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Back Staff. See Instruments for Angle Measuring; Back Staff

Balkans. The Balkans comprise the large mountainous peninsula in southeast Europe surrounded by the Adriatic, Ionian, and Black Seas. The word “balkan,” from Turkish, means “mountains.” The region lies south of the rivers Danube, Sava, and Kupa, incorporating in a wider sense the area south of the Carpathian mountain range. For centuries the multiethnic and multicultural Balkan region was infamous for instability and unrest.

After the second failed siege of Vienna (1683) the Austrian Habsburg Empire gradually recovered the territories of the former Kingdom of Hungary (including Transylvania). The borders agreed to in the Treaty of Karlowitz (1699) became relatively stable, although there were later modifications in the Treaties of Passarowitz (1718) and Belgrade (1739). The fundamental military and political situation changed little as the territory was contested by the Austrian Habsburgs and the Ottoman Empire. Although the city of Belgrade was taken by Austria three times during the eighteenth century, Turkish rule was restored each time. In the east the vassal principalities of Walachia and Moldavia were occupied on several occasions by an emergent Russia, yet they too remained attached to Turkey.

The conventional division of Europe into east and west may be considered an eighteenth-century invention reflecting a Western European perception of the world. The relative economic, cultural, political, and social backwardness of the region was the fundamental reason why Enlightenment philosophers considered the Balkans as belonging to their spatial and temporal counterpart, the Orient. Contemporary maps by Guillaume Delisle, Gilles Robert Vaugondy, and Didier Robert de

Vaugondy showing an imaginary political-geographic entity of “Turkey in Europe” served as visual propaganda of this East-West concept.

Although represented early on Ptolemaic maps, the Balkans’ harsh geographic and political conditions meant that by the eighteenth century it was an underexplored region of Europe. Although its coastlines and islands were represented on marine charts and the Venetian territories (Dalmatia) were well mapped, the cartography of the inner peninsula was based on scarce information. The 1762 journal and the measurements by the Jesuit astronomer Ruggiero Giuseppe Boscovich (published in 1784) were useful, but their accuracy was limited by the lack of astronomical information and dearth of appropriate measuring instruments in the region.

The exploration and modern mapping of the Balkans was closely related to Austrian and Russian military operations in the Turkish wars. The map corpus made by Luigi Ferdinando Marsigli and Johann Christoph Müller in connection with the Treaty of Karlowitz pioneered cartographic work in the region. Their survey of the course of the Danube was represented correctly to a wider audience with Delisle’s map of Hungary (1703). Apart from large-scale fortification, siege, and battle plans, maps of larger regions were constructed for strategic reasons by military geographers or engineers (e.g., Giovanni Morando Visconti’s *Mappa della Transilvania, e prouintie contigue nella qualesi vedano li confini dell’ Ongaria, e li Campam^{ti} fatti dall’ Armate Cesaree in queste ultime guere*, 1699).

In the eighteenth century, large areas were topographically mapped in the northern Balkans by Austria (e.g., Banat of Temeswar, the military frontiers districts). The 1761–69 meridian arc measurements by Joseph Liesganig resulted in triangulation points in Croatia and Serbia. The southern part of the Balkan peninsula was represented on the new map of Greece by Rhigas Velestinlis (1797), for the first time in the Greek language, an expression of national identity (Tolias 2010, 26).

The weakening Ottoman Empire posed a special danger, called the “Eastern Question.” The international interest in the Balkan question required general maps for the public (e.g., Maximilian Schimek’s *Oesterreichisch-*

Russisch-Türkischer Kriegsatlas, 1788), as well as more detailed and accurate topographic maps for making military and political decisions. By the nineteenth century, rising nationalism resulted in uprisings, wars of independence, and, with the decline of Ottoman power, new territorial-political divisions of the Balkans.

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SEE ALSO: Austrian Monarchy; Karlowitz, Treaty of (1699); Ottoman Empire, Geographical Mapping and the Visualization of Space in the; Russia

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Bathymetric Map. See Heights and Depths, Mapping of: Bathymetric Map

Battle Map. See Military Map: Battle Map

Beautemps-Beaupré, Charles-François. Born in La Neuville-au-Pont (in present-day Marne) on 6 August 1766, Charles-François Beautemps-Beaupré began studying cartography in 1780 under his cousin, Jean-Nicolas Buache, *premier géographe* of King Louis XVI, who brought him to Paris in the summer of 1776. From May to June 1785, supervised by Buache and Charles-Pierre Claret de Fleurieu—his two principal masters and the best geographers of their time—Beautemps-Beaupré prepared the manuscript maps for Jean-François de Lapérouse’s expedition to the Pacific (1785–88). In August 1785 with Fleurieu, he began six years of work on the *Neptune du Cattégat et de la mer Baltique* (1785–90). On 1 September 1785, Beautemps-Beaupré was named *ingénieur hydrographe* of the Dépôt des cartes et plans de la Marine, but he reported directly to Fleurieu, under whom from February to September 1791 he prepared maps for Joseph-Antoine-Raymond Bruny d’Entrecasteaux, whose two ships left in search of Lapérouse on 29 September 1791; on 31 July 1791, Beautemps-Beaupré was chosen as the expedition’s hydrographer. During this expedition (which lasted until October 1793), he prepared thirty-two maps (Beau-

temps-Beaupré 1807), mainly around New Holland (Australia), in Van Diemen’s Land (Tasmania), and in New Caledonia (the latter two islands being where most of the expedition’s principal discoveries occurred). Although these exploration maps were not very informative and rather poor in soundings, the depiction of coastlines benefited from a new sea surveying technique (Chapuis 1999, 511–23). Beautemps-Beaupré was inspired by the work of Jean-Charles Borda and used Borda’s reflecting circle (see fig. 411). For the first time a large scientific expedition systematically and reliably employed the simultaneous use of many precise astronomical observations for longitude and latitude and cartographic plotting, carried out by determining angular distances between the sun and coastal landmarks. Real-time graphic constructions made by Beautemps-Beaupré—bearings and resulting triangles—enabled geodesy to control astronomy and vice versa, since each relative position was directly attached to an absolute position, independently of each other.

Beautemps-Beaupré drew the maps for the report of Étienne Marchand’s voyage, then became the hydrographer for Napoleon Bonaparte for all missions conducted in the coastal regions of the great French Empire (1799–1814). During this period he produced an innovative printed map of the coast of Flanders in which he used color to emphasize the bathymetry and isobaths for the shoals (fig. 86). He prepared enormous secret manuscript maps for the emperor that primarily covered the Scheldt, the Baltic, and the Adriatic. He published the method used during the d’Entrecasteaux expedition in 1808 (Beautemps-Beaupré 1808). While he trained and led a pioneering generation of French hydrographers in land surveying along European coasts, the second edition of his method (1811) was also used by naval officers carrying out overseas reconnaissance. This activity marked the end of the first period of Beautemps-Beaupré’s long career, the most significant part of which was still to come during the nineteenth century. He died in Paris on 16 March 1854.

OLIVIER CHAPUIS

SEE ALSO: Marine Chart; Marine Charting: (1) Enlightenment, (2) France; Pilot Book; Sounding of Depths and Marine Triangulation

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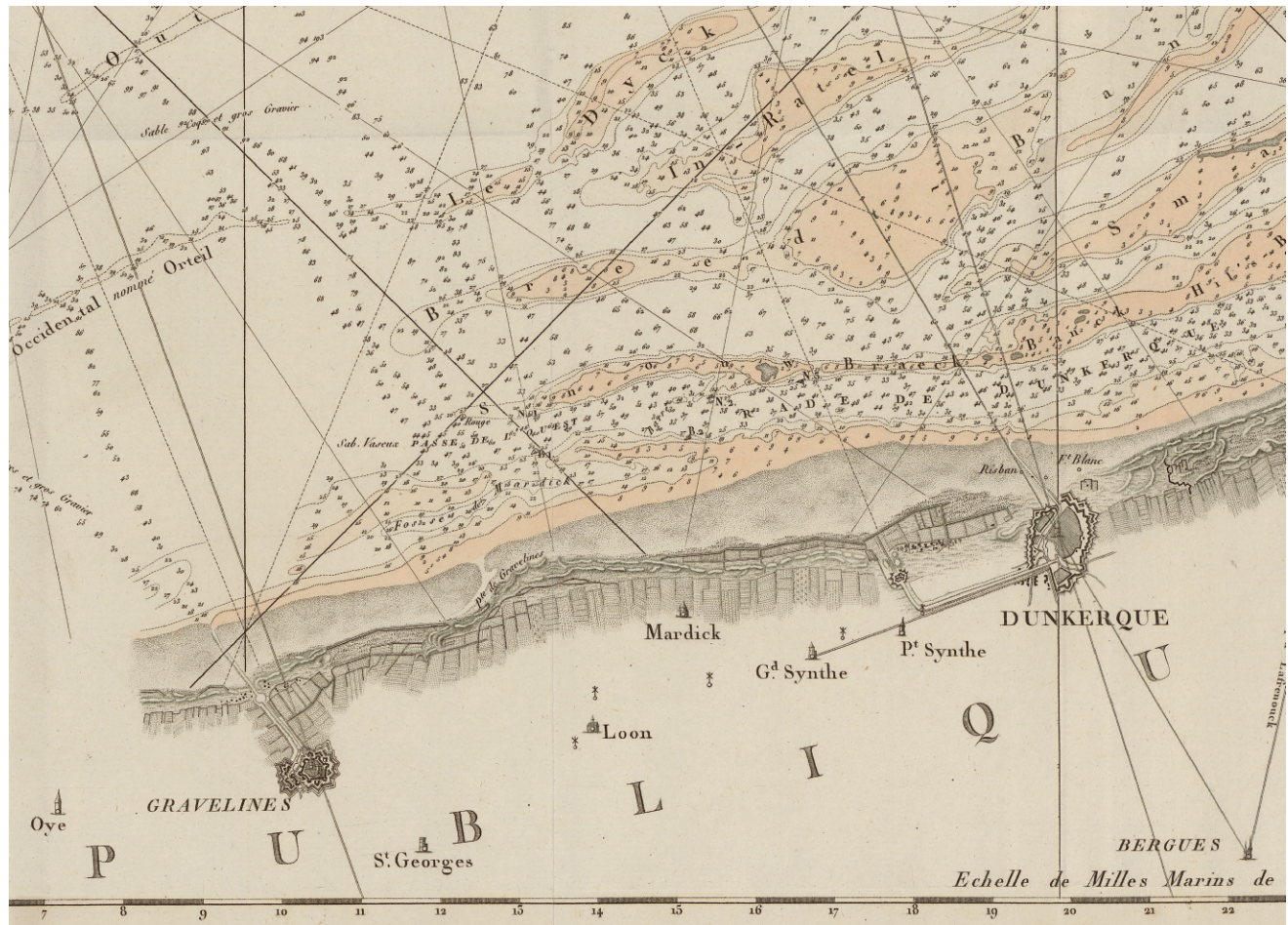


FIG. 86. DETAIL FROM CHARLES-FRANÇOIS BEAUTEMPS-BEAUPRÉ, *RECONNAISSANCE HYDROGRAPHIQUE DE LA CÔTE NORD DE FRANCE* (PARIS, 1804), FIRST EDITION. From Beautemps-Beaupré, *Description nautique de la côte de France sur la mer du Nord, de Calais à Ostende* (Paris, 1804), following 46. Map engraved on one sheet, 1:87,100. Surveyed in 1801 and 1802, this map of Flanders marks an important stage in the work of Beautemps-Beaupré and in French hydrography. The density of the soundings is even more striking in that each is fixed by the use of a repeating

(i.e., reflecting) circle, with the best precision possible in that epoch. The representation of depth is just as interesting. The sand banks are colored in two shades of pink; the area of the intertidal zone is in a grey stipple. This classification of depths works out into contour lines or isobaths, which were already old but still little used.

Size of the entire original: 63.5 × 93.0 cm; size of detail: ca. 23 × 31 cm. Image courtesy of the Bibliothèque nationale de France, Paris.

gence de la précision en navigation et dans la cartographie marine.
Paris: Presses de l'Université de Paris-Sorbonne.

Bellin, Jacques-Nicolas. Born in Paris in 1703, Bellin entered the Dépôt des cartes et plans de la Marine in early 1721, only a few weeks after its creation. Almost nothing is known about his training (Le Guisquet 1999, 5), but he did show a talent for drawing. Thus, his initial task as a *premier commis* was to trace manuscript and engraved maps, both French and foreign, onto oiled paper for use by the French Marine. With the help of logbooks he updated printed maps (mainly Dutch). His

only venture near the sea was a trip to Dunkirk in 1730, where he surveyed various plans of the port. In the great tradition of the first half of the eighteenth century, Bellin was a *géographe de cabinet* who compiled the data from sailors and other geographic works. Such was his *Carte reduite de la mer Mediterranée* (1737; see fig. 206), the very first map published by the Dépôt.

Ubiquitous foreign publications encouraged the French to engrave and print their own nautical charts, not only to assure national independence, essential in times of war, but also for prestige. Granted the new title *ingénieur hydrographe de la Marine* by Louis XV on 1 August 1741, Bellin launched the republication of *Le*

Neptune françois (1693) in 1753. As he was not able to survey new maps, the *Neptune* remained almost exactly as it was, save a few dubious slight changes to the plates (Chapuis 1999, 106–8). As publications of the Dépôt's plates grew in number, the hydrographer spent more time piecing together collections of maps and plans needed by the Marine. These *neptunes* were assembled on request and received the generic title *Hydrographie française* (fig. 87). They were produced in successive versions in 1756, 1765, 1785, and 1806. Essentially the work of Bellin, the maps were often the subject of published memoirs, initially printed separately, then as collections (Bellin [1767]). At the same time, the hydrographer published his own works, such as *Le Petit atlas maritime* (1764) in five volumes, financed by the Marine

even though the maps were too small to plot locations and routes.

Bellin was a member of the Académie de marine (created in 1752) and the Royal Society of London, as well as the *censeur royal* for travel logs (for which he often drew the maps), geography, and navigation. He was also concerned with classical geography and its teaching (*L'enfant géographe, ou nouvelle méthode d'enseigner la géographie*, 1769). Moreover, he wrote some nautical articles for Denis Diderot and Jean Le Rond d'Alembert's *Encyclopédie*, although the contribution of someone who had never set foot on a boat did little to help the much debated maritime credibility of this prestigious work. These varied pursuits won him enemies, especially in the wake of accusations of plagiarism by Jean-Baptiste-Nicolas-Denis d'Après de Manneville (Filliozat 1993, 119). Thus Bellin never officially obtained the title of *ingénieur hydrographe en chef*, which he requested many times, even though he fulfilled the same duties in his role as *hydrographe de la Marine*. Some also criticized him for profiting excessively from the sale of nautical charts, a privilege that became enormous as production grew and the terms of his employment allowed him to sell maps privately (Chapuis 1999, 191).

Bellin did not complete government control of hydrographic production, which only occurred shortly after his death, but he nevertheless upheld the preeminence of the state in cartographic compilation. He knew how to protect and expand the collections in his care (e.g., introducing a Dépôt stamp to prevent the fraudulent release of manuscript maps), and became the veritable popularizer of maps on the Mercator projection in France by publishing *Le Neptune françois*, which owed its success to the systematic application of principles developed by Pierre Bouguer.

Bellin died in Versailles on 21 March 1772, as the second edition of *Le Neptune françois* was being published (dated 1773). He was by far the most prolific hydrographer of the French Enlightenment, and as such the most famous (along with d'Après de Manneville): among the 127 plates printed under the authority of the Dépôt from 1737 to 1772, only 12 are not the work of Bellin. However, the quality of his work was heavily criticized, both during his life and after death, by officers versed in science, adept at using new navigation methods to calculate longitude at sea (Fleurieu 1773; Chapuis 1999, 174–87). In the absence of on-site practical hydrography, with a few rare exceptions, Bellin's work remained in use until the early nineteenth century, when Charles-François Beautemps-Beaupré brought hydrography to a new standard.

OLIVIER CHAPUIS

SEE ALSO: Dépôt des cartes et plans de la Marine (Depository of Maps and Plans of the Navy; France); Marine Chart; Marine Charting;



FIG. 87. DETAIL FROM JACQUES-NICOLAS BELLIN, *CARTE RÉDUITE DE L'OCEAN OCCIDENTAL CONTENANT PARTIE DES COSTES D'EUROPE ET D'AFRIQUE*, 4TH ED. (PARIS, 1766). Map engraved on one sheet, 1:11,000,000. This map does not appear in all issues of the third edition of the *Hydrographie française*, where it is often replaced by the more recent plates that are much superior to it. In fact, even though this fourth edition of the map of the Atlantic Ocean (after those of 1738, 1742, and 1756) comprises all the principal reference meridians, it still includes many *vigies* (dangerous spots or observed hazards), most of which were imaginary. Some are visible here in the Bay of Biscay (Golfe de Gascogne), including the “Roche la Chapelle vue en 1764”: these represent a conjunction of hallucinations due to the fatigue of a long sea journey and the sea rising along the continental shelf. Size of the entire original: 63 × 95 cm; size of detail: ca. 16 × 16 cm. Image courtesy of the Bibliothèque nationale de France, Paris (Cartes et plans, Ge DD 2987 [9645 B]).

France; *Neptune françois* and *Hydrographie françoise*; Reproduction of Maps: Color Printing

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Bering Expeditions to Northeast Asia. At the beginning of the eighteenth century European geographers did not yet possess empirical data for northeast Asia, northwest North America, or the northern Pacific Ocean. The dearth of information gave birth to hypothetical and fantastic features on European maps of these unexplored territories near the north Pacific, such as the "Anian Strait" and the lands of "Yeso," "De Gama," and "Compagnie."

Russian travelers looking for new lands and natural resources were destined to change that state of affairs. In 1639, a party of Russian Cossacks and *promyshlenniki* (hunter-traders), under Ivan Yur'yevich Moskvitin, reached the Pacific. The following year, Cossacks from this party sailed the Sea of Okhotsk north to the mouth of the Okhota River and south to the Shantar Islands. In 1648, Fedot Alekseyevich Popov and Semën Ivanovich Dezhnev, sailing along the Arctic coast from the Kolyma River east, rounded East Cape (Cape Dezhnev) of the Chukchi Peninsula, and thus were the first European explorers to sail between Asia and America to the Pacific. The geographical information acquired by the Russian advance to the east is especially visible on two maps of Siberia from 1667 and 1673 that show an uninterrupted waterway along and around the northeast Asian coast.

The Russian government sharpened its focus on this area when in 1701 Vladimir Vasil'yevich Atlasov furnished new information about an island or a "Great Land" off the Chukchi Peninsula after his four-year trip to Kamchatka. In the first decade of the eighteenth century, these tales were confirmed by other Cossacks from the Anadyr River region. Two of them, Ivan Petrovich Kozyrevskiy and Danilo Yakovlevich Antsyforov,



FIG. 88. DETAIL FROM "ANCIENNE CARTE DE SIBÉRIE ET CAMCHAT," 1724–29. This manuscript map from the collection of Joseph-Nicolas Delisle shows the results of the Cossack expeditions to the Kuril Islands and the Kamchatka and Chukchi Peninsulas.

Size of the entire original: 108 × 138 cm; size of detail: ca. 66.0 × 33.5 cm. Image courtesy of the Bibliothèque nationale de France, Paris (Cartes et plans, Ge BB 124 [158] RÉS).

reached at least two of the Kuril Islands and described and made drawings of fifteen others while exploring and raiding for *yasak* (levy) collection in the Kamchatka and Chukchi Peninsulas. Their results are reflected in the "Ancienne carte de Sibérie et Camchat" (fig. 88).

Peter I struggled throughout his reign to put Russia

on the same level as Europe both in economic development and in scientific achievement. He well understood the special opportunity for his country to compile a reliable map of the northern Pacific and to answer definitively the question of whether America was connected to Asia. The emperor ordered a naval exploration expedition, the result of which would be conveyed via a precise cartography that would be understood and acknowledged by European scientists. The First (1725–30) and Second (1732–42) Kamchatka Expeditions were led by Vitus Bering and Aleksey Il'ich Chirikov, and the voyages to the islands in the Bering Strait and to the shores of northern Alaska were led by Mikhail Sipuridonovich Gvozdev and Ivan Fëdorov (1732).

Vitus Bering, born 1681 in Horsens, Jutland (Denmark), was the son of a customs officer. He studied at the Amsterdam Marine Cadet Corps and received practical training by sailing to the East Indies aboard a Dutch vessel. After graduation in 1703, he moved to Russia and joined the Russian navy, serving as sublieutenant in the Azov campaigns initiated by Peter I. He rose quickly in rank while engaged in many important missions during the Great Northern War. Ultimately he was awarded captaincy of the largest vessel in the Russian fleet, the ninety-gun battleship *Lesnoye*. Having been selected by Peter I in 1725 to explore northeastern Siberia, he moved men and supplies across Siberia. In 1728 he sailed north along the Asian coast to 67°18'N, but strong winds and mist prevented sighting land to the north and east. A second attempt in 1729 also failed to verify land to the east. He returned to St. Petersburg in 1730 with his report of the strait, but met criticism for not having actually seen the American coast.

