Beautemps-Beaupré during the d'Entrecasteaux expedition (1791–93), astronomical observations locating an object determined its true bearing. The difference between its true bearing and the bearing derived from its compass reading (magnetic bearing) was the magnetic declination. By performing multiple comparisons in the course of one day, an average declination was obtained. This method was necessarily more reliable, since it balanced out the errors inherent in the deviation. Since declination did not change very rapidly, the operation did not have to be repeated too often as long as one did not change the zone of navigation (Chapuis 1999, 717).

Over the course of the eighteenth century, marine maps were more and more systematically oriented with north at the top (signified by a *fleur-de-lis* or a compass arrow). Most often, this was true (or geographic) north, which is immutable. Already included on some documents (both maps and the texts accompanying them) at the end of the seventeenth century, magnetic declination often appeared on the best charts beginning between 1770 and 1775 (independent of those maps specifically dedicated to the representation of the terrestrial magnetic field). From the third quarter of the eighteenth century, magnetic declination was displayed correctly, something that had not always been the case up to that time, notably on the maps of Jacques-Nicolas Bellin, where there were errors of orientation (a western declination being shown as an eastern declination, for example). But there were still marine charts constructed relative to magnetic north through the 1780s. It was not until the beginning of the nineteenth century that the value of declination appeared systematically on maps, and by the middle of the century the value of its annual change also appeared (Chapuis 2007, 225).

OLIVIER CHAPUIS

SEE ALSO: Halley, Edmond; Instruments for Angle Measuring: (1) Marine Compass, (2) Circumferentor; Longitude and Latitude; Marine Charting; Meridians, Local and Prime

BIBLIOGRAPHY

Bouguer, Pierre. 1753. *Nouveau traité de navigation, contenant la théorie et la pratique du pilotage*. Paris: Guérin & Delatour.

Chapuis, Olivier. 1999. *À la mer comme au ciel, Beautemps-Beaupré & la naissance de l'hydrographie moderne (1700–1850): L'émergence de la précision en navigation et dans la cartographie marine*. Paris: Presses de l'Université de Paris-Sorbonne.

———. 2007. *Cartes des côtes de France: Histoire de la cartographie marine et terrestre du littoral*. Douarnenez: Chasse-Marée.

Fleurieu, Charles-Pierre Claret de. 1773. *Voyage fait par ordre du roi en 1768 et 1769, à différentes parties du monde, pour éprouver en mer les horloges marines inventées par M. Ferdinand Berthoud*. 2 vols. Paris: Imprimerie Royale.

Flinders, Matthew. 1814. "On the Errors of the Compass Arising from Attractions within the Ship, and Others from the Magnetism of Land; with Precautions for Obviating Their Effects in Marine Surveying." In *A Voyage to Terra Australis*, 2 vols., 2:512–32. London: G. and W. Nicol.

Jonkers, A. R. T. 2003. *Earth's Magnetism in the Age of Sail*. Baltimore: Johns Hopkins University Press.

Ritchie, G. S. 1967. *The Admiralty Chart: British Naval Hydrography in the Nineteenth Century*. London: Hollis & Carter.

Northwest Passage. The European Enlightenment embraced the determined effort to replace myth and superstition with more rational foundations for knowledge.

Paradoxically, the period also witnessed a revival of the hope, often based on the flimsiest of evidence, that a navigable Northwest Passage might yet exist. Believers in the passage included fur traders in Hudson Bay, merchants eager to expand their trade west across the American continent, patriotic naval officers, and speculative cartographers. Some were spurred on by curiosity, but more by the desire to gain commercial advantage from the discovery of a short sea route to the East.

Earlier attempts from the 1570s to the 1630s, mostly English, had faltered in the ice-choked waters of Baffin Bay and Hudson Bay. When the Hudson's Bay Company (HBC) was established in 1670 to exploit the fur trade of the Canadian north, it hoped to carry on its operations in obscurity and discouraged any efforts by its own servants or by outsiders to reveal details of its monopoly. The chink in the HBC's armor was a revival of interest in the Northwest Passage, the search for which was first resumed by one of its senior officers, James Knight. Knight became obsessed by the prospect of gold and other minerals that he believed lay northwest of Hudson Bay, and in 1719 he persuaded the HBC to fit out an expedition to the land of gold by way of the legendary Strait of Anian. His geographical thinking was influenced by a crude map thought to have been drawn by "Northern or Chipewyan Indians" (with names added later), who arrived at York Factory in Hudson Bay in 1716, which showed waterways along the west coast of Hudson Bay stretching far to the west (Williams 2002, 14–15; Lewis 1998, 149, fig. 4.83). Knight and his two ships and their crews disappeared after passing through Hudson Strait, and it was forty years before the sunken hulks of the vessels were discovered at Marble Island on the west coast of Hudson Bay (Geiger and Beattie 1993).