The Second Kamchatka Expedition, also called the Great Northern Expedition or *Velikaya severnaya ekspeditsiya*, was one of the largest the world had seen, consisting of several thousand men and including several members of the *Akademiya nauk*, such as Gerhard Friedrich Müller, Johann Georg Gmelin, Georg Wilhelm Steller (whose account of the voyage is the only published primary source on the expedition), and astronomer Louis Delisle de La Croyère, whose brother, Joseph-Nicolas Delisle, prepared a memoir and map for the expedition based on earlier compilations of his brother, Guillaume Delisle (Golder 1914, 170, and app. F). As overall expedition leader, Bering supervised his own mission, which was to find and map the west coast of America; a second group under Chirikov was to explore the Arctic coast; and a third group with Morten Spangberg was to explore the islands of Japan.

In 1741 Bering commanded the *Su. Pëtr* while Chirikov commanded the *Su. Pavel*. They set out, rounded Kamchatka, founded the town of Petropavlovsk, and then sailed east, but the vessels were separated. Chirikov's

ship reached 55°36'N, sighting Prince of Wales Island. This discovery supported Russia's claim to that stretch of coastline that became, by agreement with Great Britain and the United States in 1824 and 1825, the southern limit of Russian America and consequently of Alaska. Both ships were within sight of the Aleutian Islands, and Bering reached the North American coast near Kayak Island, which he named St. Elias. His officers made a survey of this region and compiled a large-scale chart that has survived. On his return voyage, the *Su. Pëtr* anchored off the coast of Nogay Island, which Bering named Shumagin in memory of a sailor who was buried there. The island was also surveyed. These two surveys resulted in the first European charts of Alaskan coasts and islands (for facsimiles, see *Russskiye ekspeditsii* 1984, 220–21).

But Bering was forced by bad weather to turn back to Kamchatka and by illness to give up command of his ship during the return journey. After months of difficult sailing, the *Su. Pëtr* sought refuge on an island near the Kamchatka Peninsula in the Bering Sea, where Bering died, on 8 December 1741, along with many in his company. Of seventy-seven men originally on board the ship, only forty-six survived; they named the island after their commander. The third arm of the Second Kamchatka Expedition was led by Spangberg with Englishman William Walton on board; Spangberg sailed his two ships, the *Arkhangel Gavriil* and *Su. Mikhail*, to Japan, where they were well received.

The two main charts from the Second Kamchatka Expedition were based on the nautical surveys routinely performed on both expedition vessels. But the charts created two different images of the lands and waters between Kamchatka and America. The chart compiled by Ivan Fomich Yelagin, the pilot of the *Su. Pavel*, and checked by Chirikov shows some lands between Kamchatka and America, which Chirikov's men correctly guessed to be islands. In contrast, the chart compiled by Sven Waxell and Sofron Fëdorovich Khitrovo on Bering's *Su. Pëtr* proposes a continuous coast from the American mainland to the middle of the ocean. In his summary map, Chirikov faithfully represented all lands sighted by his own men and by the members of Bering's crew, but he did not follow Waxell's and Khitrovo's cartographic interpretations of their discoveries and kept to his own notion about the region between Kamchatka and America (fig. 89).

Russian officials tried to keep the results of the Bering Kamchatka Expeditions secret. They were successful to such a degree that even the *Akademiya nauk* in St. Petersburg was not entirely privy to these results, which is evident on the *Nouvelle carte des decouvertes faites par des vaisseaux russiens*, drawn by Müller, who had been on the expedition (see fig. 10). There is also a

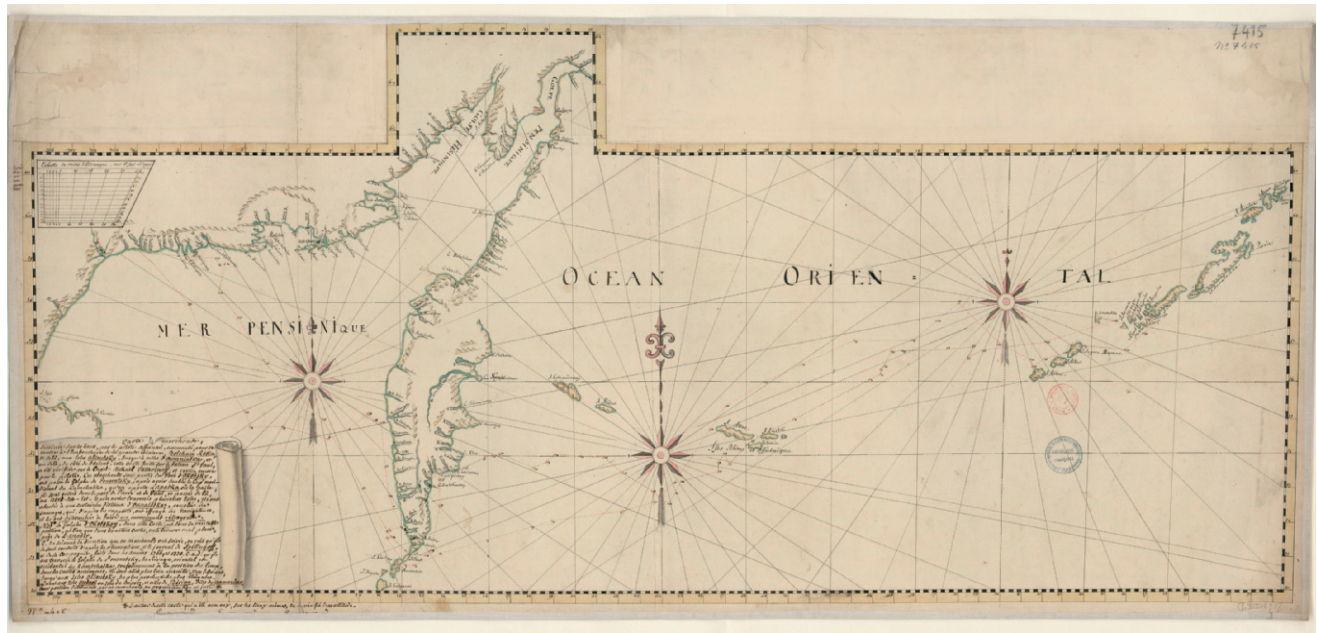


FIG. 89. “CARTE MARCHANDE, DESSINÉE SUR LES LIEUX, PAR LE PILOTE AFFANACI . . . FAITTE SUR LE BATEAU ST PAUL, . . . VÉRIFIÉE PAR LE CAPIT. MIKAÏL TATARINOFF, ET REVÛE ENCORE PAR LE PILOTES,” 1770. As described in the explanatory text, this manuscript map shows the route of a merchant ship from the southern end of Kamchatka to the Aleutian chain of islands inspired

by the earlier voyages of Bering and Chirikov. It forms part of the collection of d’Anville, who notes the veracity of the map’s author as having been on the spot. In two sheets.

Size of the original (assembled): 58 × 127 cm. Image courtesy of the Bibliothèque nationale de France, Paris (Cartes et plans, Ge DD 2987 [7415 B]).

Russian edition by Ivan Truskott, both being published by the Akademiya nauk in 1754/1758 (Postnikov and Falk 2015, 66–67). This map propagates the conception drawn from the Bering chart, not the Chirikov, with the mainland of North America extended close to Asia in the form of a wide projecting landmass. Müller and Truskott added even more fantastic data to their map from the apocryphal voyages of Juan de Fuca and Bartholomew de Fonte, taken from the map by Joseph-Nicolas Delisle and Philippe Buache published in Paris in 1752.

Nonetheless, reports of the expedition were available in the European press (Golder 1914, 218n420), and Delisle, who returned to France from Russia in 1747, presented a memoir to the Académie des sciences in Paris on 8 April 1750 in which he outlined briefly and incompletely the history of Russian voyages to the American coasts. His attention focused more on the fictitious early eighteenth-century so-called discoveries of Fonte and of Fuca in 1592. Delisle’s map, compiled with the aid of Philippe Buache, attempted to reconcile various accounts of discoveries in the northern Pacific, as witnessed by its title: *Carte générale des découvertes de l’Amiral de Fonte et autres navigateurs espagnols, anglois et russes pour la recherche du passage à la Mer du Sud*. The map shows the courses of Bering’s expeditions, and in the vicinity of Alaska there is a following

inscription in French, “This is a land that has been seen by Spangberg in 1728,” and below that, “A land that has been seen by Russians under Chirikov’s command in 1741.”

The great accomplishment of both the First and Second Kamchatka Expeditions was to demonstrate that Asia was not joined to America, that the large mysterious lands of “Yeso,” “Gama,” and “Compagnie” did not exist, and that a chain of islands was to be found instead in the north Pacific. All these discoveries led to further exploration and the establishment of trade stations along the Aleutian chain and North American mainland throughout the eighteenth century.

ALEXEY V. POSTNIKOV

SEE ALSO: Geographical Mapping: Russia; Imaginary Geographies and Apocryphal Voyages; Pallas, Peter Simon; Russia

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Boscovich, Ruggiero Giuseppe. Ruggiero Giuseppe Boscovich (Ruđer Josip Bošković; Roger Joseph Boscovich), SJ, was born in Ragusa (Dubrovnik, Croatia) in May 1711 of a Serbian father and Italian mother. Initially educated at the local Jesuit Collegium Regusinum, he continued his studies from age fourteen in Rome at the Jesuit Collegium Romanum. There he was ordained a priest and in 1740 appointed professor of mathematics at the college.

In Rome he published scholarly dissertations in several disciplines: mathematics, physics, astronomy, and geodesy. He also was called upon to represent his native city of Dubrovnik in a number of legal disputes within the Austrian and Ottoman Empires. His diplomatic manner, intellectual prowess, and lively personality drew him into the learned circles surrounding Pope Benedict XIV and Cardinals Silvio Valenti Gonzaga and Alessandro Albani. Boscovich's publication *Dissertatio de telluris figura* (1739) involved him in the debate about the shape of the earth and its anomalies due to gravity; the work qualified him as a candidate to join the other Jesuits invited by João V of Portugal to participate in the mapping of Brazil. However, the pope was persuaded that his talents would be better used for the geodetic survey of the Papal States. Between 1750 and 1752 he joined his fellow Jesuit Christopher Maire in measuring the meridian arc of two and a half degrees between Rome and Rimini. The resulting data served as the basis for Maire's map of the Papal States (fig. 90), published in Rome to accompany the full narrative of their two-year survey, *De litteraria expeditione* (Maire and Boscovich 1755). Their measurements resulted in a meridian arc that was shorter than that measured in France between similar degrees of latitude. Assuming all measurements had been taken properly—and the few doubts about them were gradually dispelled—a reason for such a discrepancy had to be found. Similar expeditions were undertaken in various European states, modeled on that of Boscovich and Maire, in order to collect the data necessary to resolve the problem of the shape of the earth.

Boscovich's reputation as teacher, scholar, and diplomat brought him to Vienna to represent the interests of Dubrovnik. In the Austrian capital his seminal and enormous scientific treatise, *Philosophiæ naturalis theoria*,

was published (1758) and drew the attention of the entire European intellectual community. Regarded by some as the most important scientific book after Isaac Newton's *Philosophiæ naturalis principia mathematica* (1687), it offered a system explaining the forces of nature with one law.

In 1759 he journeyed to Paris, where he attended meetings of the Académie des sciences and participated in discussions planning the international effort to observe the transit of Venus across the sun in 1761. He next traveled to London, where he became a foreign member of the Royal Society. He continued through the Netherlands, Belgium, and Germany until reaching Venice in 1761, then to Constantinople, where he intended to observe the transit of Venus, although delays in departure prevented him from doing so. In Constantinople he stayed at the French embassy, under the aegis of the ambassador Charles Gravier, comte de Vergennes, who later, as minister of foreign affairs under Louis XVI, would protect Boscovich. From Turkey he traveled north to Warsaw, a journey that he recorded in a diary published in 1784.

Having returned to Rome, in 1763 he was called to serve as the chair of mathematics at the University of Pavia, which was undergoing reforms reflecting the enlightened thinking of the Austrian monarch and the minister Wenzel Anton von Kaunitz. Boscovich was enthusiastic about the new assignment, which would give him more freedom as a teacher. In 1764 he began to design and build the astronomic observatory of the Jesuit College Santa Maria di Brera, in Milan. While working at Brera, he applied his own study methods to practical astronomy, with special focus on the evaluation of errors in measurement tools. But by 1772 internal dissent brought his removal from the post of director of the Brera Observatory. With the suppression of the Jesuit order in 1773, his many powerful French friends encouraged him to go to Paris, where he was appointed director of optics for the Marine in 1774. He remained in France for nine years, during which he worked on problems of the achromatic telescope and his mammoth poem *Les éclipses* (1779), which he dedicated to Louis XVI. Obtaining royal leave to return to Italy to work on optics and astronomy, Boscovich died in Milan on 13 February 1787.

PASQUALE TUCCI

SEE ALSO: Calcografia Camerale (Copperplate Printing Administration; Rome); Geodetic Surveying: Italian States; Society of Jesus (Rome)

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Bouguer, Pierre. Pierre Bouguer was born on 16 February 1698 in the harbor town of Le Croisic (present-

day Loire-Atlantique), where his father, Jean Bouguer, the author of *Traité complet de la navigation* (1698), was professor of hydrography from 1691 to 1714. Immersed early in mathematics and the art of navigation, Bouguer studied under the Jesuits at Vannes (Chesnais 2002). Although only sixteen years old when his father died in 1714, he succeeded him as professor of hydrography (then understood as the science of navigation and not as surveying). Interested in a wide variety of disciplines including naval geometry, architecture, and shipbuilding, as well as astronomy, optics, and geodesy, he acquired the prestigious chair of hydrography at Le

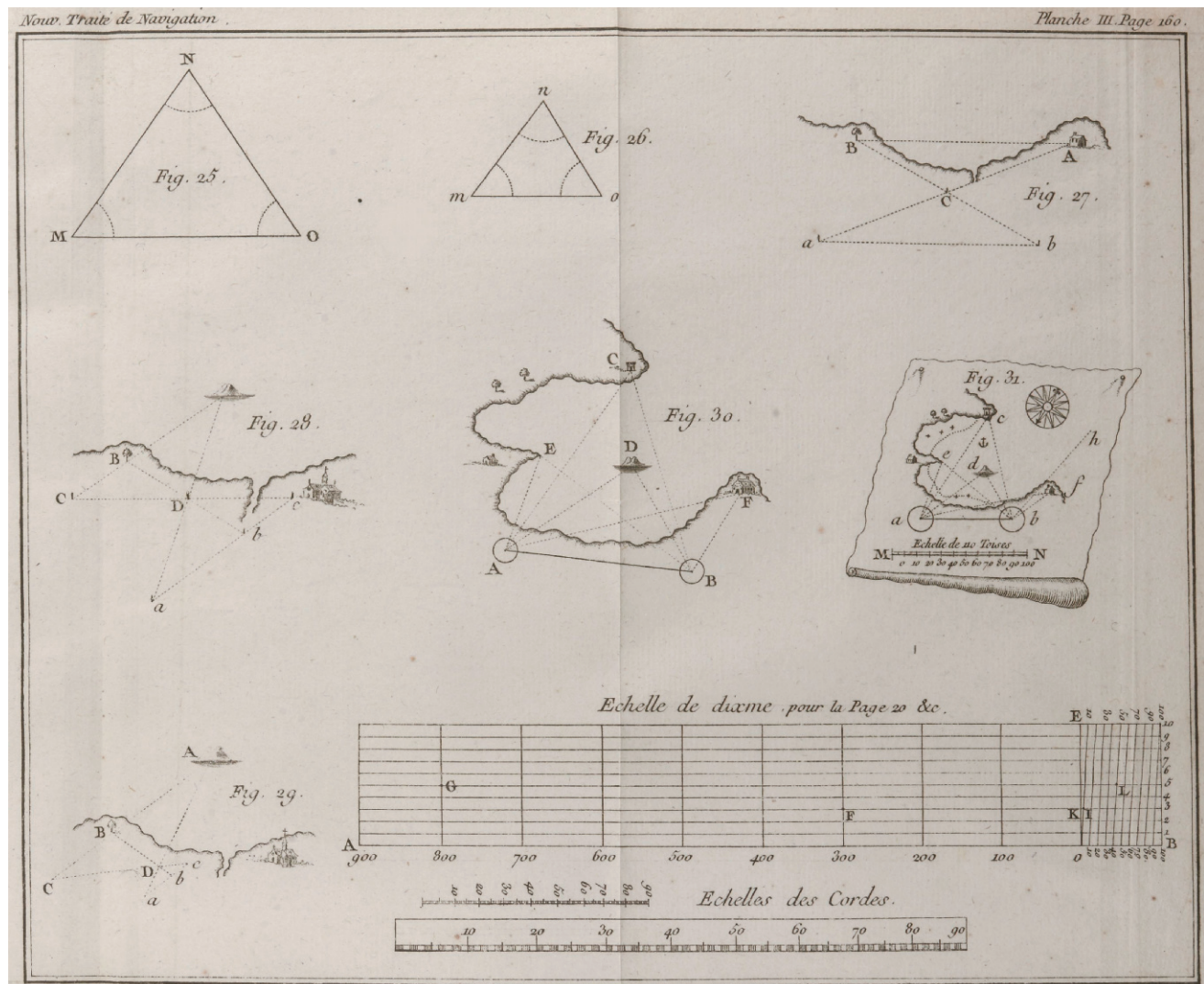


FIG. 91. PLATE FROM PIERRE BOUGUER, *NOUVEAU TRAITÉ DE NAVIGATION* (1753). The first edition of a major work by Bouguer, with 466 pages and 13 plates. Much used by French naval officers versed in science in the eighteenth century, this navigation manual was reedited in 1760 by Nicolas-Louis de La Caille, and in 1769, 1781, and 1792.

In plate III (between 160 and 161) shown here, Bouguer applied principles of trigonometry to navigation (figs. 25 and 26) and provided examples for the purpose of teaching sailors to measure distances (figs. 27, 28, and 29) and even to survey a simple map (figs. 30 and 31). Image courtesy of the Bibliothèque nationale de France, Paris.

Havre in 1730, which he occupied until 1745, while his younger brother Jean succeeded him in Le Croisic. Named associate member of the Académie des sciences in September 1731 and pensioner in January 1735, Bouguer was chosen by the Académie in 1735 to lead an expedition to Peru with Charles-Marie de La Condamine in order to measure a degree of latitude on the equator. In doing so, he helped solve the great geodetic question of *La figure de la Terre*, the title of his work published in 1749. In 1757, he did the same—with Charles-Étienne-Louis Camus, César-François Cassini (III) de Thury, and Alexandre-Gui Pingré—resulting in the publication of the *Opérations faites par ordre de l'Académie royale des sciences pour la vérification du degré du méridien compris entre Paris & Amiens*.

Bouguer returned from South America in June 1744, a year before he moved to Paris to serve as astronomer to Louis XV. The South American trip had allowed him to practice open ocean navigation and to refine and deepen his nautical thinking. This experience resulted in one of the most important nautical manuals of the eighteenth century: his *Nouveau traité de navigation* (Bouguer 1753; Chapuis 1999, 91, 139–40), republished four times before the end of the century, well after his death in Paris on 15 August 1758. In this major work, Bouguer laid out methods and developed concrete exercises that joined theory to practice, two systems so often pitted against each other by naval factions during the Enlightenment. Bouguer's combination of the two ensured the success of a treatise with which navigators could identify, at least those officers versed in science. Some pilots and candidates for hydrography schools found it too complex, and a simplified edition was produced by Nicolas-Louis de La Caille in 1760.

Brilliant scientist, contributor to Denis Diderot and Jean Le Rond d'Alembert's *Encyclopédie*, member of the Royal Society in London, and honorary member of the Académie de marine from its creation in 1752, Bouguer was the most important navigation professor of the eighteenth century. Doubtless, he was one of the most famous as well, as much for the didactic quality of his observations as for his efficiency and particularly for his use of *cartes réduites* (charts on the Mercator projection instead of the more commonly used plane charts). He did, however, err in proposing that maps be oriented to magnetic north. Though he touched on the use of triangulation, he did not concretely apply the principles of trigonometry to marine cartography in a way that would have made him a chartmaker. He was concerned only with teaching trigonometry to navigators including the way to survey a simple map (fig. 91), which was itself an important contribution.

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SEE ALSO: Geodesy and the Size and Shape of the Earth; Geodetic Surveying; Enlightenment; Lapland and Peru, Expeditions to; Marine Charting; France

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Boundary Disputes and Cartography. Europeans drew up hundreds of thousands, perhaps even millions of maps and plans during the eighteenth century, but it is difficult to evaluate how many of these pertain to boundaries (Brun 1997). The eighteenth century did not introduce this type of cartographic representation. Boundaries had appeared in both manuscript and printed maps, either because the maps represented circumscriptions, from principalities to *seigneuries*, or because the administrator or draftsman had to resolve a conflict. The *seigneurie* was composed of lands whose extent had long since been carefully established, and the same was true of the parish inscribed in a known territory. It would therefore be erroneous to pay attention only to external borders or frontiers, forgetting that these sometimes had their origins in and rested on internal boundaries (Antoine 2000, 73–103).

A persistent conviction has shaped the historians who focus on ancient boundaries: the idea that these circumscriptions were always imprecise and shifting. Medieval historians, who have produced very convincing studies on these issues over the last half century, have helped to call into question this long-prevailing negative evaluation by providing evidence to show that it is inappropriate to attribute such characteristics to medieval administrative boundaries. They were not, a priori, uncertain; many of them were known at the local level and accepted by the local government and inhabitants. They were not (or at least were not all) approximate and discontinuous, nor did they all fluctuate over time. From the end of the Middle Ages, maps have illustrated what appeared on the land by placing in the margins of maps or on the map itself enclosures underlined in bright colors, swollen rivers, trees marked by a letter, boundaries or posts, borders (varying in straightness), inscriptions, and brief keys to the symbols. This tendency toward universality is perhaps a fundamental element of a system that assumes interlocking elements, articulations, and methods of circulation for decision making and application.

Nonetheless, the eighteenth century can lay greatest

claim to being the century of delimitation. In the preceding century, conflicts among powers or negotiations over land could still be resolved without cartographic documentation. But beginning in the 1740s, the plan and the map appeared as the instruments providing the justification for claims, serving to accompany and illustrate claims when debate concluded, and finally—an essential point—allowing a return to origins of the dispute. An initial example from religious geography is found in the work of dom Augustin Calmet, a Benedictine from the congregations of Saint-Vanne and Saint-Hydulphe. In an article concerning Calmet's *Commentaire littéral sur tous les livres de l'ancien et du nouveau Testament* (1711), the comment was made that maps are weighed down haphazardly with countless names whose position is uncertain. Yet in the Bible when Yahweh spoke to Moses, he told him to indicate the southern frontier of the Promised Land (Numbers 34), "He used the word 'to turn' (*tourner*) twice to show that the line running from the Dead Sea to the Mediterranean turned to the southwest toward Egypt" (*Mémoires* 1712, 411, 414; reprint 12:112–13). In this instance, the boundary results from legislative operation and is precise. In philosophical reflection, it is the foundational act described resoundingly by Jean-Jacques Rousseau: "The first person who, having enclosed a piece of land, dared to say: 'This belongs to me' and found people simple enough to believe him, was the true founder of civil society. How many crimes, wars, and murders, how many miseries and horrors might have been spared the human race had someone who, pulling up the stakes or filling the ditch, shouted to his fellows, 'Beware of listening to this imposter; you are lost if you forget that the fruit belongs to all and the land to no one'" (Rousseau 1755, 95). Delimitation is the act of origins, whether within history or outside of it.

The European concept of boundary—whose limitations as a term will become clear—extended also into space appropriated by Europeans. The abbé Gabriel Bonnot de Mably, who served in the French ministry of foreign affairs, pondered questions of international politics and diplomatic practices. He enjoyed a certain prestige with Friedrich II and, as a specialist in public law—known in Switzerland, Italy, and Germany—was consulted on questions of Polish politics and on constitutional problems in the United States. He wrote: "America should not in fact be thought of as completely different from Europe. It is as easy to regulate its destiny as it is for the provinces that are within our view and which we know. In Europe, all the states have borders and clear boundaries; in America there are vast deserts and regions without jurisdictions or boundaries, and each power regards the undefined countryside that bor-

ders it as its empire, and without limits. The early treaties that the French and the English made on the subject of America were intended to provide justifications for excessive demands from the moment that they acted to establish the frontiers and borders between the two nations. If this could have been predicted at the Congress of Aix-la-Chapelle, it would have been easy . . . to avoid disagreements by fixing limits" (Mably 1789, 7:148–49). Similar issues preoccupied the geographer Jean-Nicolas Buache, author of "Considérations géographiques sur la Guiane française" (1801), in which he contested Portuguese claims. Continual conflicts with the Spanish over colonial claims in Saint Domingue (Haiti) were addressed in the 1777 Treaty of Aranjuez, which recalled that various provisional agreements had not resolved the frequent disputes between members of the two colonies. The treaty committed the sovereigns to order their governors to survey the territories and to prepare exact maps (Glénisson 2006).

Governments in Europe organized administrative bodies, such as the French Bureau des limites, whose principal role, as defined by jurists, was to establish the boundaries of private property and the frontiers of states. An archetypal model was the Jointe des terres contestées created in Brussels in 1740 by Archduchess Maria Elisabeth of Austria, governor of the Netherlands from 1725 to 1741, to examine territorial disputes between the Austrian Netherlands and the Principality of Liège. The Jointe soon extended its jurisdiction to cover all questions of this type as well as relations with France. It often included important figures (a counselor of state and of finance, the president of the Conseil de Flandre, and members of the Conseil privé). In 1749, Patrice-François de Nény, counselor in the Conseil suprême, general treasurer of finances, and then *chef-président* of the Conseil privé, joined and remained active in the Jointe until 1783. Far from functioning as an obscure office of technicians, this organization was integral to the machinery of government. It brought together various types of documentation, including instructions for boundary commissioners, minutes from meetings, correspondence, investigations and supporting *mémoires*, and maps. Two sources fed the growth of the Jointe's archival holdings: documents generated by current activities and preexisting items assembled for the defense of rights, the latter dating, for the most part, to the sixteenth and seventeenth centuries. All the materials consolidated territorial memory and with patient compilation and cataloging provided an inventory of it (a summary list along with thirteen volumes of analysis of documents were developed around 1765) (Hélin, Grauwels, and Thielemans 1952, V–XIV). In 1793 a Bureau du dessin et de la rédaction des cartes des limites

was added to the Jointe, to which two engineers of the hydraulic corps were appointed. As at the archives, the maps held at the new bureau could circulate. In 1794 the maps were sent to Vienna and in 1809 to Paris (Dubois 2001, XXV–XXVIII). In Turin, an office of topography recruited technicians and cartographers for its personnel. In Tuscany, the magistracy of the *Nove conservatori della giurisdizione e del dominio fiorentino*, founded in 1560 and suppressed in 1769, was replaced by the *Archivio dei Confini* (1782), which had employees working from offices in Florence and engineers working in the field. The former copied old documents and kept up correspondence with local judges, while the latter carried out reconnaissance, established the lines of frontiers, and placed boundary markers (Stopani 2008). In eighteenth-century France the ministerial offices of the secretary of state for foreign affairs also had established protocols (summaries of correspondence, synthetic notes, *mémoires* and copies, and a command of foreign languages) and formed a *Dépôt des archives* in 1709 where jurists and commissioners housed documents. In 1746, the ministry established a collection devoted solely to boundaries. Associated duties were divided between lawyers and engineers, both experts in their own rights, and their work reflected a systematic desire to resolve interminable frontier disputes.

Jurists never tired of proclaiming this desire, as Emer de Vattel stated:

Since the slightest usurpation of another's territory is an injustice, in order to avoid such a situation and to stave off all subject of discord [and] every occasion for disagreement, one should mark with clarity and precision the limits of territories. If those who drew up the Treaty of Utrecht had given this important matter all the attention that it deserved, we would not see France and England in arms to decide, by bloody warfare, the borders of their possessions in America. But often, someone left in the design some obscurity, some uncertainty in the agreements, in order to provide a basis for a disagreement; an unworthy artifice in an operation where good faith should prevail. Commissioners have also been seen working to surprise or corrupt their counterparts in a neighboring state in order to gain unjustly for their master a few leagues of land. How do princes, or their ministers, allow themselves to engage in maneuvers that would dishonor an individual? (Vattel 1820, 1:302–3)

One notes that juridical reasoning detoured into territories considered new, as in an experiment *ex nihilo*. In Geneva, the jurist Jean-Jacques Burlamaqui, discussing the rights and duties of nations, evoked the example of a nation that, already possessing a certain expanse of territory, might legitimately take possession of a coun-

try without a ruler, as did those exploring sailors who claimed in the name of their nation islands or other uninhabited lands that they encountered. However, the nation was obliged to establish colonies and make the land useful to people. One nation cannot drive out another that inhabits a country in order to establish itself there, as the ancient Helvetians, discontented with their native land, had tried in vain to do in the time of Julius Caesar. The jurist concluded: “In order to avoid all occasion of disagreement or conflict with regard to territory, it is very important to mark boundaries with precision so that each nation knows the extent of its domain. This maxim is not, moreover, to the taste of our politicians; they are quite content to provide themselves with a basis for conflict” (Burlamaqui 1820–21, 5:7).

Treaties establishing boundaries proliferated. A sampling would include treaties that determined boundaries for the Austrian Netherlands (1769, 1779); the episcopal Principality of Liège (1767, 1772–78) and the electoral Principality of Trier (1773, 1778); the principalities of Nassau-Saarbrücken (1760–70), of Nassau-Usingen (1774), and of Nassau-Weilburg (1776); Zweibrücken (the duchy of Deux-Ponts) (1766, 1783, 1786); the Principality of Salm (1751); Württemberg for the comté de Montbéliard (1748, 1785, 1786); the episcopal Principality of Basel (1780); the cantons of Soleure (1771) and of Bern (1750); Prussia for the Principality of Neuchâtel (1765); the Republic of Geneva (1749); the Sardinian states (1760); and Spain. All of them negotiated their boundaries with their powerful French neighbor. In central and Mediterranean Europe, Austria, Prussia, Bavaria, and Venice agreed on boundaries with their neighbors.

While treaties were the final result of negotiations, a complex relationship existed between the land, the words of the treaty, and the map. It is helpful to distinguish several, interrelated levels. First, there were the projects related to politics that aimed to defend frontiers, avoid future usurpations, suppress enclaves, fight against contraband and establish better fiscal control, regularize watercourses serving as boundaries by controlling flooding, and facilitate the circulation of people and merchandise. They could not be separated from political debates over duties and customs and freedom of trade. Second, there were discussions and agreements dictated by juridical preoccupations specific to the Enlightenment. The law of nations tended to establish the rules of a durable peace among nations. Agreements ended these frequently laborious discussions and, once lines were drawn, cartographers were sent into the field. In order to draw boundaries, the operations of a commission were necessary. These were conducted on location by surveyors, engineers, geometers, and geographers who were aided by subordinates such as chainmen. These manual

workers undertook to establish boundary markers using instruments such as graphomètres, compasses, and plane tables. It was still necessary, in the city offices, to carry out the drawing and to report the boundary on a paper document. The map responded more than ever to the requirements of visual sense and to theories of the senses (*Traité des sensations*, 1754, by Étienne Bonnot de Condillac). The limits drawn could respond to different concerns. Many were conceived as convenient spatial frameworks, static and reputedly permanent, indispensable a priori for the control of territory and for increased intelligibility of the space in question, allowing one to locate a city, villages, or a forest and providing names for provinces as well as judicial, fiscal, and religious territories. Other maps were in play at the moment of their conception and were themselves diverse in purpose. They might either constitute provisional topographic instruments in support of a particular position in negotiations, or they might accompany decisions playing the role of a supposedly definitive guarantee. Finally, the maps were later verified and rectified and all levels of consideration intervened—ideological, juridical, state-related, and technical. These were the means by which territory was delimited.

The question of boundaries became a specific preoccupation, as it impinged on relations with neighboring principalities. It is impossible, however, to consider boundaries and maps as the outcome of high politics alone. Rural communities and frontier villages were involved in the reorganization of boundaries. New borders took the structures of habitation into account, avoiding as much as possible the division of villages (whole communities often passed to one side or the other); jurists, engineers, and topographers went on site and heard grievances; principal inhabitants were consulted as witnesses and took oaths of fidelity to the new ruler. The elaboration of limits, the recognition of boundary drawings, and the establishment of boundary markers were the result of the intense circulation of norms, orders, requests, relations, and reactions across the entire social scale.

Nor did the sea escape these general tendencies. In contrast with the Mediterranean Sea, *mare nostrum* for the Romans but not appropriated completely by successive empires, the channel between the British Isles and the Continent raised the question of ownership, evident in the symbolically important debates over proper names: Manche, mer du Nord, océan germanique, mer d'Irlande, British Seas, Channel, North Sea, even mers françaises. International law pitted the *Mare liberum* (1609), supported by the Dutch jurist Hugo Grotius, who cited Cicero in comparing water to the air, declaring that the open sea could not be appropriated (unlike watercourses), against the *Mare clausum* (1635) of the

English jurist John Selden, who affirmed that the seas had been possessed by the Hebrews, the Carthaginians, the Greeks, and the Tuscans, but not by the French. The Dutch Cornelius van Bynkershoek formulated the doctrine of territorial waters (*De dominio maris dissertatio*, 1703), and the distance of a marine league (the distance of a cannon shot) was recognized by the end of the eighteenth century. Specific disagreements concerned issues like the maritime ceremonial and salute to the flag, to which the English were particularly sensitive having imposed “British Seas” as an expression in 1654; naval captures; herring fishing in the North Sea; the Anglo-Norman (Channel) Islands; and the establishment of customs duties. When diplomats convened at Saint-Malo in 1749, the French plenipotentiary marked off with two red horizontal lines a neutral zone on a rudimentary map for negotiations, and, in their turn, the English commissioners proposed a dotted line encircling the British Isles. Then the question of the borders of the Channel, the North Sea, and the Irish Sea as well as their nomenclature came to the fore. In 1752, after three and a half years of debate, the commissioners declined to draw boundaries. The project of delimitation, realistic on land, was technically ill adapted to the sea. However, it demonstrated that the importance of the historic argument about who was first to possess the sea had gradually faded in the face of the needs for geographic partition. Despite the failure, the idea had appeared (Morieux 2008, 160–63).

These agreements rested on the sometimes fictive idea that it was necessary to negotiate as equals, with the strongest recognizing the weakest. Without doubt, violence did decrease in the eighteenth century, but not everywhere. For example, in the partitions of Poland-Lithuania (1772, 1793, 1795) and the period of the French Revolution and the First Empire, large areas were redistributed, accompanied by a change of sovereign, such that the territorial mass often mattered more than the detailed delimitation. In addition, in a country like Russia, there was the search for so-called natural boundaries, especially rivers that were useful for commerce and easy to defend with a small number of fortresses (LeDonne 2004, 103, 119). After the First Partition of Poland-Lithuania, the treaty of cession concluded at Warsaw on 3 August 1773, imposed by Empress Maria Theresa on Poland, described the new boundaries, chiefly composed of rivers such as the Vistula and straight lines. They were to be marked and determined according to the locale and its received ideas regarding the most ancient demarcations. Commissioners would be named for both sides before preparing an exact map of boundaries on site, which would have the force of law in the future. Ceded vassals, subjects, and inhabitants were freed from their loyalty oath to

the Crown of Poland. Meanwhile, archives, documents, charters, and other public and individual papers were to be handed over to Maria Theresa (Article II). Article V made provision for commissioners in case of boundary disputes. Analogous clauses concerning boundaries, the loyalty oath, and the cession of papers appeared in the treaty between the empress of Russia, Catherine II, and the king, Stanisław August Poniatowski, and parliament of Poland, signed at Warsaw in that same year (Article II); commissioners were to be named in the case of disagreements over boundaries (Article VII). The Prussian king, Friedrich II, also imposed a treaty. In 1776, specific boundary agreements between the Austrian burghs and Poland and between Prussia and Poland provided for the intervention of engineers and the elaboration of maps (Martens 1791–1801, 1:474–98). However, the three powers competed in their claims, with a map (one it seems, that was already prepared and available) serving as a pretext:

A new rumor then spread in Poland: the nation complained loudly about reports that the Austrians and the Prussians placed no limits on the extension of their boundaries. The complaints were not completely without foundation; for the Austrians, exploiting an inexact map of Poland, as they all were, and having confused the names of the two rivers, the Sbruze and the Podhorze, had on this pretext extended their boundaries far beyond what had been granted them by the treaty of partition. Yet it had been agreed that the divisions were to take place with such perfect equality that none of the portions falling to each of the three powers would be larger than the others. Since, therefore, the Austrians had infringed on this condition, the king believed himself authorized to do the same: he therefore expanded his boundaries and encompassed both the old and the new Netze in the part of Pomerellie that he already possessed. The court of Petersburg intervened in this affair, and the king promised to restrict the limits of his cordon once again, provided the court of Vienna would do the same. (Friedrich II 1789, 102)

Moreover, the involvement of local society and their customs and geographic milieu made the politics of delimitation difficult. In the Pyrenees, conflicts between shepherds in the valley with those on the opposite slopes had long existed. Livestock found grazing outside authorized areas were subject to seizure, and occasions for reprisal were not lacking. The agreements between good neighbors (the *lies et passeries*) were renewed regularly in an attempt to find peaceful solutions. The agitation linked to demographic growth and to clearances, the exploitation of wood and iron, the resistance of the shepherds, and the defense of the rights of usage and shared pasturage all emphasized the urgency of regulation. A

Franco-Spanish commission (the Caro-d'Ornano Commission) worked several years (1784–92), built up vast documentation, proceeded to conduct cartographic surveys, and established boundary markers (see fig. 123) (Sahlins 1989, 98–99). Sixteen geographical engineers (the eight French included four geographical engineers from the department of war and four from foreign affairs) were sent into the field. Discussions concerned the possibilities of cession and exchange. On several points, the work of delimitation bore fruit. In November 1785 the Spanish completed a plan for delimitation up to the valleys of Salazar and of Roncal, and a map of the forest of Irati was prepared. The Treaty of Elizondo (1785) decreed the boundary by establishing two straight lines running across the pastures in Aldudes, north of the dividing line of the rivers. The lines served as the boundary for the two realms and prevented inhabitants from crossing or maintaining their system of neighborly relations, which disappeared. Contested by frontier dwellers and local administrations and interrupted by the Revolution, further boundary agreements were taken up again under the Second Empire by the Treaties of Bayonne (Nordman 1998, 339–40).

While the situation was different elsewhere in Europe, it had comparable effects. The conclusion of the Treaty of Karlowitz (1699), in which the Ottoman Empire, Austria, the Venetian Republic, Poland, and Russia were all involved, marked one of the most memorable periods in Ottoman history (Hammer-Purgstall 1838, 12:449, 455, 473). From the first meeting, the line determining frontiers was followed attentively on the map—through Transylvania, along the Danube and the Sava River up to the Una—and it was agreed to establish three borders where the line stopped, having crossed five states watered by these three rivers (see fig. 426). With the boundary line established, discussions on the exchange of prisoners, fortifications, religion, and commerce could follow. At negotiations for the Treaty of Passarowitz (1718), the Ottoman government nominated commissioners in order to definitively establish in 1718–19 the boundary along the Danube, in Walachia, and on the boundaries of Venetian territory. The territorial adjustments, if not upsets, affected one end of the Adriatic to the other, although the populations were left largely unchanged, including populations of Venetians, Slavs, and Morlachs (Chaline 2001, 357–59). Toward the east, the zone of contact between Venetian and Ottoman territory created a porous frontier, with no obstacle to migratory currents, to the displacement of manpower and the exploitation of domains under foreign jurisdiction, to transhumance or the frequentation of markets—in a word to the neighborly solidarity that maintained peaceful practices in the populations despite the threat of hostilities between states. Between the possessions of Venice

and those of the Ottoman Empire, between the two interlocking worlds (Poumarède 2004), the convergence of interests was manifest, even to the de facto practice of a double allegiance (Vatin 2004). This perhaps extreme case indeed shows that forms of local autonomy could effectively elude the law of states.

DANIEL NORDMAN

SEE ALSO: Administrative Cartography; Boundary Surveying

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Boundary Survey Plan. In 1648 the Peace of Westphalia confirmed the right of German princes of the Holy Roman Empire to choose their state's religious confession independent of the emperor and to impose the choice on their populations. This date has been viewed as a decisive turning point in the use of territory to define sovereignty: each prince provided a territorial foundation for his power. A more or less direct consequence of this event was the emergence of the linear frontier as the ordering principle of international relations. Émile Benveniste (1969, 14) noted the connection in Latin between *rex* (king) and *regere fines* (to draw boundaries); so we may associate the sovereign with the act of drawing a straight or just line, which is simultaneously a boundary and a route to follow. It is an act that, in an even more suggestive manner, recalls a distinction between order and disorder.

While accepting Westphalia as an ideological frame of reference, it is important nonetheless to specify the variable and particular circumstances in which the demarcation of a separating line between two state formations emerged as a political necessity. In this sense, the cartography of frontiers is inseparable from both the establishment of a policy of frontiers and the diverse significations that this policy assumed within governmental practices, which were undergoing dramatic and rapid evolution. This movement was particularly evident in the course of the eighteenth century, when frenetic reform efforts intersected with the institutional apparatuses of a number of European states, multiplying the number of both permanent governmental offices supervising boundaries and provisional commissions charged with occasional tasks.

The relation between the elaboration of a policy of frontiers and a thematic cartography of boundaries should be understood in relation to the complex military events that pitted European powers against one another. To this end, it is helpful to distinguish three contexts of cartographic production. First, boundary cartography could respond to the need of the military to provide itself with a graphic instrument during a military campaign, whether in progress or imminent, in a location where no previously existing representation was available

(fig. 92). For example, during the war between Poland and Austria in 1790, Jan Gawłowski was charged with preparing a map of the Galician border no less than three miles wide. Similar operations were conducted in Poland again the following year in 1791, when war with Russia loomed (Buczek 1966, 113–14). The speed with which information was selected to satisfy military demands characterized this type of cartographic production, which focused on the principal inhabited and fortified locations and the networks of roads and rivers.