When the search for a passage was renewed in the 1740s, it was through the efforts of Arthur Dobbs, an Irish politician long interested in the expansion of British trade (Williams 2002, 46–50). He argued that a Northwest Passage would not only provide a short trade route to the Pacific but would also enable British merchants to anticipate the French in exploiting the hitherto unknown regions in the northern parts of the American continent. Although Dobbs did not convince the HBC of the validity of his arguments, he persuaded the Admiralty to send to Hudson Bay the first naval expedition to search for the Northwest Passage. Its commander, Christopher Middleton, was a former HBC sea captain, a skilled navigator, and a fellow of the Royal Society. Middleton's explorations of 1741–42 failed to find a passage, but he did produce the first reasonably accurate chart of the west coast of Hudson Bay (Barr and Williams 1994, 1:246–47). On its publication, Dobbs accused Middleton of accepting a bribe from his former employers to conceal the existence of a passage. In the subsequent pamphlet war, maps were used as debating weapons, and John Wigate, Middleton's clerk on the voyage, produced at Dobbs's request a chart that differed significantly from Middleton's, for it showed unexplored openings along the west coast of Hudson Bay (Barr and Williams 1994, 1:249–315). By now, Dobbs had turned the HBC's alleged failure to search for a passage into a full-scale attack on its monopoly. In 1744 he published a map that showed an easy sea route between Hudson Bay and California (fig. 611) (Cumming et al. 1974, 189). This reflected the information obtained from a *coureur de bois*, Joseph La France, who met Dobbs in a London tavern where "on the floor we chalkt out this map, till he was satisfied it corresponded to the Idea of his Travels" (quoted in Williams 2002, 129).

A private expedition organized by Dobbs to find the passage achieved little, but its excursions into the HBC's domains prompted the company to send sloops to survey the west coast of Hudson Bay. Unlike earlier HBC expeditions, the masters of the sloops were well equipped with Hadley and Elton quadrants and a theodolite, and their surveys resulted in a detailed chart of the central section of the bay's west coast (Ruggles 1991, 41–42, pl. 7). Its main use for the HBC was that it showed that various promising openings along that part of the coast were closed inlets, but since the map was never published, the HBC's opponents remained to be convinced. Their cause was helped by the publication in the 1750s of highly imaginative maps by French cartographers that linked the current Russian explorations of the northwest coast of America with the fictitious discoveries attributed to Juan de Fuca (1592) and Bartholomew de Fonte (1640). These maps showed wide waterways running inland from the coast north of California toward Hudson Bay and Baffin Bay, and supported the arguments of those who claimed that there was a short, navigable passage (Lagarde 1989, 31–37).

An ambitious attempt by the HBC to explore the region northwest of Hudson Bay and to settle once and for all the question of a Northwest Passage through its territories came with the overland journey of Samuel Hearne, a young seaman at the HBC's Churchill factory. There, the factor Moses Norton was as intrigued as Knight had been fifty years earlier by the reports and deerskin maps drawn by Chipewyan captains depicting great rivers and copper deposits to the north (Ruggles 1991, 41–42, pls. 8, 8a; Lewis 1998, 136–37, figs. 4.71, 4.72). To investigate these reports, Norton sent Hearne north with Chipewyan guides. In July 1771, he reached the mouth of the Coppermine River and became the first European to sight the northern coast of the American continent. Hearne's grueling journey eliminated the possibility that a route for shipping could be found through the American continent, for he had crossed its northeast shoulder from Hudson Bay to the Arctic Ocean without