A second type of boundary cartography provided much more detailed elaborations of these objects of military interest when the map was made with a military objective but outside the context of an immediate conflict. The cartographer might then undertake the representation of terrestrial morphology, give greater attention to the connection of roads, and differentiate inhabited locales according to their function and importance. In both types of cartography, plans or geometric or topographic maps depicted the frontier as a zone of friction and more rarely as a separating line. Under these circumstances, the boundary was rendered in an approximate manner with a hatched or dotted line as depicted in numerous atlases from the latter half of the seventeenth century.

The third military context for a boundary plan focused on issues of delimitation arising out of military conflict. It expressed a desire for a more precise relationship between the boundary and the natural (e.g., forests) and man-made (e.g., cities and roads) that it divided. To show this relationship, governments prepared a provisional but consensual frontier line to insert in the text of a treaty by using topographic maps; the line might later be made more precise or even be modified at the time of field operations (fig. 93). Similar cartographic documents, mentioned in 1713 at the time of the Treaty of Utrecht and in 1718 at the Peace of Passarowitz, exemplify the growing role of maps in the establishment of peace accords in the latter half of the seventeenth century. In this sense, there was a striking difference between the operational procedures of Gian Battista Nani in 1671 and Giovanni Grimani in 1699, both Venetian commissioners in Dalmatia. At the end of the War of Candia (or Cretan War) between the Republic of Venice and the Ottoman Empire (1645–69), Nani had to begin his mandate by soliciting the dispatch of documents and conducting investigations among very mobile local populations. Grimani could rely on a vast documentation gathered for this objective as well as an approximate—but constraining—definition of the boundary represented on a map that the diplomats had agreed upon at the time of the Treaty of Karlowitz (Mayhew 2008, 23–90).

With the wave of treaties peacefully pursued by European princes during the eighteenth century, practices

pioneered in the previous century became routine. Bilateral commissions were established, directed by diplomats, jurists, and influential commissioners, while technicians—surveyors, engineers, and cartographers—accompanied them and assisted their work in the field. Technicians would gradually assume greater and greater importance. The commissions applied the treaty articles with the territorial variations sanctioned by military vicissitudes and sealed by preliminary negotiations. As the instrument of communication par excellence, maps were first levied unilaterally by each commission. The first sketches that captured the principal stakes were later refined to prepare for diplomatic discussions. In the course of negotiations, maps allowed commissioners to illustrate their reciprocal claims and to propose and negotiate agreements. Finally, at the signing of the treaty, maps were included more and more frequently among the pieces of official documentation. The map thus rendered visible the line of the newly established frontier by enumerating and designating the boundary markers and by drawing attention to the territorial consequences of recent divisions.

The frontier maps produced varied in scale—between 1:10,000 (or larger) and 1:50,000—as a function of the different stakes at the core of individual agreements and variation in their intended uses and recipients. Differing representations of territorial allotments emerged. The maps produced within the framework of commissions, whether made during or at the end of negotiations, shared the goal of precisely indicating how frontier lines (concurrently projected by the commissions or agreed upon by them) would be drawn, along with the divisions they established. The representation of terrestrial morphology (relief and plains), the reference to vegetation with conventional signs, and the use of colors to distinguish cultivated plots from wooded expanses were the techniques available that responded to the concern for anchoring the boundary to the land and making visible the division that it decreed. These maps were infused with a concern for the representation of detail that could extend all way to the depiction of individual property divisions if these became significant for the work of the commissions. The maps—whether preparatory or annexed to treaties—used varied scales within the same document. In 1765, Antoine Durieu, an engineer from Savoy, reproduced a map that he had made with his counterpart, Giovanni Andrea Boldrini of the Duchy of Parma (fig. 94). Durieu enlarged certain sections of the frontier, as if “zooming in” to show in detail areas where the more heated discussions had resulted in an amicable agreement such as possessions particularly intertwined, confusing twists and turns on a riverine frontier, or the institutional entanglement of an enclave.

In general the scale of the map was adapted to the context of the negotiations. At all stages of the negoti-



FIG. 93. “CARTE POUR SERVIR A LA NEGOCIATION D’UN TRAITÉ DE LIMITES ENTRE LA FRANCE ET LES PAÏS-BAS,” 1760. The engineer Fisco, representing the Habsburgs, prepared this provisional map for the negotiations between France and the Austrian Netherlands. He used a color key to focus on the territorial claims of all parties to enclaves

and to the routes between the two states, which would later become an object of discussion by the French and Austrian plenipotentiaries in 1769. Manuscript ink, and watercolor. Size of the originals: 70 × 118 and 65 × 110 cm. © Service historique de la Défense, Vincennes (GR J6 M J10C 647 [1 et 2]).

ating process, variant maps were sometimes necessary to extend visual understanding. From 1769 to 1779, France, the Austrian Netherlands, and the Principality of Liège sought to make their enclave-strewn frontiers more regular. Communication routes were at the heart of negotiations in which the stakes were to define territorial sovereignty in relation to the road traffic in the whole region with its commercial network and geography of customs and duties. The demarcation of frontiers was articulated by the leitmotif of freedom of trade and freedom of circulation of goods and persons, of which sovereigns made themselves the guarantors in order to assure the “happiness of the people” (Stopani 2008, 382–83).

Another type of smaller-scale boundary cartography was elaborated within organizations created by various European princes to coordinate frontier policy. Some of these maps summarized the results of several previously

concluded treaties and allowed one to see at a glance the boundaries that were represented more precisely on the topographic and geometric plans annexed to the agreements. The “Réduction géométrique” drawn by Durieu in 1761 combined the results of several treaties that the Court of Turin had signed with Geneva and France from 1754 (fig. 95). The progressive establishment of frontier bureaus, committees, and offices called for this sort of cartographic production that allied the recollection of modifications and (sometimes historical) disputes with the celebration of the efficacy of administrative action.

In the eighteenth century, the cartography of frontiers benefited from advanced techniques in topographic representation. As far as the boundary was concerned, its semiography developed along lines already indicated in the past. The thick line (red and/or yellow, sometimes black) snaked on the maps supported by bound-



ary markers, increasingly represented by symbols in the form of dots or triangles, numbered or labeled with letters. This change from portraiture of individual markers to a generic symbol for any marker reflected the shift to using man-made boundary markers on the ground, objects that also provided a stable base for making measurements of angles and distances. Preparatory maps made use of colors to identify the surface of lands whose ownership was disputed or which were the object of an amicable exchange. The maps were ornamented with decorative insets in the form of cartouches and illustrations containing the title, the typological technique of the map ("plan" or "map"—topographic, in measure, geometric—"geometric reduction," "perspective view," "sketch," "illustrative drawing"), and the location of the part of the frontier represented.

The date and the author(s) of the map or plan were accompanied by an official signature on the document. The

map was not considered simply technical performance on the part of one or several engineer-cartographers. The official circumstances of the production of the map lay at the heart of an initiative that affected sovereignty. In this sense, diplomatic agents were all the more solicitous to authenticate maps as maps increasingly occupied a place among the documents composing a treaty or an agreement.

Illustrations and cartouches opened a space for complex symbolic discourse: princes and states drew from an allegorical register (royal figures with scepters or other signs of royalty) or symbolic register (emblems and coats of arms of the powers concerned); local life was represented by popular clothing or scenes from daily life; the principal localities such as cities and fortifications affected by the delimitation were shown in perspective view, or bird's-eye-view, or in plan; the professional identity of the engineers was shown in the ap-



FIG. 94. ANTOINE DURIEU, "CARTA TOPOGRAFICA CHE COMPRENDE I CONFINI DEL BOBBIESE E DEL PAVESE OLTRE PO," 1765. The map represents the territorial transformations produced by the determination of the border between the state of Piedmont and the Duchy of Parma. The sections colored pink designate the part of the territory discussed by the bilateral commission with regard to claims on both sides. The upper part of the map shows in more detail the nature of the land of individual parcels. Numbers in black and red scattered on the pink sections identify precisely those parcels that were subject to the agreement and those for which there was insurmountable opposition and would be discussed by the appropriate ministries. Manuscript, ink and watercolor. Size of the original: 103.0 × 171.5 cm. Image courtesy of the Archivio di Stato, Turin (Corte, Paesi, Confini con il Piacentino, Carte Topografiche, m. I, n. 5, 1765).



FIG. 95. ANTOINE DURIEU, “REDUCTION GEOMETRIQUE DE LA CARTE DU COURS DU RHÔNE DEPUIS GENÈVE JUSQU’AU CONFLUENT DU GUIERS,” 1761. The map recapitulates the territorial transformation accomplished by the negotiations between the Duchy of Savoy, France, and the Republic of Geneva. The small scale employed demonstrates that the finality of this document rests less on the technical representation of the position of the boundary markers

and the drawing of the boundary line than in the general presentation of the modifications and territorial exchanges codified by the treaty, shown by the colors used along the zones that were the object of the transactions (pink, yellow, black). Size of the original: 36 × 108 cm. Image courtesy of the Archivio di Stato, Turin (Corte, Paesi, Duché de Savoye, Confins avec la France, Plans et Desseins, m. 2, n. 8, 14 février 1761).

plication of a scale and wind rose and the images of instruments of the trade (compass, square, and graduated half-circle). The legend appeared in this discursive space where the cartographer specified the semiographic conventions adopted: the meaning of the signs and colors indicating the disputed spaces and the adjustments adduced or proposed and the letters and numbers designating the succession of boundary markers.

The course of the eighteenth century saw an increased propensity for multiple insets on boundary plans. The text tended to spread onto the map and to emulate written documents by providing the reader with more and more information. While the legend had previously provided space for historical information or a summary of claims, it now included much technical data. The boundary markers were numbered, and their position was described with the aid of mathematical, geometric, and astronomic techniques. The objects of territorial exchanges were qualified and quantified in terms of rights (fiscal and customs-related), surface area, and demographic or residential units. This accumulation of technical information fed the illusion at times of the omnipotence of the image of the frontier line in relation to its verbal description. The idea that the map itself could become, on its own, the legal support of a treaty was even sometimes proposed by a functionary or an engineer, but this practice was not adopted during the period discussed here (Stopani 2008, 345–400).

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SEE ALSO: Administrative Cartography; Boundary Surveying; Cartouche

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Boundary Surveying.

ENLIGHTENMENT
 AUSTRIAN MONARCHY
 DENMARK AND NORWAY
 FRANCE
 NEW FRANCE
 FRENCH WEST INDIES
 BRITISH AMERICA
 ITALIAN STATES
 OTTOMAN EMPIRE
 PORTUGAL
 PORTUGUESE AMERICA
 RUSSIA
 SPAIN
 SPANISH AMERICA
 SWEDEN-FINLAND
 SWITZERLAND

Boundary Surveying in the Enlightenment. From the end of the Middle Ages in Europe various levels of administration added painters, draftsman, and technicians to commissions charged with resolving disputes between princes, a practice attested and well documented from the early sixteenth century. Plans in perspective (in both black-and-white and color) increasingly depended on geometric operations, which united precision in depicting the actual boundary with a realistic view of the frontier landscape. The line drawn by the cartographer on the map exhibited a spatial discontinuity that mimicked the discontinuity created by the boundary on the terrain. Moreover, the representation of the line and the institution of the boundary emerged from the same institutional context that sanctioned the division between two adjoining powers. But the line was not meaningful without the indication and localization of objects on the map that the map showed as divided. Villages, churches, roads, rivers, and contours were included; they were represented because various property, fiscal, and jurisdictional rights were simultaneously attached to them and were split from them by means of the border.

To understand the natural, demographic, and juridical composition of the frontier landscape required direct observation of locales. This did not always happen, as, for example, in the case of a unilateral topographical survey in preparation for a diplomatic meeting. From the sixteenth century, instructional guides described secret tours, offering profuse advice on how to cross territory without the knowledge of its sovereign or how to gather fiscal, demographic, or topographic information without the knowledge of inhabitants. Disguised as a merchant or traveler, the engineer was to behave with great circumspection. Even without the instruments of

his trade (plane table, compass, and graduated semicircle) he was to note the morphology of the terrain, assess economic values, calculate distances, and estimate population. Later, upon return, he would reconstruct these data in order to prepare a map responding to the demands of those who had ordered it. When morphological conditions permitted, the engineer might draw a map from a high peak, which allowed him to view the whole frontier zone at once and situate the observations made during the secret tour more precisely (Bartoli 1564).

Unlike the fields, forests, and villages that it divided, the boundary itself was not visible on the terrain. Therefore, mapping a boundary implied the representation on the map of those material signs that served as markers for the boundary line on the ground. Certainly there were boundaries that relied on and incorporated concrete objects that were already there, such as roads, watercourses, and watersheds that provided concrete anchoring of the boundary to the land. When the terrain lacked these elements, boundary markers punctuated the path of the border, sometimes established by assigning this function to a preexisting object (a tree, rock, or summit) and sometimes by erecting a new, artificial reference point. However, between these markers the boundaries were still not tangible; they were invisible, tracing a kind of conceptual trajectory in space, yet all the while producing consequences that were concrete and divisive. Boundary markers faced one another along imaginary or immaterial lines, each marker serving as a point of arrival and departure for two segments of the boundary.

Because they were the only material elements providing concrete support for lines of division, boundary markers attracted the greatest attention in the cartography of frontiers. Cartographers preferred to represent the markers with a portrait rather than with a symbol; the latter suppressed the specificity and individuality of the markers in the name of an abstract and standardizing principle (fig. 96). The predilection for using an icon of the boundary marker arose from the realist logic that acknowledged the marker's dual role as both symbol and practical embodiment of sovereignty. Erected on the occasion of an agreement, arbitration, or other international pact, boundary markers bore the imprint of these highly formalized circumstances when plenipotentiaries and diplomats proceeded to give a treaty material form. The arms or the initials of sovereigns and states as well as the dates of the agreement were solemnly carved on the marker and minutes of the event were recorded. At the same time, other signs indicated the source and destination of the two lines that came into and went out from each boundary marker. The small arms of a cross, a strike-through stripe, or, more explicitly, an arrow pro-

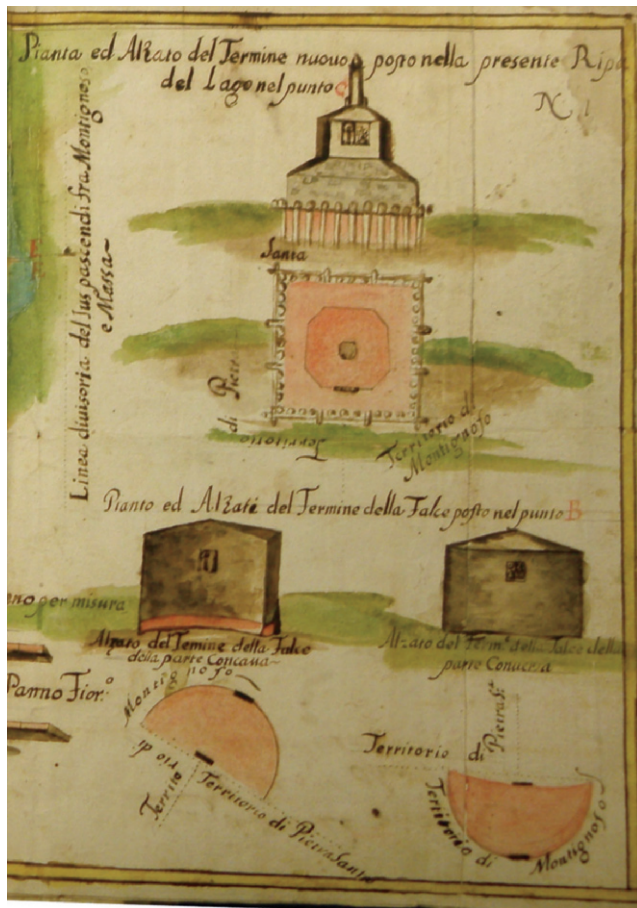


FIG. 96. DETAIL FROM *INGÉNIEURS* GIOVANNI MARIA VERACI AND GIULIO AMBROGIO GIANNETTI, “PIANTA ED ALZATO DEL TERMINE NUOVO POSTO NELLA PRESENTE RIPA DEL LAGO NEL PUNTO,” 1729. In this detail, Veraci and Giannetti show a series of the relevant boundary markers both in plan and elevation. Manuscript, ink and watercolor; scale of 100 pertiche, each of 5 Florentine braccia (1 braccio = 0.583 m). Size of the entire original: 35 × 70 cm; size of detail: ca. 35.0 × 24.5 cm. Image courtesy of the Archivio Storico Comunale di Pietrasanta (356, 1729).

vided this explanatory function to orient the viewer and was of the greatest importance for understanding the course of the frontier line. The desire for verisimilitude in the image of the boundary marker on the map caused the cartographer to enlarge either its image or a detail on the border of the map and to describe its form in the map’s legend in great detail, e.g., “Letter A, place called Fontaine Couverte, where there are two old stones on which are carved the arms of Savoy and of the *République de Vallois*, and in the middle there is a sign serving as an alidade to indicate the line of division (BCD) . . . ; letter E, wooden cross of Dromaz with the date 1749

facing the monastery of *Grand St. Bernard* . . . ; letter K, stone column topped with iron bearing the arms of the aforementioned powers” (fig. 97) (Comba and Sereno 2002, 2:101–2 [no. 59]). The same practice applied to localizing the site of a marker identified with the aid of toponyms that appeared on the maps alongside the icons of boundary markers.

In the second half of the seventeenth century, the visibility of the material signs of the frontier and their stability through time became the object of sustained reflection. In the field, the boundary (especially the international boundary) was to conform to a particular grammar and to be characterized by its own semiology. When a portion of territory was delimited, it was necessary to ensure that border markers were numerous and near one another. With the reduction of intervening distances, these markers rendered the imaginary lines discernable and reduced confusion as much possible. Markers were to be uniform, and their form was to be clearly differentiated from other objects standing out in the surrounding environment (a tree, a rock, a summit). Parallelepiped or cylindrical stones were to be erected and identified with conventional signs, which were codified to a greater and greater degree: they often included the year of the treaty, together with the arms of the princes and the initials of the states concerned (fig. 98).

While border markers were visible in the field, the boundary was conceived, understood, and described by means of three technical operations that developed and spread successively, effecting a progressive geometric abstraction of the frontier line and raising the status of the cartographer-technician. First, the boundary was conceived as a succession of lines, each having a boundary marker as a point of departure and arrival. The calculation of the length of each segment was no doubt practiced in diverse fashions in different regions, but it had long been known, as evidenced by the rediscovery of Roman surveying texts at the end of the Middle Ages and their diffusion in print within Europe. Second, during the seventeenth century, particularly in the latter half, the practice began of defining the line between two markers by its orientation with respect to the four cardinal directions or the wind rose using degrees, e.g.: “Marker n.1 is found 182 *cannes romaines* in a straight line 14 $\frac{1}{6}$ degrees to the east” (Florence, Archivio di Stato [ASF], Archivio dei Confini, 23, Dossier n. 14). Third, by the middle of the eighteenth century a new technique of calculating the value of the angles formed by the lines that connected boundary markers gained strength.

The increasing geometric abstraction involved in understanding frontiers was accompanied by increasing complexity in the technical instruments needed for their description. Any surveyor had sufficient knowledge to

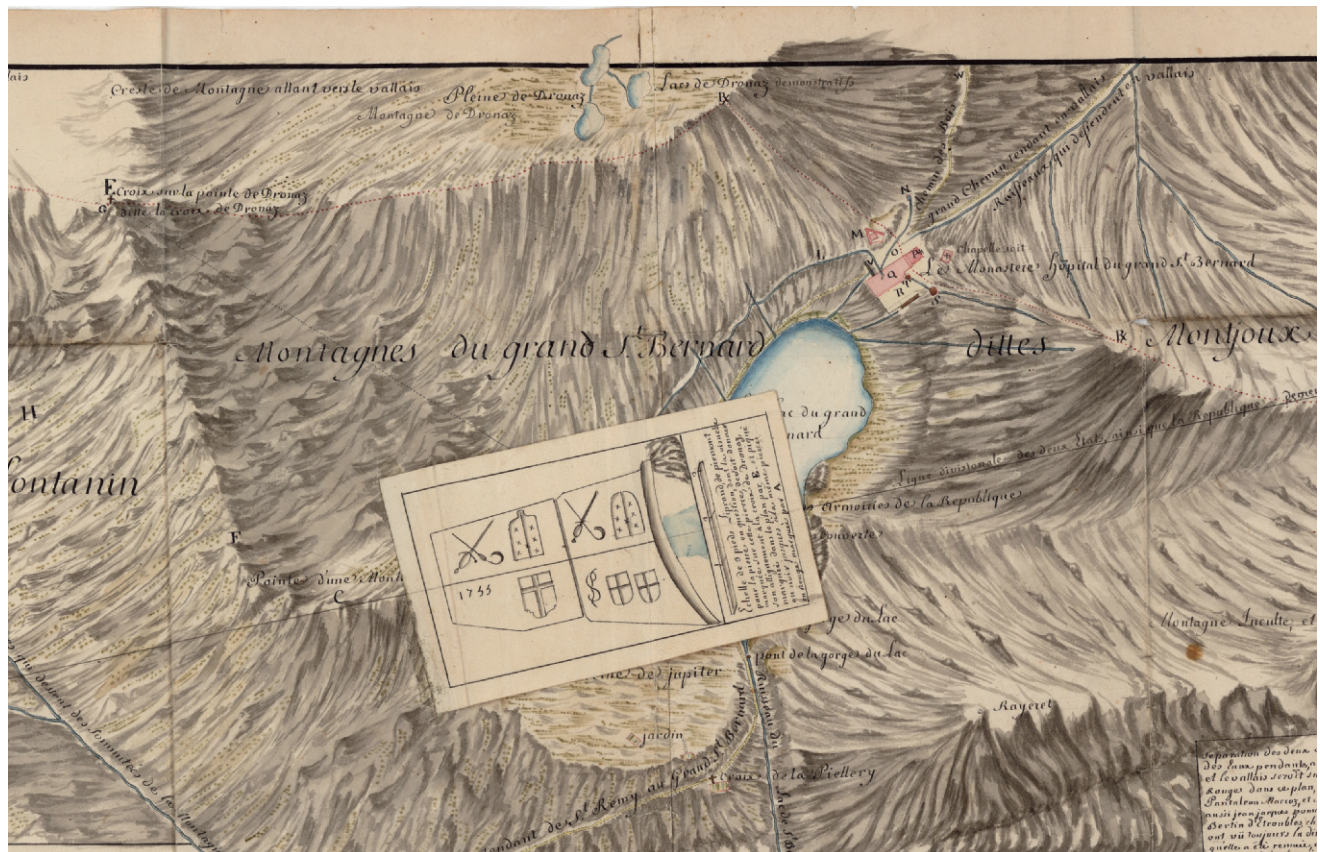


FIG. 97. DETAIL FROM ANTOINE DURIEU, “PLAN TOPOGRAPHIQUE, EN MESURE, DES MONTAGNES AUX ENVIRONS DU MONASTÈRE HÔPITAL DU GRAND S.^T BERNARD DIT MONTJOUX,” 1756. The entire map shows the area around the Saint Bernard pass in the Alps, an area of dispute between the Duchy of Savoy and the Republic of Vallese. The inset pasted onto the map highlights the boundary stone (K) near the covered fountain (A) that determined the line of division, shown with a straight line drawn in black,

in contrast to the natural boundary lines of the watersheds, articulated with red dotted lines, from (E). Manuscript, ink and watercolor; scale of 110 trabucchi (the trabucchio varied from 2.611 to 3.243 m).

Size of the entire original: 49 × 130 cm; size of detail: ca. 38 × 60 cm. Image courtesy of the Archivio di Stato, Turin (Corte, Paesi, Duché d’Aoste, Constestations avec le Valley, cat. II, m. I, n. 5/2, 1756).

measure the distance between two objects, though the instruments and units might vary from region to region. However, defining the angle between the two lines intersecting at a boundary marker required competence with instruments, such as the compass for azimuths with respect to magnetic north and the graduated semicircle for terrestrial angles. Their diffusion and use were directly linked to the scientific preparation of the technical personnel and the institutional support surveyors received in topographic offices and engineering schools.

The inclusion of the map among the documents that illustrated and sanctioned international treaties increased during the eighteenth century. This resulted from, on the one hand, the diffusion of mathematical and geometric techniques for the definition of boundaries, and, on the other hand, the recourse to the services of military engi-

neers or engineer-cartographers in operations of delimitation. The cartography of the frontier thus tended to assume a formal character previously unknown. Indications of the length of lines between boundary markers, together with the azimuths or angles they formed, were integrated into a cartographic framework. The length of each segment or the height of boundary markers might appear in red ink in the drawing itself or in framed areas specifically created in order to contain this technical information (fig. 99).

The mobilization of these mathematical and geometric techniques in the description of boundaries made the boundary marker a privileged location where an array of instrumental practices were put in place that only engineer-cartographers could effectively supervise, e.g., “With the compass positioned beside the parapet

toward the tramontana [the north] and perpendicular to the latter, we looked through the alidade, observing that the line goes toward marker XIII with 37 degrees of sirocco [southeast]” (ASF, Archivio dei Confini 79, 17 November 1762). Such notes dedicated much space to the results of the observations made, the usage of instruments, and the execution of technical operations. “After having measured the distance of 628 perches of Bologna between markers XII and XIII, we placed the compass on the horizontal plane of marker XII and found that the line headed toward marker XIII with 30 degrees between *grec* [northeast] and *levant* [east]” (ASF, Archivio dei Confini, 40, Dossier 13, 28 July 1704).

As the boundary became progressively more abstract, the boundary marker increasingly assumed a parallel-epipedal or cylindrical form in order to allow the systematic application of these technical methods, and straight lines increasingly tended to appear everywhere, even where the boundary could have joined or adapted itself to the sinuous contours of the natural landscape

(rivers, paths, watersheds) (fig. 100). In the eighteenth century, the abstract logic of the geometric line did not contradict the rise of the concept of natural frontiers as a geopolitical principle in international politics. It joined with this principle and, at the level of the terrain, made it more precise. Riverbeds were split in half, frontier routes were bounded, and mountain watersheds were marked with a series of artificial reference points. The innumerable segments, which were established by the repetition at will of these same technical operations and which composed each portion of the frontier, disappeared from maps at smaller scales in favor of curved lines, drawn in thick colors, emphasizing the separating and impermeable character of the new forms of territorial sovereignty. At this smaller scale, local customs linked to the circulation of persons, merchandise, and livestock disappeared, as did systems of reciprocity assuring access to sources, forests, or paths at certain locations. It was, however, these principles that frontier treaties regulated by codifying good neighbor principles—such as the *lies*



FIG. 98. DETAIL FROM GIOVANNI SANTINI, “CARTA DELLA DIVISIONE TRA IL GRANDUCATO DI TOSCANA E LA REPUBBLICA DI LUCCA,” 1686. The map shows the territorial consequences of the “imaginary lines” drawn from one marker to another. The images of the boundary markers with the carved signs of sovereignty and their technical details are accompanied by representations of the houses and hamlets

at stake during boundary negotiations. Manuscript, ink and watercolor; scale in pertiche lucchesi, each of 5 braccia (1 pertica = 2.95 m).

Image courtesy of the Archivio di Stato, Florence (Piante Antiche dei Confini 63). By concession of the Ministero dei Beni e delle Attività Culturali e del Turismo.

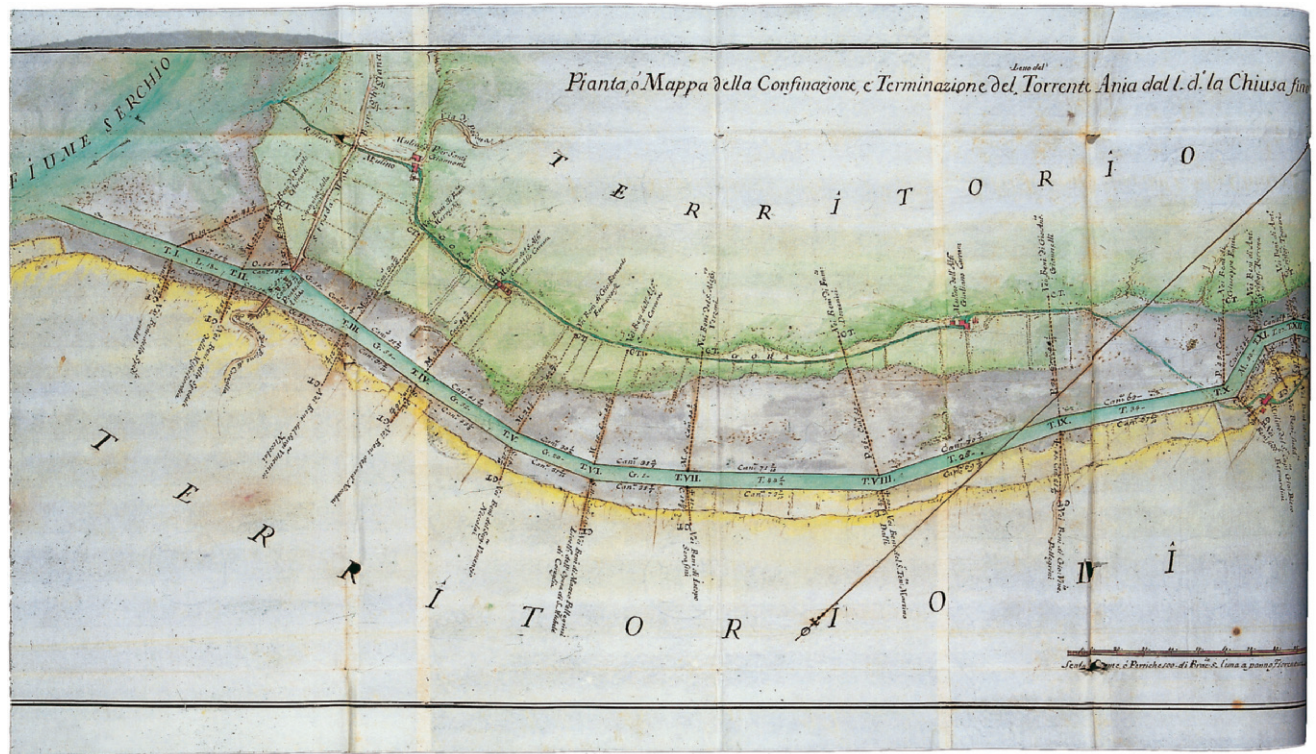


FIG. 99. DETAIL FROM GIOVANNI CRISTOFORO LORRAIN AND GIOVANNI AZZI, “PIANTA, O MAPPA DELLA CONFINAZIONE, E TERMINAZIONE DEL TORRENTE ANIA DAL L. D. LA CHIUSA FINO AL SUO SBOCCO NEL SERCHIO, 1684.” *Ingénieurs* Lorrain and Azzi deployed mathematical and geometrical techniques and instruments to represent the border along the streambed (Torrente Ania) that formed the boundary between Lucca and Tuscany by placing

markers on either side of the bed and then measuring the distance between them. Manuscript, ink and watercolor; scale of 100 pertiche, each of 5 Florentine braccia (see fig. 96). Size of the entire original: 45 × 120 cm; size of detail: ca. 45 × 75 cm. Image courtesy of the Archivio di Stato, Florence (*Piante Vecchie dei Confini* 78). By concession of the Ministero dei Beni e delle Attività Culturali e del Turismo.

et *passeries* of the Pyrenees and similar practices governing the exchanges between local societies.

ANTONIO STOPANI

SEE ALSO: Administrative Cartography; Boundary Survey Plan; Modes of Cartographic Practice; Traverse: Surveying Traverse

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FIG. 101. JOHANN CHRISTOPH MÜLLER, MAP OF AUSTRIAN-TURKISH BORDER, CA. 1:500,000, CA. 1706. The “Mappa geographico-limitanea in qua imperiorum caesarei et ottomannici confinia in almæ pacis Carlovitzensis congressu decreta” provides the overview of the proposed boundary between the territories of the Ottoman and Habsburg monarchies. Oriented to the south, it uses red for the Ottoman

side of the boundary and yellow for the Austrian. It is one of hundreds of maps made by Müller, under the direction of Luigi Ferdinando Marsigli, who headed the Austrian boundary survey (see fig. 426).

Size of the original: 36.0 × 63.7 cm. Image courtesy of the Kartensammlung, Österreichische Nationalbibliothek, Vienna (Cod. Min. 85 Han, fol. 1r).

ing on boundary markers (Veres 2015). A number of printed maps were based on the modifications of the boundaries of the Moravian counties in 1783, such as *Das Markgraftum Mähren* (1784, ca. 1:320,000).

Besides official boundary surveys, a number of semi-official efforts focused on regional boundaries during the second half of the eighteenth century, especially in Hungary, where many *Comitat* (county) maps were produced by local land surveyors. These maps showed not only topographic and economic data of a single territory, but also documented administrative boundaries, although with varying quality, from the refined topographical detail of *Neue und Volstaendige Karte von dem Szalader Comitat im Koenigreich Ungarn* (1789, ca. 1:147,000) to the aesthetically decorative *Tabula Bannatus Temesiensis* by Francesco Grisellini (1776, ca. 1:480,000). However, these maps only incorporated the results of boundary surveys to provide an overview at a smaller scale of a particular region.

GERHARD HOLZER

SEE ALSO: Austrian Monarchy; Karlowitz, Treaty of (1699); Marsigli, Luigi Ferdinando; Müller, Johann Christoph; Poland-Lithuania, Partitions of

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FIG. 102. DETAIL FROM CONSTANTIN JOHANN WALTER, "MAPPA DER IENIGEN GRÄNZEN LINIE," 1754–56. A single sheet from Walter's twenty-sheet reduction (1:28,000) of the original survey, performed at 1:14,400 in seventy-three sheets, shows the proposed boundary line (yellow), the boundary claimed by lower Austria (red), and that claimed by Hun-

gary (green). The capital letters mark station points along the surveyed lines and are described in the accompanying booklet. Size of the entire original: 580 × 143 cm. Image courtesy of the Kriegsarchiv, Österreichisches Staatsarchiv, Vienna (Kartensammlung B IX c 642, sheet 16).

Boundary Surveying in Denmark and Norway. Surveying and mapping of the boundaries of Denmark-Norway in 1650–1800 focused almost entirely on the Norwegian-Swedish boundary. Denmark's boundaries with the duchies of Schleswig and Holstein remained largely undisturbed during the period and required no official efforts to delineate them. Moreover, the mid-seventeenth century wars with Sweden, concluding in peace treaties of 1645, 1658, and 1660, led Denmark to lose large areas of land. The land boundary between Denmark and Sweden now became a sea frontier through Øresund. By contrast, the complex mountainous boundary between Norway and Sweden was of interest because of access to deposits of iron ore and other economically useful minerals. Several boundary demarcations were accordingly made; the resultant maps and journals can be found in the respective national archives (Oslo, Arkivverket, RA/EA-5930/T/T023; Stockholm, Riksarkivet, SE/RA/81007/2).

The peace of 1658 transferred coastal Bohus County

from Norway to Sweden, necessitating a survey of the new national boundary. This was accomplished in 1661, and a map was made by Kettel Classon Felterus of the area from the sea to Øvre Kornsjø (Kjellén 1899, 287–88). After the conclusion of the Great Northern War (1700–1721), it was agreed to survey the long mountainous boundary between Norway and Sweden. This frontier had previously been accepted unchanged since time immemorial. In 1738 delegations from Sweden and Denmark-Norway met at Øvre Kornsjø to establish the boundary from there to Finnmark. The delegations were to establish where the boundary should run and make a provisional map. The general rule was to follow the watersheds—along the height of land, so that Norwegian areas were where water ran north and west, while Swedish areas were where water ran south and east—adjusted for actual possession and use of the land, for example where inhabitants had grazing rights in disputed areas or where inhabitants went to church or paid tax. Where there was no agreement, both countries'

claims were marked. In 1742, the southern boundary of the Trondheim diocese was reached and from that year the Norwegian delegation received help from Peter Schnitler. He collected additional information by studying historical documents and by questioning the local population. The survey work on the Norwegian side was carried out by Thomas Hans Heinrich Knoff and Friedrich Christian Knoff, while the Swedish surveyors were Lorents Lindgren and Kilian Ratkind. After the boundary survey was completed in 1749, there were negotiations over the disputed points and an agreement was signed in Strømstad in 1751 (Fraenkl 1997).

In 1752–66, a boundary survey was carried out with the erection of boundary cairns. The chief surveyor on the Norwegian side was Jørgen Nicolai Holm and on the Swedish side Nils Marelius. The surveying was done with the help of plane tables (see fig. 127), and Marelius also had with him a new instrument for measuring angles, the *geografiska cirkel* (geographical circle) designed by the Stockholm instrumentmaker Daniel Ekström (see fig. 406). Marelius also used the instrument to take measurements of latitudes, which he published, along with his observations of magnetic declinations and associated boundary maps in three articles (Marelius 1771a, 1771b, 1772).

NILS VOJE JOHANSEN

SEE ALSO: Denmark and Norway; Geodetic Surveying: Denmark and Norway

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Boundary Surveying in France. In seventeenth-century Europe, after fierce conflict, defeated foes suffered imposed or negotiated annexations of territory. By the eighteenth century the price of war was less onerous: technical progress, military discipline, ability to resupply, as well as the philosophical and juridical currents of the day prevented the massacre of populaces. Although the eighteenth century had not rejected all violence, as shown by the fate of Poland, French frontiers bore less military pressure. An equilibrium had nearly been reached, with Dombes (1762), Lorraine (1766), and Corsica (1768) as the last additions to French territory. Barter politics—the acquisition of Corsica was a dis-

guised sale—carried more influence than the results of armed conflict. Henceforth, discussions would concern small borderlands, featuring interminable negotiations over boundaries. This boundary regularization began to define the relationship between land and state, as it made more sense to attend to the status of tiny hamlets than to engage in massive displacements (Nordman 1998, 286).

New methods were applied. In the seventeenth century, the secretary of state for war assumed jurisdiction over the frontier provinces because of their relative proximity to Paris, their imbrication in political and strategic decision making, and, as with Flanders, Lorraine, and the Franche-Comté, the need to maintain order (Nordman 1998, 295–300). By the eighteenth century, the secretary of state for foreign affairs oversaw border politics, and his ministerial offices adopted certain administrative routines (resumés of correspondence, summaries, memos and copies, uses of foreign languages) that required the establishment of a *Dépôt des archives* in 1709. Jurisconsults or clerks—including Jean-Conrad Pfeffel, Chrétien-Frédéric Pfeffel, and Jean-Baptiste Duché—continuously gathered documents, and in 1746, a collection devoted to boundaries was established within the ministry. By having diplomats, jurists, and surveyors on site, the ministry at Versailles tended not to increase territory but to simplify territory through the exchange of disputed enclaves. The jurist Emer de Vattel declared that to avoid the injustice of usurpation it was necessary to mark boundaries with precision (Nordman 1998, 303). Thus it became less a matter of an offensive on the borders (*frontières*) than of the contractual establishment of boundaries (*limites*). During this period these terms became synonymous, and the frontier slowly became peaceful. The result was clear: after the Treaty of the Pyrenees (1659) and its supplements there were about 350 disputed territories from the North Sea to the Meuse (Girard d'Albissin 1970, 97). In 1789, only four enclaves remained.

In an earlier period, sovereignty was based on juridical and fiscal rights, which were difficult to prove because they were conceptual and invisible. Now the establishment of sovereignty responded to other demands. More than ever, kings, ministers, *intendants*, and residents of city and countryside wanted to know their boundaries henceforth geographically, thus both visible and accessible. In this way, eighteenth-century French border maps were not innovative: good examples exist from the early seventeenth century for the area between France and the Spanish Franche-Comté. After a visual inspection (*inspection oculaire*) commissioners drew up wonderful color maps—called *tibériades* after the maps of the Tiber—showing woods, paths, watercourses,

bridges, and hamlets (Pelletier 2007, 1523). However, when France acquired a small portion of Lorraine in 1661, no allusion to a map existed. Yet by the period between 1740 and 1780 an immense borderland cartography developed systematically, piece by piece, from the Austrian Netherlands to the Lorrainian and German principalities, along the Swiss cantons, Sardinian states, and to Spain; this was not surprising in the era of large-scale mapping by the Cassinis.

In the north and east, France made agreements with the Netherlands and the principalities of Trèves and Liège in the second half of the eighteenth century through long negotiations (Nordman 1998, 363–64). While certain criteria, such as language, were absent, the basic principle was founded on exchange of property: entire villages were evaluated (including hearths, land, livestock, and state revenues) and balanced “within a few sticks”; surveyors and geometers together undertook the surveying (Nordman 1998, 399–402). For example, after the France-Liège treaty of 1772 and the articles of 1773, one surveyor went to the very small town of Givet, fixed the origin of the boundary line at the height of a small island in the Meuse, differentiated points from A through F, and raised twelve boundary markers in dressed stone (figs. 103 and 104). Certain adjustments revealed that sometimes geography prevailed over geometry. Other *arpenteurs jurés* (sworn surveyors) continued the work in the presence of mayors and magistrates from Haybes (France) and Oignies (Liège). During four days in November 1774 they established markers on Mont Castillon. In November 1776, boundary markers that were visible (*se reconnaître*) to one another were established in the territory of Philippeville. A dossier includes minutes, attestations, and a sketch of a large and a small boundary marker (fig. 105).

Such dossiers included precise descriptions for every marker, whether old or new, such as the following one on the border of the Swiss principality of Porrentruy: “the new marker, numbered eighteen, with the same coats of arms and mileage as the preceding marker, also set up in the woods in the same place at distance of seventeen perches, four pieds from the preceding, whence one continues through the woods north toward the next marker, turning twelve degrees to the west” (quoted in Nordman 1998, 384–85). The markers were mutually visible. The boundary was a succession of angles and lines. On cloth-mounted manuscript maps, the markers were numbered in red ink with distances indicated. The continuous black line of the border was accented in yellow and red (fig. 106). Although this fragmentation of space is extreme from the point of view of geographical and topographical representation, the geometric abstraction guaranteed continuity of the boundary line.

The Rhine, with its many channels and contested



FIG. 103. “CARTE FIGURATIVE DES LIMITES DES TERRES DE FRANCE D’AVEC CELLES DE LIÈGE,” 1774. From the papers relating to the process of boundary adjudication near the small town of Givet, attached to a letter of one of the sub-delegates, Gérard de Contamine.