FIG. 611. ARTHUR DOBBS, *A NEW MAP OF PART OF NORTH AMERICA*, 1744. From Dobbs's *An Account of the Countries Adjoining to Hudson's Bay* (London: Printed for J. Robinson, 1744). The map is largely based on the travels of Joseph La France between Lake Superior and York Fort on Hudson Bay, and shows in crude form the French thrust westward from the Great Lakes. To the south, Dobbs marks features taken from the imaginative geography of Louis Armand de Lom d'Arce, baron de Lahontan, the Long River and Lake Tagulauk. The most striking feature of the map is the way in which Dobbs shows the Californian coast north of Cape Blanco swinging northeast toward Hudson Bay, an encouragement to his hopes of finding a Northwest Passage in temperate latitudes.
Size of the original: 32.8 × 47.2 cm. Image courtesy of the John Carter Brown Library at Brown University, Providence.

finding a saltwater strait or even a sizeable river (Hearne 1958). If a passage existed, it must lie along the Arctic coast of North America or even farther north.

The last decades of the eighteenth century saw a change in focus in the search for a Northwest Passage from the disappointing coastline of Hudson Bay to the more open waters of the North Pacific. There, one hoped, there would be less ice. In 1776, James Cook sailed on his last voyage, this time to find the Northwest Passage, having seen copies of Hearne's journal and maps, then still unpublished. Alongside them, Cook had a map by Jacob von Stählin, secretary of the St. Petersburg Akademiya nauk, that purported to show recent Russian explorations in Alaskan waters (see fig. 391). It showed a wide strait between Alaska, represented as an island, and a truncated Northwest America. Through this, Cook hoped to sail into the sea glimpsed by Hearne from the mouth of the Coppermine River and east into the Atlantic. The only strait that he found after his dangerous run along the Alaskan coast in 1778 was that reached by Vitus Bering fifty years earlier, and once through the strait Cook's progress was blocked by a frightening wall of pack ice bearing down on his vessels. In his journal, Cook expressed his fury at his false guide: "If Mr. *Stæhlin* was not greatly imposed upon what could induce him to publish so erroneous a Map? . . . A Map that the most illiterate of his illiterate Seafaring men would have been ashamed to put his name to" (Cook 1967, 456).

Cook's own chart showed how much he had achieved in a single season. He had charted the Alaskan coastline from Mount Saint Elias to Bering Strait and beyond, and farther south had touched on the coast from Oregon to Vancouver Island. He had used chronometers, sextants,

FIG. 612. CHARLES DUNCAN, *SKETCH OF THE ENTRANCE OF THE STRAIT OF JUAN DE FUCA* (LONDON, 1790). Published by Alexander Dalrymple in early 1790, this sketch represents the voyage of Charles Duncan in the *Princess Royal* in 1788 as far as the Indian village of Claaset just inside the entrance of the Strait of Juan de Fuca. The chart shows the tide setting out of the opening, and an accompanying note states that "the Indians of Claaset said that they knew not of any Land to the Eastward; & that It was A'ass toopulse, which signifies a Great Sea."

and lunar distances to establish the latitudes and longitudes of salient features of the coastline. He had closed the gap between Spanish probes from their Mexican ports and the operations of Russian fur traders in the north, and he had put on the map the outline of Northwest America (Barnett and Nicandri 2015). Unlike the products of his Spanish and Russian contemporaries, Cook's detailed charts were published by the Admiralty authority soon after the expedition's return.

Cook's crews reported good prices at Canton for sea-otter pelts collected on the northwest coast, and trading vessels from Europe and the United States soon reached the region. Exploration was not the main objective of these ventures. The most hopeful discovery was made by Charles William Barkley, who in 1787 found a large opening in latitude 48°N, which he immediately assumed was the putative strait of Juan de Fuca (Williams 2002, 350). The next year, Charles Duncan sailed some miles into the strait (fig. 612), while farther north other traders found openings, one or another of which they hoped might be the great entrance supposedly discovered by Fonte in 1640. In contrast to the optimistic hopes of the British traders, a French naval expedition commanded by Jean-François de Lapérouse and a succession of Spanish vessels sailing north from San Blas found no sign of a strait. Spanish efforts culminated in the ambitious survey expedition of Alejandro Malaspina, which in 1792 searched the Alaskan coast for an opening that, in one of the most absurd of all accounts of apocryphal voyages, Lorenzo Ferrer Maldonado claimed to have found in 1588 (Williams 2002, 375–84). Comprehensive charts of the coast from Vancouver Island to King William Sound were made by Malaspina and by subordinate expeditions, but in line with the traditional Spanish policy of secrecy none was published at the time. Only in 1802 did an account appear of the detailed Spanish surveys of the Strait of Juan de Fuca, and that was too little and too late, for in 1798 George Vancouver's journal and atlas of his exploration of the coast from Oregon to Alaska on behalf of the British Admiralty had been published in London (Vancouver 1984). By the time Vancouver's ships arrived on the coast in 1792, the Spaniards had almost completed their explorations, but Vancouver over the space of three years carried out his own meticulous surveys. They were a far cry from maps chalked on a tavern floor, deerskin sketches, and longitudes based on guesswork. The detailed charts of Vancouver's voyage long remained standard guides for navigators on the northwest coast. It was a sign of the British precedence in publication that the name given to the largest offshore island on the coast as a mark of the harmonious relations between Vancouver and his opposite number during the survey years—"The Island of Quadra and Vancouver"—was soon shortened to Vancouver Island.