Image courtesy of the Archives du ministère des Affaires étrangères et européennes, Paris (Limites, Pays-Bas, vol. 276, fol. 227).

islands, required lengthy operations (1770–88) to reconcile geometry and local interests, both on the terrain and on the map. A boundary line separated France from the margravate of Baden-Durlach and the city of Basel. Distances were measured “geometrically and horizontally without regard to height or the slope of terrain.” Marker 6 on the Île des Veaux, fixed in 1720 and clamped with iron, separating the territories of the city of Basel from that of the margravate, and marker 7, formerly planted on the right bank, both assure (*assurent*) fixed point 1. “R” and “M” were inscribed on the markers (*royaume, margraviat*). A black line shaded (*nuancée*) in yellow and red separated the sovereignties on the

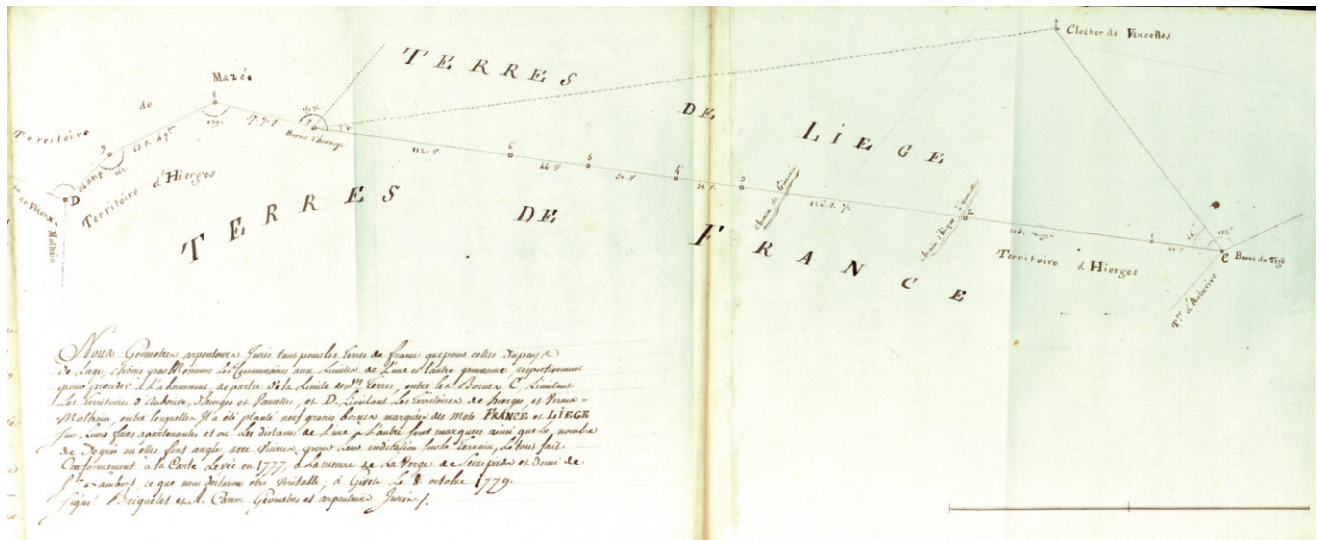


FIG. 104. PLAN OF THE BOUNDARY ESTABLISHMENT FOR THE TERRITORY OF HIERGES, BETWEEN FRANCE AND LIÈGE, 8 OCTOBER 1779. The plan shows the precise measurements and placements of the boundary markers.

Image courtesy of the Archives du ministère des Affaires étrangères et européennes, Paris (*Limites, Pays-Bas*, vol. 284, fol. 298).

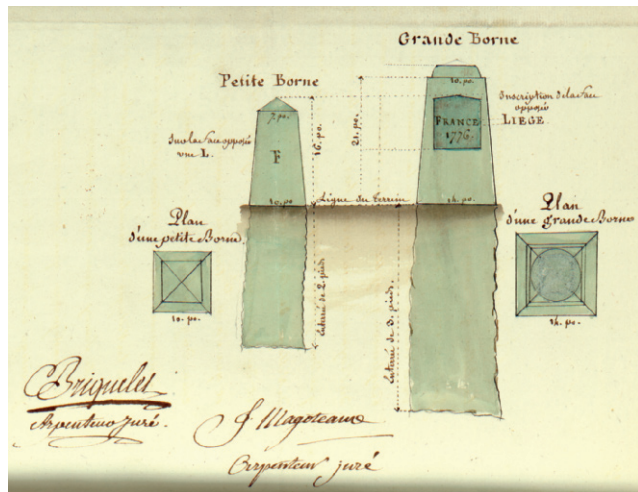


FIG. 105. DRAWING DEPICTING BOUNDARY MARKERS THAT WERE ESTABLISHED AT THE CORNERS AND ALONG THE LINES OF THE TERRITORIAL LIMITS CEDED TO FRANCE BY THE PRINCE-BISHOP OF LIÈGE IN THE ENVIRONS OF PHILIPPEVILLE, 27 NOVEMBER 1776. The design of the large and small boundary markers was made by two *arpenteurs jurés*, who signed their work.

Image courtesy of the Archives du ministère des Affaires étrangères et européennes, Paris (*Limites, Pays-Bas*, vol. 142, fol. 285bis verso).

map (fig. 107) (Nordman 1998, 319–20). Local interests prevailed: boundary delimitation would concern lands dependent upon villages, not the boundaries between villages. Some islands remained intact; others were divided; local rights were distinguished from sovereignty.

Some residents took no notice of the pretensions of state. For example, mountain dwellers, whose habits were of movement and exchange, clearance, forest access, flock passage, oaths of peace taken by communities on opposing slopes, and contraband, had for centuries ignored state sovereignty. Their world was codified in the Pyrenees during the eighteenth century. Yet the Alpine region became less abstract as it became better known: numerous toponyms were more frequently used; the valley beds were reduced in size on the map, whereas they had previously been shown much larger in relation to the higher mountain regions; and astronomic and mathematical coordinates no longer had only symbolic value. The mountain became more familiar. One of the treaties of Utrecht (1713) established a natural boundary between France and the House of Savoy along the summits, formalizing the geographic and judicial criterion of natural slope and drainage, or *eaux pendantes*. Thus international law confirmed an ongoing evolution causing the Alpine border to edge ever nearer the ridges (fig. 108).

In a century of boundaries—more than frontiers—cartography combined, in varying proportions, a large-scale understanding of local usage and the demanding requirements of sovereignty, which redefined the relationships between nature, law, and power. While in the seventeenth century the question of borders could still be settled without recourse to a map, the negotiations of the eighteenth century were expressed simultaneously in texts and maps. However, visual representations alone, presented as simple annexes to documents, were not suf-

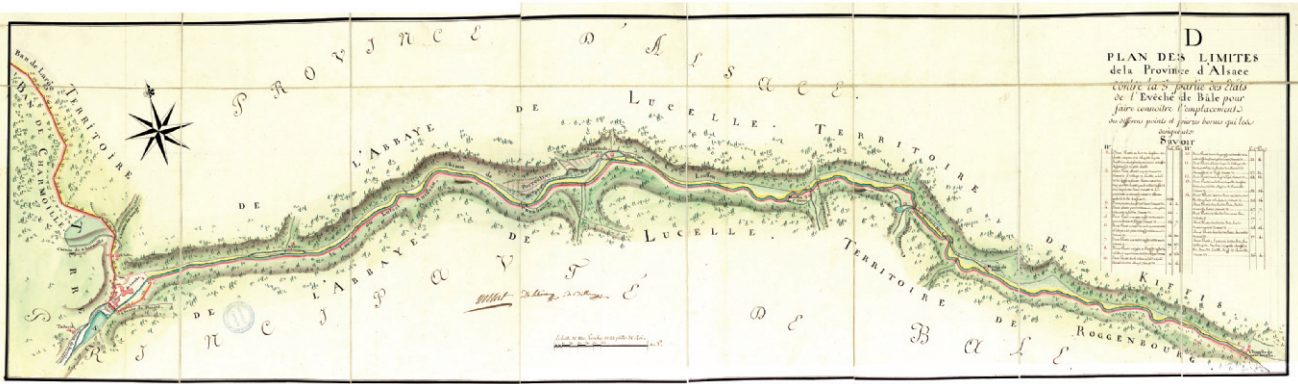


FIG. 106. "PLAN DES LIMITES DE LA PROVINCE D'ALSACE CONTRE LA 3^E PARTIE DES ETATS DE L'EVÊCHÉ DE BÂLE" (PRINCIPAUTÉ DE PORRENTROY). The black line of the border is highlighted in yellow and red, with the boundary markers numbered in red.

Image courtesy of the Archives du ministère des Affaires étrangères et européennes, Paris (Limites, Suisse, Annexe cahier no. 4 Limites Alsace/Bâle).

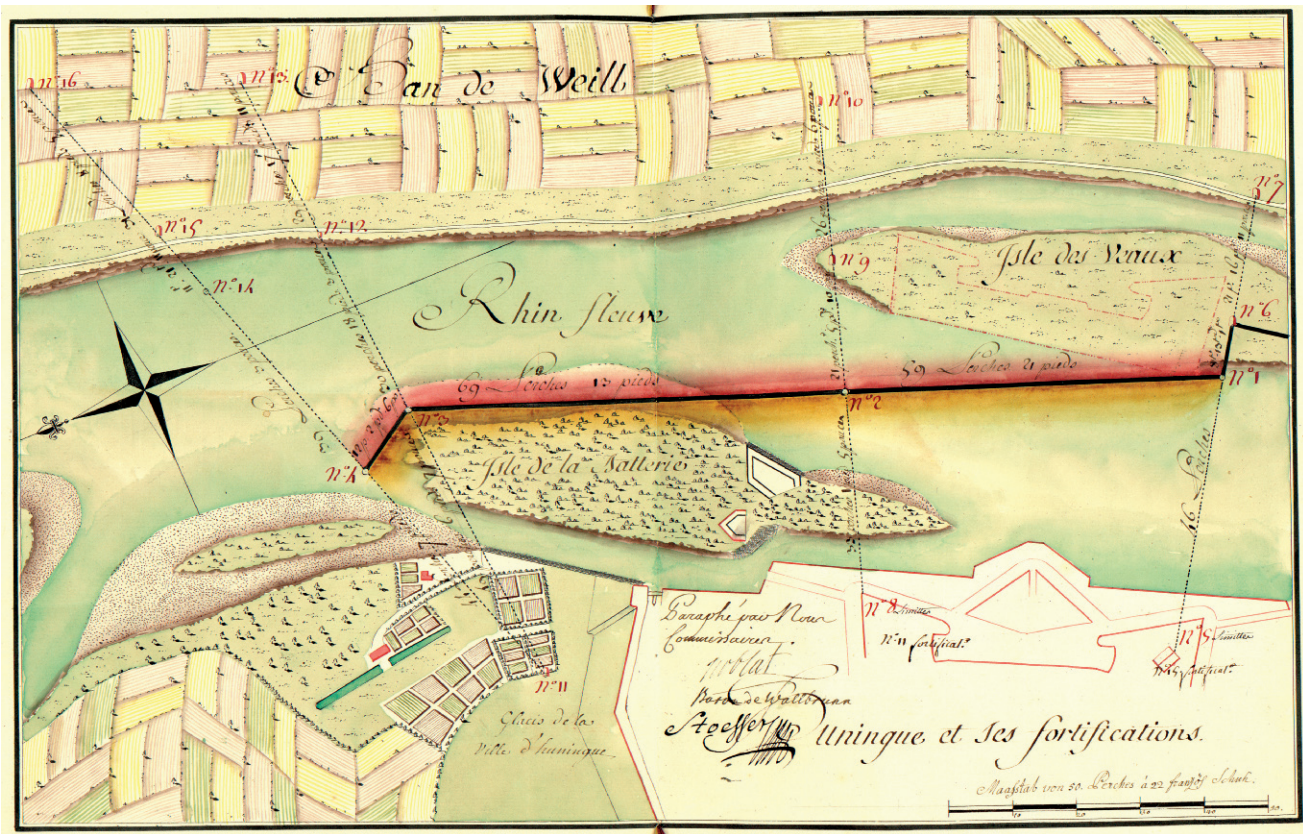


FIG. 107. THE COMMUNITIES OF HUNINGUE IN FRANCE AND WEILL (WEIL AM RHEIN) IN GERMANY, 22 OCTOBER 1770. The plan employs a black line to separate the two sovereignties on either bank of the Rhine, highlighted in yellow and red, with the sixteen boundary markers enumerated in red and the measured distances between them shown in dotted lines.

Size of the original: 28.5 × 43.0 cm. Image courtesy of the Archives du ministère des Affaires étrangères et européennes, Paris (Limites, Bade, Annexe procès-verbal délimitation du Rhin).



FIG. 108. *CARTA GENERALE DE STATI DI SVA ALTEZZA REALE*, GIOVANNI TOMMASO BORGONIO, 1680, SHEET 8. The detail of the map of the Italian Piedmont shows provincial borders in red and blue along the alpine summits between modern France and Italy. Torino (Turin), outlined in red, is in the lower right corner where the Doria Riparia River meets

the Po. In French Savoy, Mont Cénis (Grand and Petit) lies in the center, just above the red and white coat of arms, with the legendary massif of Mont Iseran immediately to the north. Size of the original: 48.0 × 70.5 cm. Image courtesy of the Bibliothèque nationale de France, Paris (Cartes et plans, Ge DD 2987 [5023,8 B]).

ficient in the eyes of diplomats to resolve disputes. The old customs—texts, research on the ground—counted more in the final negotiations.

But the boundary was more than a line, important less for the places through which it passed than for its character (juridical, administrative, state-related, permeable or impermeable, linked or not to former feudal-vassal structures). This explains why from the French Revolution to 1815 the line itself was less contested than it had been or would be in the nineteenth century. It became a military frontier once again; enormous territories were redistributed just as they were, signaled by the changing of a sovereign at the top. Finally, from the Revolution to 1815, the total mass of territory would matter more than lines. Some nuance was possible, as indicated for instance by the Treaty of Paris of 1796, which applied to the Alpine frontier; or the First Treaty of Paris (1814),

which left to France several cantons of the former French *départements* of Jemmapes and Sambre-et-Meuse (Lentacker 1974, 21–22); or the allocation of Versoix (1815) and Carouge (1816) to Geneva. The micro-territory always existed within the macro-territory, and the boundary still eroded the frontier. However, what mattered henceforth was the optimal division of states as a decisive factor in international relations, on the one hand, and, on the other, the link established by powers between the territory, its symbolic value, and the nature of the political regime.

DANIEL NORDMAN

SEE ALSO: Administrative Cartography: France; France; Topographical Surveying: France

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Boundary Surveying in New France. The process of demarcating boundaries in New France was very unstable over the course of the territory's history, shifting in response to conquest and competing claims. The French, English, and Spanish all marked their territories as they understood them, interpreting in their own fashion the successive treaties signed by their sovereigns. On several occasions French authorities appealed to cartographers not only to describe the limits of the empire but also to explore and map frontier zones. To the extent possible, French explorers expanded the frontiers of the empire and took possession of territories that would assure the "maintenance of commerce and the growth of the colony" (Louis XIV 1688) while blocking the expansion of rival powers.

In 1688, preparing for negotiations with the king of England, Louis XIV ordered the preparation of an "exact map to indicate what should belong to each nation" (Louis XIV 1688). The cartographer Jean Baptiste Louis Franquelin complied, but the map he gave the king was executed at a scale too small to provide a precise description of territory. At the time, detailed surveys of frontier zones were quite rare. Nonetheless, Franquelin benefited from some sketches carried out on the margins of the empire: a map of the Hudson Bay, 1687, by Pierre Allemand, a member of the expedition that attacked the English outposts (Paris, Bibliothèque nationale de France, Cartes et plans, Ge SH 18 PF 124 DIV 1 P 1) and a sketch of Iroquois territory, ca. 1687, probably linked to the military campaign led by Governor

Jacques-René de Brisay de Denonville against the Tsonnontouans (Senecas) (see fig. 825); a general map and particular plans of Acadia, 1686, produced at the time of an expedition by the *intendant* Jacques de Meulles in that region (Boucher 2007). In a *mémoire* submitted to the king, Franquelin ([1688–89]) emphasized the importance of mapping the frontiers of New France, especially around Hudson Bay, a region recently settled by English merchants. Louis XIV reacted by ordering the cartographer to "draw borders, erect boundary markers, and display our arms wherever necessary" (Louis XIV [1689]). Unfortunately, the outbreak of war, followed by a series of unfortunate events, prevented the realization of these efforts (Palomino 2017).

About twenty years later, the Treaty of Utrecht (1713) modified the frontiers. France lost important parts of its empire: Hudson Bay, Newfoundland, and Acadia. However, the fact that the exact boundaries of these territories were still not fixed caused many problems. For example, there was disagreement over the exact definition of the "former boundaries" of Acadia mentioned in the treaty. The British, on the one hand, maintained that these extended north to the Saint Lawrence River and west to the Penobscot River. Their territorial ambitions received support from various official documents, including the grant of a concession by King James I to William Alexander, earl of Stirling, in 1621 (Litalien 2007, 170). The French contested this definition, reducing Acadia to the Atlantic coast of present-day Nova Scotia and the territory of Port Royal. After the Treaty of Aix-la-Chapelle (1748) was signed, commissioners were named to resolve the matter once and for all. Several maps of Acadia were brought into the discussion as evidence, some of which already existed, such as that of the Jesuit Joseph Aubery (1713), and some which were produced to defend French interests, notably those by Gaspard-Joseph Chaussegros de Léry, *fils* (1751) and by the missionary Jean-Louis Le Loutre (1752). Extremely active both in the field and behind the scenes, Le Loutre even indicated which territories should be conceded and which retained by the negotiations.

By midcentury, the Ohio River Valley emerged as another point of contention. The English presence in Virginia and Pennsylvania threatened this strategic communications water route from the Great Lakes to the Mississippi. In 1749 the French governor, Roland-Michel Barrin de La Galissonnière, sent an armed detachment to guarantee military control of the region. Joseph-Pierre de Bonnécamps, SJ, joined the troops in order to map precisely the course of the Ohio River using astronomical observations (fig. 109). On the resulting map, he carefully indicated the place where his team had buried engraved pieces of lead marking the territory as French property (Palomino 2009, 94–95). Cartog-

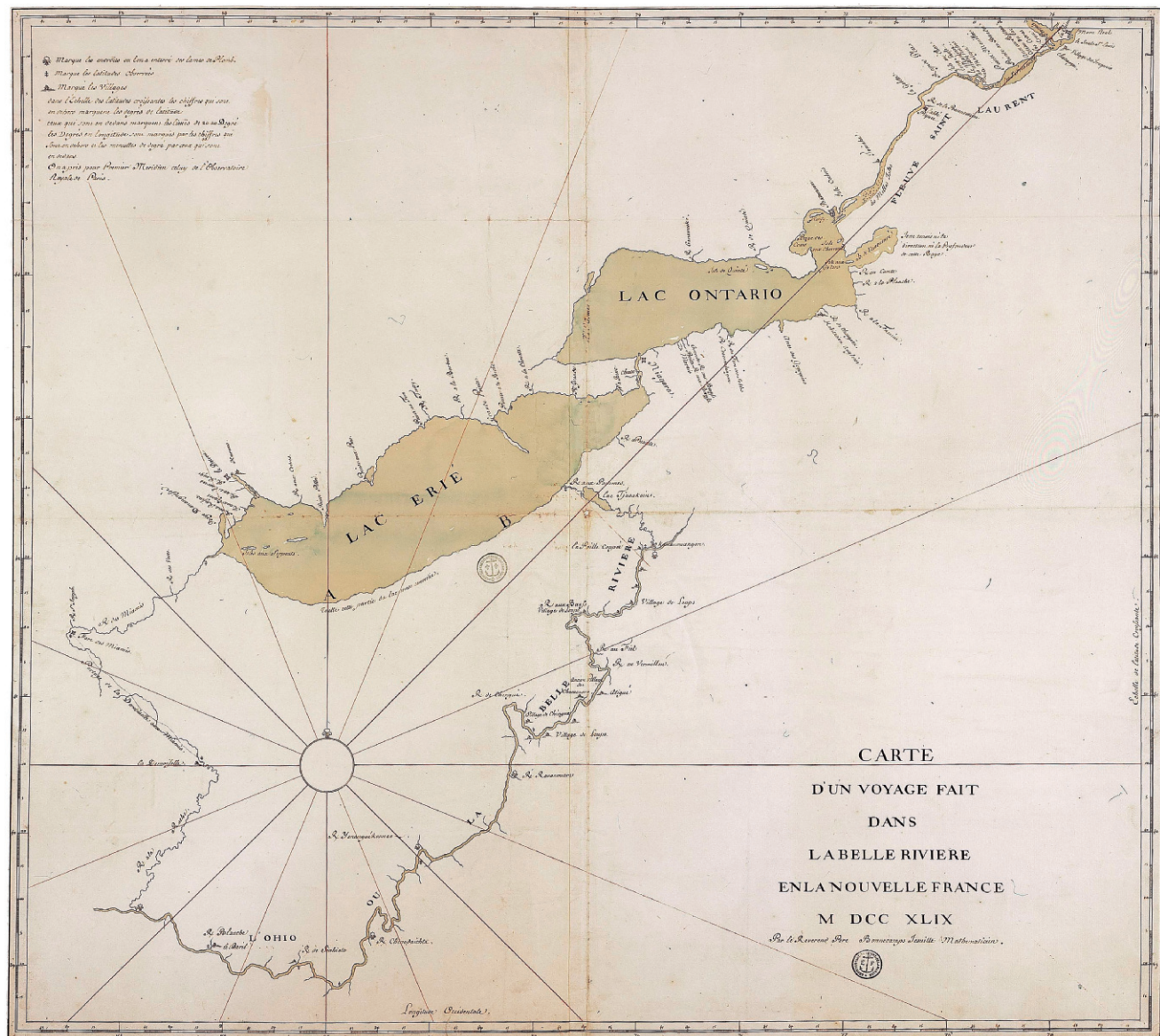


FIG. 109. JOSEPH-PIERRE DE BONNÉCAMPS, “CARTE D’UN VOYAGE FAIT DANS LA BELLE RIVIERE EN LA NOUVELLE FRANCE,” 1749. Pen, ink, and watercolor on paper; ca. 1:1,000,000.

Size of the original: 80 × 90 cm. © Service historique de la Défense, Vincennes (MV/71/67-21).

raphers also attended to other frontier areas, including the water routes linking Canada to the English colonies through Lake Champlain and the Hudson River. This route was examined and mapped by the aforementioned Chaussegros de Léry in 1743.

These surveys in response to treaty negotiations in the early 1750s precipitated an avalanche of maps rolling into the office of the *ministre de la Marine*, Antoine-Louis Rouillé, comte de Jouy. The documents “left no doubt regarding the possession of the Ohio and all the

ivers that run into the Mississippi on its left side. . . . All these maps placed the boundaries of English possessions at the summit of the Appalachian Mountains” (La Galissonnière 1755).

Even though the question of frontiers preoccupied French authorities, it was never possible for them to clearly define the borders of New France. The empire was immense, and differences between viewpoints of English and French authorities were too great, not to mention the claims of the Amerindians. For years peace-

ful coexistence had been possible, despite the vagueness of the law concerning the issue. Then, by the middle of the eighteenth century, with an increasing shortage of unoccupied space, frontier quarrels became too frequent. With no diplomatic solution possible, the Seven Years' War (1756–63) was fateful for New France, resolving the issues of boundaries entirely. The territory, with exception of the islands of Saint-Pierre and Miquelon, was lost.

JEAN-FRANÇOIS PALOMINO

SEE ALSO: New France; Topographical Surveying; New France; Utrecht, Treaty of (1713)

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Boundary Surveying in the French West Indies. During the period covered in this volume, rivalries among the Europeans in the West Indies caused the partition of certain islands, including Saint-Christophe (Saint Kitts), which France had to cede to England in 1713; Saint-Martin (Sint Maarten), still divided today between France and

the Netherlands; and Saint-Domingue (Haiti), where the treaty establishing the Franco-Spanish border in 1776 was based on a large-scale topographic map. The mapping of the Saint-Domingue border serves as an exemplar for the other islands.

Beginning in 1640, the French settled the western part of the island, previously a Spanish colony. The Treaty of Nijmegen (1678) recognized the French colony, but because of the very imprecise border, incidents, sometimes violent, continued until the rapprochement of the Pacte de Famille in 1761 that more or less stabilized the border. Following the Massacre (Dajabón) River south, the border turned west near Mont-Organisé and followed the heights of land along the left bank of the Grande Rivière du Nord, then turned southwest near Marmelade and, rejoining the Cahos range north of Dessalines, it turned and ran southeast along that range, north of the Artibonite Valley, to reach the Etang Saumâtre from whose southeast shore it crossed the mountains to follow the Anses-à-Pitre (Pedernales) River. Simply marked by guard posts at the main crossing points, it remained controversial in several places. The borderline was confirmed at the end of long and difficult negotiations (1771–76), largely conducted by the governors of the two colonies, Pierre Gédéon, comte de Nolivos, followed by Victor-Thérèse Charpentier d'Ennery, for France, and for Spain José Solano, who had previously established the boundary between Brazil and New Castile, in the upper valley of the Orinoco River.

The Atalaye treaty, signed by d'Ennery and Solano on 29 February 1776 and ratified on 3 June 1777 in Aranjuez, stipulated that the border be punctuated by pyramid-shaped markers "numbered and located by means of a compass" and described in a topographic map accompanied by a *procès-verbal* to be prepared under the supervision of one French and one Spanish commissioner (Glénisson 2006, 84). Two copies were to be sent to Madrid and Versailles, and two copies kept in Port-au-Prince and Santo Domingo. Moreover, each governor had to name a general border inspector to "ensure the compliance with this border treaty and the tranquility of the border," with the death penalty threatening anyone who moved the markers (quoted in Glénisson 2006, 84).

In August 1776, the map and the *procès-verbal* were completed and sent to Versailles. The map, in nine sheets on a scale of 1:14,400 (fig. 110), was drawn by a French military *ingénieur géographe*, Jean-Pierre Calon de Felcourt, who had previously worked on the *Carte de France* before collaborating on the topographical map of Saint-Domingue of the later 1760s, a colony for which he continued to work as engineer. Having surveyed the boundary without a Spanish counterpart, Calon de Felcourt's map indicated the location of the

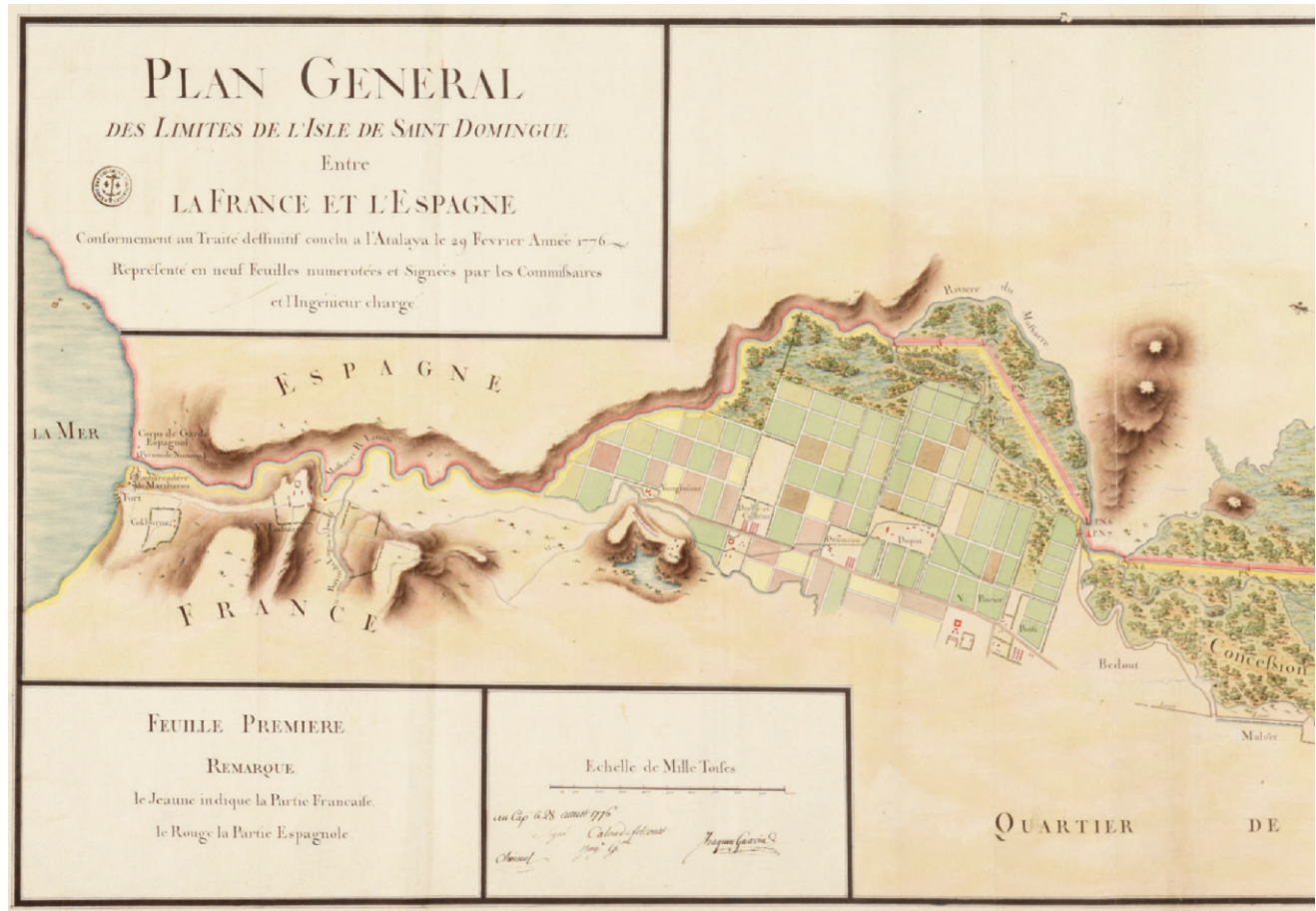


FIG. 110. DETAIL FROM SHEET ONE OF THE “PLAN GENERAL DES LIMITES DE L’ISLE DE SAINT DOMINGUE ENTRE LA FRANCE ET L’ESPAGNE,” BY JEAN-PIERRE CALON DE FELCOURT, 1776. The estuary of the Massacre River and the Petit Islet is shown, divided by the border, yellow for France and red for Spain. The boundary markers, in shape of pyramids, are shown on this sheet in red triangles noted by a

“P” (for *pyramide*) and their number. On the other sheets, they are represented by a triangle and the note “Bne” (for *borne*, boundary marker) followed by the number. Scale: 1:14,400. Size of sheet one: ca. 55 × 246 cm; size of detail: ca. 55 × 79 cm. Image courtesy of the Bibliothèque nationale de France, Paris (Cartes et plans, SH pf 147 pièce 1).

markers and described a short width of the terrain on both sides of the border, but the work was not based on triangulation. Because of the difficulty of manipulating the large-scale map, sheets at a smaller scale were prepared (ca. 1:88,000, 1:250,000, and ca. 1:750,000). The map was not a complete success: as early as 1777, the *secrétaire d’État à la Marine*, Antoine de Sartine, noted several inaccuracies, which he pointed out to Hyacinthe-Louis, vicomte de Choiseul, who seems to have neglected to have the chief engineer on the island, Nicolas Taverne de Boisforêt, verify the boundary, an omission from which Choiseul may have profited. However, the accompanying “Procès-verbal des limites de Saint-Domingue” (La Courneuve, Archives du Ministère des Affaires étrangères, service des traités) written in

French and Spanish, described precisely the border and placement of the markers in easily spotted locations, according to the terms of the treaty. Some were engraved directly on rocks while in the dense forest of the south, simple markers were indicated on big trees (Glénisson 2006, 86).

Provisionally ignored while the island was unified (1801–2, then 1822–44), the physical border remained in place until 1936, when a new treaty annexed the central basin to the Republic of Haiti. It is difficult to know whether the map and the *procès-verbal* describing the 1776 boundary were used in the later boundary disputes or were entirely forgotten. More likely the new border recognized the situation resulting from the continuous and spontaneous expansion of the numerous Haitian

small farmers seeking new lands in the nearly uninhabited central basin during the nineteenth and early twentieth centuries.

JEAN-LOUIS GLÉNISSON

SEE ALSO: French West Indies; Topographical Surveying: French West Indies

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Boundary Surveying in British America. The earliest political boundaries drawn on North American maps were proclaimed by one or another of Europe's great powers in the absence of surveyed lines, monuments, or accurate maps to guide their choice. Formulated as they were in Europe's royal council chambers, the claims were easily exaggerated and the documents describing them were verbose, with often strikingly unclear language. Furthermore, early grants were overlapped by later grants (see fig. 303) and actual colonial settlement did not always align neatly with the imperial territorial vision. Disputes over intercolonial boundaries were accordingly a chronic feature of local politics in British America, and their demarcation a subject of literary remark (Byrd 2013). Yet, bound up as they were in local conditions, the only point of similarity between the many disputes was their referral to the imperial authorities in London for adjudication.

Initial decrees of the boundaries for colonies featured parallels of latitude running from the Atlantic shoreline westward to the uncharted interior and the western sea beyond. Typical of these was the charter King James I granted to the Virginia Company of London in 1606. It granted liberty to found Virginia's first settlement anywhere on the coast "in some fit and convenient Place, between four and thirty and one and forty Degrees of the said Latitude." In the same year, another grant permitted the Virginia Company of Plymouth to settle on the coast anywhere "between eight and thirty Degrees and five and forty Degrees," thus creating a three-degree overlap (Thorpe 1909, 7:3783). Nor were things improved in 1609, when the so-called second charter was granted describing Virginia's bounds as beginning at Point Comfort and running "all along the Sea Coast to the Northward, two hundred miles" and the same distance along the coast to the south; toward the interior, Virginia was confusingly described as extending from "Sea to Sea, West and Northwest" (Van Zandt 1976, 92).

Colonial charters could also designate rivers as bounding the territories granted. The Potomac River was chosen to divide the Maryland of Cecil Calvert, second baron Baltimore, from Virginia in 1632. Disputes concerning this riverine boundary continue to the present day (De Vorse 2004). Even the ill-defined watershed of the Appalachian Mountains was proclaimed in 1763 as dividing eastern North America between its Indians and the colonial settlers (De Vorse 1966, 34; Edelson 2017, 141–95). As the land was explored and settled, such proclaimed boundaries soon proved too vague and produced seemingly endless boundary disputes. It was through the many attempts to solve these disputes that boundary surveying developed in North America.

The surveying of relatively short political boundaries posed no great problem once delegated boundary commissioners from each neighboring jurisdiction came to agreement on where the line should run. The familiar tools and techniques of the land surveyor, based on the assumption that the landscape was essentially a plane surface, were employed to demarcate a line's course through field and forest. Directions were found with a magnetic compass corrected to true north by the application of local declination. Declination, the local difference between true and compass north, was determined by relatively simple astronomical techniques. Distances were found by means of the sixty-six-foot Gunter's chain. Trees were blazed and marked, and stakes, rocks, cairns, or carved stones were placed to demarcate the surveyed lines on the landscape; maps were prepared to record the location of the monuments (fig. 111). In the process, the surveyors kept careful record of the nature of the landscape through which the boundary passed (see fig. 194).

When lines of latitude or positions of longitude were concerned, however, more sophisticated astronomical techniques were called for. A parallel of latitude, although often appearing straight on maps, in reality forms a subtly curving line on the earth's spherical surface. Latitude was determined by finding the angular altitude of the sun at local noon or the angle of Polaris above the horizon when visible. For accurate determination, both these methods required training in astronomy and the use of instruments not always available on the frontier. Longitude determination was even more demanding.

The persistence and technical complexity of boundary disputes is evident from the example of Charles II's 1681 grant of Pennsylvania to William Penn, which required both the accurate determination of longitude and latitude as well as the arc of a circle "drawne at twelve miles distance from *New Castle*" (Thorpe 1909, 5:3036; Van Zandt 1976, 80). It was not until 1732 that Penn's heirs and Charles Calvert, third baron Baltimore, were able



FIG. 112. CLOSE ATTENTION TO THE LANDSCAPE THROUGH WHICH A BOUNDARY RUNS. Detail of the western end of a published version of Charles Mason and Jeremiah Dixon's plan of the Pennsylvania-Maryland boundary, *A Plan of the West Line or Parallel of Latitude, which Is the Boundary between the Provinces of Maryland and Pennsylvania*

(1768). Note the indication of five-mile increments between monuments.

Size of the entire original: 65 × 185 cm; size of detail: ca. 5 × 22 cm. Image courtesy of the Geography and Map Division, Library of Congress, Washington, D.C. (G3841.F7 1768.M3).

in a number of published maps. The century-and-a-half it took for this one boundary to be delineated was not unusual; other boundary disputes lingered for as long (see, e.g., Schwarz 1979).

LOUIS DE VORSEY

SEE ALSO: British America; Mason-Dixon Line

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Boundary Surveying in the Italian States. The legal and political problems "relating to the identification and preservation of frontiers or boundaries are closely

bound up with the emergence and formation of the modern state" (Mongiano 2002, 165; Stopani 2008, 1–27). From the sixteenth century onward, special offices were created to deal with such matters, and by the second half of that century, small- or medium-scale maps—in particular, those in the large atlases printed in Italy and elsewhere in Europe—were beginning to depict state boundaries, even if imprecisely. In the seventeenth and eighteenth centuries, exceptions to this cartographic approximation started to appear: original works, most of geometric construction, that incorporated reasonably accurate national and intranational boundaries. Seventeenth-century examples include the innovative *Carta generale de stati di sua altezza reale* (1680, ca. 1:190,000), by the Savoy engineer Giovanni Tommaso Borgonio (see fig. 108) (Serenio 2007, 851–52), and the *Mappa geografica esattissima delle Provincie del Tortonese, Pauese, Alessandrino* (ca. 1680) and *Carta de la Rivera dei Genova con sus verdaderos confines y caminos* (1685), both by the military engineer José Chafrion (Quaini 1994; 2007, 863).

Some of the printed works of the eighteenth century improved markedly on those produced in the previous century in their rendition of state boundaries and constitute veritable landmarks in the cartography of Italy, even if they were prepared for purposes other than the demarcation of boundaries: the map of the Papal States (*Nuova carta geografica dello Stato Ecclesiastico*) by Christopher Maire from his and Ruggiero Giuseppe Boscovich's survey (1755) (Mangani 2001, 366; see fig. 90); the map of the Legazione di Urbino, also by Maire (1757) (Mangani and Mariano 1998, 194–95); the *Atlante geografico del Regno di Napoli* (31 sheets) by Giovanni Antonio Rizzi Zannoni (published 1788–1812; see fig. 270) (Valerio 1993, 121–217); the *Carta topografica dello Stato di Milano secondo la misura censuaria* (1777, ca. 1:135,000) designed by Carlo Galeazzi

and engraved by Giovanni Ramis, a product of the geometrically based cadastre ordered by Maria Theresa but not particularly accurate in its account of border areas (Signori 1990, 42–44); the map of Lombardy prepared by the astronomers of the Brera Observatory from 1783–96, published as *Carta topografica del Milanese e Mantovano eseguita dietro le più esatte dimensioni geografiche ed osservazioni astronomiche* (1804–7, ca. 1:86,400; see figs. 269 and 306) (Signori 1990, 44–45; Cantile 2007, 110); and the “Carta geografica del Granducato di Toscana” by Ferdinando Morozzi (1784), which remained in manuscript (Rombai 1993, 149–55).

In spite of the rich production of large-scale topographical maps that often focused on representing the boundary lines between states or between the different provinces and communes within a state, many maps that were prepared during the late seventeenth and eighteenth centuries remained in manuscript, kept as secret documents in the offices of the state institutions that ordered and used them. These large-scale boundary documents responded to conflicts over borders within a state or, more likely, between different states, usually arising from disputes over the exploitation of the natural resources (pastureland, woods, waterways) that lay in border areas. When official treaties and agreements stipulated boundaries at the end of the eighteenth and beginning of the nineteenth century, many of these boundaries neither existed in codified legal form nor were they easily recognizable on the ground. Contributing to inaccuracies was the general practice of hasty—often clandestine—surveys carried out in enemy territory well into the eighteenth century. Nevertheless, within Italy the cartography of boundaries was an indispensable instrument of government, important both to respond to contingent events and to prepare and negotiate international agreements. Work on these matters involved state functionaries, topographers, and local officials.

In seventeenth-century Liguria the manuscript atlas prepared in 1650–55 by Pier Maria Gropallo was the first systematic survey of boundaries dividing the Genoese Republic from the Duchy of Savoy and a number of fiefdoms (Genoa, Archivio di Stato [AS], Manoscritti, 39, atlante A) (Quaini 1983, 33; Bislenghi 2001, 145). In the following century, the 1757 “Valle di Pieve di Teco” (Genoa, AS, Raccolta cartografica, B. D., 13) by Giuseppe Maria Sibilla fixed the locations of areas of woodland and pasture that were subject to dispute between various communities (Quaini 1986b, 99–100). Matteo Vinzoni produced his excellent maps of the borders between Genoese and Tuscan territory in the 1711 “Carta della Selva della Pertegara” (Genoa, AS, Archivio Segreto, Confinium, 190) (Quaini 1994, fig. 22) and the 1714 “Carta de boschi di Gambatacca di Pontremoli e di Suvera” (Genoa, AS, Raccolta cartografica, busta 19,

n. 1120) (Quaini 1986a, 98–99, 102, 104). Vinzoni also created a geometrical model of the areas around Monte Gottero in Lunigiana in 1743–44, which incorporated both perspective views and planimetric rendering, in collaboration with Giovanni Maria Veraci and Antonio Falleri, two engineers from the Grand Duchy (Rossi 2001, 442, 449–51) (fig. 113).