Vancouver's surveys marked the end of centuries-old hopes that a Northwest Passage might be found in temperate latitudes and demolished the imaginative efforts of cartographers who had filled the unmapped spaces of North America with straits and inland seas. From Knight to Malaspina and Vancouver, the explorers who searched for a navigable passage were pursuing a phantom. Even so, the navigators of the eighteenth century discovered much as they took their coastal and inland expeditions to remote parts of North America. When the search moved to the Pacific side of the continent, long stretches of coastline from California to the Bering Strait were opened to trade and future settlement. However, the most daunting implication of their failure was the realization that if a passage existed, it had to lie far to the north among the ice-choked channels of the Arctic archipelago.

GLYNDWR WILLIAMS

SEE ALSO: Cook, James; Geographical Mapping; Imaginary Geographies and Apocryphal Voyages; Sea of the West

BIBLIOGRAPHY

Barnett, James K., and David L. Nicandri, eds. 2015. *Arctic Ambitions: Captain Cook and the Northwest Passage*. Seattle: University of Washington Press.

Barr, William, and Glyndwr Williams, eds. 1994–95. *Voyages to Hudson Bay in Search of a Northwest Passage, 1741–1747*. 2 vols. London: Hakluyt Society.

Cook, James. 1967. *The Journals of Captain James Cook on His Voyages of Discovery*, vol. 3, *The Voyage of the* Resolution *and* Discovery, *1776–1780*, ed. J. C. Beaglehole. Cambridge: For the Hakluyt Society at the University Press.

Cumming, William Patterson, et al. 1974. *The Exploration of North America, 1630–1776*. New York: G. P. Putnam's Sons.

Geiger, John, and Owen Beattie. 1993. *Dead Silence: The Greatest Mystery in Arctic Discovery*. London: Bloomsbury.

Hearne, Samuel. 1958. *A Journey from Prince of Wales's Fort in Hudson's Bay to the Northern Ocean, 1769, 1770, 1771, 1772*. Ed. Richard Glover. Toronto: Macmillan.

Lagarde, Lucie. 1989. "Le Passage du Nord-Ouest et la Mer de l'Ouest dans la cartographie française du 18e siècle, contribution à l'étude de l'oeuvre des Delisle et Buache." *Imago Mundi* 41:19–43.

Lewis, G. Malcolm. 1998. "Maps, Mapmaking, and Map Use by Native North Americans." In *HC* 2.3:51–182.

Malaspina, Alejandro. 2003. *The Malaspina Expedition, 1789–1794: Journal of the Voyage by Alejandro Malaspina*, vol. 2, *Panama to the Philippines*. Ed. Andrew David et al. London: Hakluyt Society, London, in association with the Museo Naval, Madrid.

Ruggles, Richard I. 1991. *A Country So Interesting: The Hudson's Bay Company and Two Centuries of Mapping, 1670–1870*. Montreal and Kingston: McGill-Queen's University Press.

Vancouver, George. 1984. *A Voyage of Discovery to the North Pacific Ocean and Round the World, 1791–1795*. 4 vols. Ed. W. Kaye Lamb. London: Hakluyt Society.

Warkentin, John, and Richard I. Ruggles. 1970. *Manitoba Historical Atlas: A Selection of Facsimile Maps, Plans, and Sketches from 1612 to 1969*. Winnipeg: Historical and Scientific Society of Manitoba.

Williams, Glyndwr. 2002. *Voyages of Delusion: The Quest for the Northwest Passage*. New Haven: Yale University Press.

Norway. See Denmark and Norway