From the beginning of the eighteenth century, as a result of the numerous treaties stipulated with its neighbors, Piedmont saw the production of official maps of the state’s borders with both France and the Genoa Republic (Sereno 2002, 69). Right up to the period of French occupation, these activities continued not only along the French and Genoese borders but also along those of Austrian Lombardy, Swiss Valais, the Duchy of Parma and Piacenza, and the fiefdom of Montferat to resolve disputes or to regulate commercial traffic and combat smuggling. Examples of these works include the maps of the borders between Kingdom of Sardinia and Parma by F. Tocchi (1748) and by Antoine Durieu (1765) (Turin, AS, Corte, Paesi, Confini con il Piacentino, Carte topografiche, m. 1, n. 1 and n. 5, respectively) (Comba and Sereno 2002, 2:106–8, pls. 63, 66); Giuseppe Ignazio Bertola and Bernardo Pessina’s 1751 map of the border between Kingdom of Sardinia and Lombardy along the course of the Ticino (“Tippo originale vistato dal Signor Bertola e dal Signor Conte Cristiani,” Turin, AS, Corte, Materie politiche, Trattati diversi, m. 29, n. 6); the maps used for the 1760 treaty between the Kingdom of Sardinia and France, which relied on the best cartographic accounts available; Durieu’s espionage map of the area of Great Saint Bernard pass 1756 (“Plan topographique, en mesure, des montagnes aux environs du monastère hôpital du grand St. Bernard,” Turin, AS, Corte, Paesi, Duché d’Aoste, Contestations avec le Valley, cat. II, m. 1, n. 5/2) (Comba and Sereno 2002, 2:101–2, pl. 59). Particularly noteworthy is the “Carta della riviera di ponente di Genova” (1746–47, Turin, AS, Carte topografiche segrete, A, 15, nero), based on geometrical surveys carried out by Savoy engineers during the War of the Austrian Succession. Various official maps were created from the mid-eighteenth century onward to resolve disputes between Piedmont and Genoa, works that still employed, in part, pictorial renditions of terrain (Mongiano 2002, 170–74; Bislenghi 2001, 143–55).

The Grand Duchy of Tuscany bordered on seven different states and various fiefdoms. From 1560 its Florentine office, the Nove conservatori del dominio e della giurisdizione, was responsible for overseeing the definition of state boundaries. From 1691 onward, those Nove conservatori employed their own engineer. In 1769 responsibility for borders passed to the Camera delle comunità, luoghi pii, strade e fiumi. Tuscan state



FIG. 113. "PARTE DEL TIPO GEOMETRICO FATTO SOTTO DI XXIII NOVEMBRE MDCCXXXIV E SOTTOSCRITTO DA DVE INGEGNERI, TOSCANO E GENOVESE." The map was copied in 1780 by Donato Maria Fini from the original map of 1744 prepared by Matteo Vinzoni and signed by him and Giovanni Maria Veraci. It shows the mountainous frontier between the Republic of Genoa and the Grand Duchy of Tuscany in the region of Monte Gottero between Levanto and Pontremoli in Lunigiana. It was prepared in order to settle a

centuries old dispute between the two states and concerning the presence of a road traveled by smugglers. Drawn on paper in ink and watercolor, ca. 1:5,700. The 1744 original is in the Archives nationales (France) (Cartes et plans, N II Apennins 1). Size of the original: ca. 52 × 73 cm. Image courtesy of the Archivio di Stato, Florence (Miscellanea di Piante, n. 77). By concession of the Ministero dei Beni e delle Attività Culturali e del Turismo.

boundaries generated immense cartographic production; by itself, the collection entitled *Confini* (Florence, AS) comprises around one thousand images produced from the sixteenth century to 1859. Examples include many maps of the boundaries between the Grand Duchy and the Principality of Piombino in Maremma prepared by the engineers Alessandro Nini and Giacomo Benassi from on-site surveys for the treaty between the two states in 1780–83 regarding control over the river resources that served the steel works of Follonica (Florence, AS, *Miscellanea di Piante*; Grosseto, AS, *Ufficio dei Fossi*) (Rombai, Toccafondi, and Vivoli 1987, 379–88; Rombai 1993). Other manuscripts account for

the border with the Papal States in Val di Chiana, including those prepared by Salvatore Piccioli and Antonio Capretti under the direction of the mathematicians Pietro Ferroni (for Tuscany) and Pio Fantoni (for the Papal States). Subsequently engraved by Cosimo Zocchi (1788) as an illustration of the 1780 *Concordato* between the two states, these maps—designed planimetrically—give a detailed account of the southern part of the valley, historically the scene of fierce disputes resulting from the adverse side effects of land reclamation and consolidation implemented by both governments (Guarducci 2005, 79).

The Republic of Lucca also had its own *Offizio so-*

pra le Differenze dei Confini, active from the sixteenth century to 1804, which employed numerous technicians. The borders of the Republic with the Grand Duchy of Tuscany and the Duchy of Modena—in Garfagnana, Lunigiana, and Massa-Carrara—attracted a sizeable body of cartography (Lucca, AS), such as Francesco Maria Butori's 1798 "Nelle marine di Viareggio," which gives a precise account of the area, showing the border between the Lucca territory of Versilia and territories of Pisa and the Grand Duchy (Lucca, AS, Acque e Strade, 737).

In southern Italy, noteworthy works defined the borders between the Papal States and the Kingdom of Naples, for the purposes of overseeing natural resources and repressing the brigandage that exploited the uncertain demarcation lines between state jurisdictions. An early example is the detailed topographical map with eleven partial drawings of the territory of Teramo, produced in 1684 by the engineer Carlo Antonio Biancone: "Situación de la Montaña de Roseto: délas Valles de San Juan y Castellana con sus confines en la Provincia de Abruzo ultra Año 1684" (Simancas, Archivo General, Mapas, planos y dibujos, t. I) (D'Ascenzo 2006, 335–42). Subsequent works include a map showing the borders as agreed in 1750: "Ritratto, seu pianta delli confini fra la Rg^a Terra d'Acvmoli, Tr^a e Conf^{no} di Norcia" (Naples, Raccolta piante e disegni, cart. XXXI, n. 10); its boundary lines are figured in Giannandrea Giardini and Feliceantonio Iafolla's 1785 "Pianta della controversia de Confini fra lo Stato di Accumoli per parte del Regno di Napoli, e di Norcia per parte dello Stato Pontificio" (Naples, AS, Archivio Farnesiano, b. 1120/I, c. 54) (Martullo Arpago et al. 1987, 24, 34). In the 1780s and 1790s, the two states tackled further problems of border definition by setting up a joint commission under Alessandro Ricci and Giovanni Antonio Rizzi Zannoni. Among other works, the commission produced a map of border between Cappadocia and Dogana Colonna (in Naples kingdom) and Feudo Valle Pietra (in the Papal States), 1786 (Naples, AS, Ministero Affari Esteri, fs. 4556, inc. XIII), in which pictorial renditions give a clear depiction of the disputed woodlands (Martullo Arpago et al. 1987, 38). Tommaso Zampi also prepared many large-scale maps (ca. 1:48,000) of specific territorial areas (e.g., Tivoli, Velletri, Cerveteri, Albano, Marino, Frascati) between 1793–98 (Naples, AS, Affari Esteri, vol. 4559; Naples, Biblioteca Nazionale Centrale, b. 4 a; Florence, Istituto Geografico Militare, cartoteca 71/12) (Valerio 1993, 654–55).

Many maps of borders and boundaries fall within the category of judicial assessment, that is, they were prepared by publicly appointed officials to resolve disputes between private individuals or between individuals and fiefdoms or public bodies. In the Kingdom of Naples, for example, the dispute between the princes of Torella and

Melfi in Basilicata resulted in a map prepared by Gabriele Preziosi and Tommaso Pinto in 1750 ("Pianta de' luoghi controvertiti tra il Sig.^r Principe di Torella ed il Sig.^r Principe di Melfi nelle loro rispettive terre di Atella e S. Fele in Provincia di Basilicata," 1:23,000) (Potenza, AS, Intendenza di Basilicata, b. 561, fasc. 121) (Angelini 1987, 122–24).

A military aspect to boundary surveying may be seen in maps depicting theaters of war (sea and land battles or the sieges of fortified cities), which had existed from the sixteenth and seventeenth centuries. These printed maps generally adopted a pictorial language well suited to their function as illustrations; their relationship to boundary cartography becomes all the closer in the eighteenth century, when the presence of military engineer-topographers in armies meant that such cartographic accounts of theaters of battle took on a higher degree of technical expertise. Such maps often could represent boundaries before, during, and/or after conflicts. The representation of change over time demonstrates the importance of boundaries in war.

There were also topographical works, such as the "Carta topografica militare dalle sponde del mare, da Ventimiglia sino a Demonte" of the Ligurian-French coast by L. Bergalli and Giovanni Maria di Monthoux in 1795 (Turin, AS, Corte, Carte topografiche segrete, Ventimiglia 22 Bis A VII rosso) (Comba and Sereno 2002, 2:124–25, pl. 76) and the "Carte militaire du Col de Tende," by Pietro Antonio Audé in 1796 (Comba and Sereno 2002, 2:115–16, pl. 70) (fig. 114).

One final category of boundary maps includes those that depict the cordon sanitaire between various states. Generally in manuscript but sometimes engraved and published, they were primarily produced in Italy from the 1720s to 1750s and were intended to prevent the transit of men, animals, or goods that might transmit pestilence and epidemics from one state to another. Examples include the "Topografia de' territorij di Cividale, di Monfalcone e Basso Piano del Friuli" of the border between Austria and Friuli, prepared in 1739 by Faustino Brascuglia at the order of the Magistrato della Sanità in Venice (Venice, AS, Senato, Provveditori da terra e da mare, b. 903, dis. 2.) (Milanesi 1990, 141); a 1745 map drawn and engraved by Antonio Bova of the cordon sanitaire placed around Messina and northeast Sicily during the plague epidemic of 1743 (*Pianta del cordon esteriore e interiore*) (Ioli Gigante 2001, 278–79); the map of the Tuscan coast and its defensive towers that was first drawn up in response to the 1743 Messina plague and subsequently redrawn and updated in 1754 by Pier Giovanni Fabbroni ("Pianta della costa del mare toscano," Florence, AS, Miscellanea di Piante, 5/20, 258) (Bertuccelli Migliorini and Caccia 2006, 176–77, 204); and the "Piano dimostrativo della marina di Lecce e



FIG. 114. “CARTE MILITAIRE DU COL DE TENDE,” 1796, BY PIETRO ANTONIO AUDÉ. An example of a representation of a theater of war map on which the border area (the Maritime Alps) is presented with precision and detail. Drawn in ink and watercolor on paper, colored, no scale given.

Size of the original: 52.5 × 65.3 cm. Image courtesy of the Archivio di Stato, Turin (Corte, Carte Topografiche segrete, Tenda 22 A V rosso).

del suo cordone marittimo,” drawn and watercolored in 1743 by Agustin de Bargas Machuco (Naples, AS, Segreteria di Stato d’Azienda, fs. 253, fascic. 20). This last work renders the entire territory of Lecce (with the Salento Peninsula) in coastal views as perceived from the sea, with indications of the cordon sanitaire and the surveillance outposts set in place in response to an outbreak of the plague in the Levant (Polto 2006, 83).

A unique work among the cordon sanitaire maps is the extraordinary manuscript collection “Pianta delle due riviere della Serenis.^{sima} Rep. di Genova divise ne’ Commissariati di Sanità,” prepared by Matteo Vinzoni from 1720 to 1758 after the outbreak of plague in Marseilles. Employing refined perspective and plani-

metric renderings based on measurements taken both on land and at sea, the thirty-six watercolored sheets (and seventy-two maps with descriptive data) show the whole of the coast of Liguria, with the exact location of settlements, harbors, and health facilities, as well as a delineation of both external and internal boundaries (Quaini 1983, 9–10, 42–50) (fig. 115).

In the second half of the eighteenth century, various states undertook the reorganization of the administrative framework of provinces, towns, and religious establishments and began to create cartographic collections and to order regional maps to indicate borders and boundaries. In the vanguard was the Grand Duchy of Tuscany, evidenced by the sizeable number of maps



FIG. 115. “COMMISSARIATO DELLA SANITÀ DI LEVANTO,” BY MATTEO VINZONI. The map represents the territory of Levanto and is part of a collection created by Vinzoni from 1720 to 1758 after the onset of plague in Marseilles, on orders from the state to represent the entire Ligurian coast

from the border of Savoy to that of Tuscany. Drawn in ink and watercolor on paper, 1:10,000.

Size of the original: 42.5 × 28.0 cm. Image courtesy of the Biblioteca Civica Berio, Genoa (Manoscritti, cf. 2.8, cc. 206–207).

generated for administrative purposes. The complete collections produced by Ferdinando Morozzi, Antonio Giachi, and Francesco Giachi (Florence, AS, vari fondi; Prague, Národní Archive, Rodinný Archiv Toskánských Habsburk [NA, RAT]; Siena, AS, Comune di Colle di Val d’Elsa, Carte Topografiche Morozzi) comprise both partial maps and such general overall works as Antonio Giachi’s 1766 “Pianta dello Stato Senese” (Florence, AS, Reggenza, n. 675, ins. 2) (Rombai 1993, 116–23; Guarducci 2008).

ANNA GUARDUCCI

SEE ALSO: Italian States

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Boundary Surveying in the Ottoman Empire. The Ottoman Empire expanded over a vast area stretching from Europe to Asia and Africa; its international boundaries were determined at relatively irregular intervals in accordance with cadastral land surveys held within the imperial territories. During the seventeenth and eighteenth centuries, the boundaries along the western and northern parts of the empire required territorial adjustments, where Ottoman lands bordered Venetian, Habsburg, Polish, and Russian lands. By contrast, the eastern boundaries with the Safavid Empire enjoyed relative stability based on the current position of settled areas. However, the southern and southwestern boundaries of the empire, namely the imperial territories covering North Africa and the Arabian Peninsula, remained largely unidentified because of the geographical peculiarities of those regions and the absence of an established political body with whom to negotiate official boundaries.

In Ottoman terminology the demarcation process was known as *kat'-i hudūd ve temyīz-i sinur*, "cutting of the boundary and separating the frontier." For this task the central administration appointed a commission that was headed by a *muḥaddid* (borderer) chosen from among high-ranking military personnel; although he carried a military title, he indeed performed civil duties. The number of borderers assigned to work on boundary surveying varied according to the significance and size of the territory to be surveyed. In fact, when the Ottoman administration had to negotiate with a single counterpart concerning multiple regions simultaneously, it dispatched at least one borderer or his deputy to each zone. After the imperial decree to survey a boundary was issued, the commission departed from Istanbul with official ceremonies. The boundary commission included a border expert (*sinur mollası/mevlāstī*) who was customarily a member of the *'ulemā* (scholar) class and who added the legal verification to the document prepared and signed by the borderer. Among the other members of the commission were dragomans and engineers. Although there is no mention of mapmakers in Ottoman boundary commissions, it is apparent that some engineers who participated in such missions were able to draft maps.

After the two sides had reached mutual agreement, a *ḥudūd-nāme-i ḥümāyūn* was signed by both parties and contained all the relevant details concerning the new border. It is possible to find examples of these documents in Ottoman archives, chiefly among the *nāme-i ḥümāyūn*, *düvel-i ecnebiye*, and *āmedī* registers. The



FIG. 116. “DEVLET-İ ‘ALİYYE HÜKMÜNDE OLAN YERLER VE MOSKOV VE NEMÇE’NİN ETRÂFLARINDA OLAN HÜDÜD VE SINUR-I İSLÂMÎYYE RESMÎDİR,” CA. 1201/1787–88. Anonymous manuscript map on cloth of

Ottoman lands and Ottoman borders with the Austro-Hungarian and Russian Empires.

Size of the original: 48.0 × 27.5 cm. Image courtesy of Topkapı Sarayı Müzesi Kütüphanesi, Istanbul (A 3623).

boundary treaties were drafted in the languages of both parties and exchanged between the two sides after they had been ratified by their signatories. Thus, the Ottoman documents concerning the status of the border, signed by the borderer and the representative of *‘ulemā*, were traded for the documents bearing the seals of the counterpart general and the engineer in charge. On some occasions, the Western counterpart also made a Turkish translation of the original treaty and submitted the translated document, which was elegantly embellished, to the Ottoman court. In case of a disagreement or appeal, the viceroys, governors, and *qādīs* (judges) who functioned at places near the frontier were authorized to publish various documents (*temessük*, *hüccet*, *‘arż*, *ķā’ime*) that revealed the status and prevailing circumstances along the border at that time.

During the seventeenth and eighteenth centuries, geographical features served as basic criteria for boundary determination. At this time military and political boundaries were determined by the Ottoman state, since there was no clear reference to any kind of commercial trade boundary. In practice, instead of surveying the frontier from one end to the other, it was more common to take

a defined piece of land whose overall length in terms of time (i.e., hours required by engineers to traverse) was calculated by the engineers sent by the relevant parties. Natural barriers such as islands, mountains, hills, rivers, lakes, valleys, forests, and deserts and settled areas like villages, towns, castles, ports, and *palankas* (wooden forts) determined to a great extent what was to be regarded as the foreign boundary. According to the Treaty of Bakhchisarai (1678), the Dnieper (Özi) River marked the boundary between the Ottoman lands and Russia; in 1680, certain villages along the Podolian frontier functioned as markers; in 1699, some fortresses served to mark the Venetian frontier and in 1774 the Russian border; finally, in 1792 the Dniester (Turla) River served as the Russian border. Ottoman boundary treaties in which the borderline was mostly delineated in harmony with the apparent location of fortresses rested heavily upon the *‘alā ḥālihi (uti possidetis*, as you possess) principle.

In Ottoman boundary treaties the border was depicted in accordance with the neighboring settlements, which were indicated by name in the text. To describe the border area, the Ottoman surveyor expressed the



FIG. 117. “LEHİSTÂN HÜDÜDU HARİTASI BY ENDE-RÜNLU RESSÂM MUŞTAFÂ,” CA. 1187/1773–74. Manuscript map drafted on silk cloth. The map of the Ottoman-Polish border.

Size of the original: 66 × 92 cm. Image courtesy of Topkapı Sarayı Müzesi Kütüphanesi, İstanbul (EH 1453).

distances in terms of the time required to cover the area on foot, using the pace (*adım*, *ayağ*, *ka-dem*, or *baṭve*) as his scale, which corresponds to ca. 38 cm. Other units of length used by the Ottoman surveyor were the Turkish statute mile (1,995 m), the league of three miles (*fersah*, 5,985 m), or a distance marched in one hour at average speed; and, for longer distances, the stage (*menzil*, 22.74 km) and the day's journey (*merhale*, 45.48 km).

During the 1701 boundary negotiations between the Ottoman Empire and Russia, one article fixed the border zone as ten hours walking distance; this became a matter of debate since the concerned parties could not agree whether this distance should be the length or width of the boundary. The 1724 boundary treaty divided the territory stretching from Shemakha to the Caspian Sea between the Ottomans and the Russians. The Ottoman portion created by the partition was carefully recorded in the Ottoman document in terms of degrees, minutes, and seconds of longitude and latitude, thus providing

geographical coordinates in order to draw the new border. In the end, the Ottoman administration established a landmark set up according to the aforementioned values.

Following the Treaty of Karlowitz (1699), the Ottoman-Austrian border was encompassed by territory extending two hours either side the border into the interior of each country. Similar articles in other agreements required such a buffer zone along a border. In boundary surveying the first step was to choose a curbstone (*hududbaşı*) to start; this was followed by determining the method of surveying. For instance, at one of the test surveys held at the time of boundary resettlements after the Great Turkish War (or War of the Holy League) (1683–99), a clock was set in order to measure the distance of one hour's march by a Turk with big steps; according to the Venetian cartographer who took part in the incident, this distance equaled 4,228 Venetian *passas*. The border went along a straight line in an

open field; however the borderer had to draw semicircles whenever he came upon a settled area. After the delineation process, the borderer had to mark the boundary line with proper signs on the ground. The borderers were instructed to dig a wide ditch, to use a big stone or tree, or to point a stake in order to identify the boundary at places not easily seen from all directions.

The common means employed in boundary marking was to pile up soil in pyramids called *hunca* (or *unca*), a term that the Ottomans also used for similar raised heaps of stones (*masiera*). In some boundary conventions the distances between *huncas* were recorded in terms of time. Up until 1699, the boundaries between the Ottoman Empire and the Venetian Republic were marked by a big stone or tree on which a Latin cross and emblems of the two dynasties were cut. The 1699 treaty changed this situation as the Ottomans began to mark the border stones with a crescent. The boundaries shared commonly by Ottoman-Habsburg-Venetian states were determined more distinctively by larger *huncas* and artful structures.

In the western part of the empire, the Treaty of Karlowitz, signed on 26 January 1699, initiated the first true boundary survey that officially authorized the border between the Habsburg and Ottoman states in more precise terms. As a result, Ottoman subjects living close to the frontier suffered various socioeconomic problems. A large group of translators and draftsmen from both sides took part in the boundary negotiations that followed the peace treaty. In order to map the area that would form the permanent border between the two empires, the Habsburg representative, Luigi Ferdinando Marsigli, used the most advanced instruments of the period and worked with the Ottoman delegation for two years. It is highly probable that an Ottoman map of the boundary was produced during this survey, although it has yet to be found.

According to Ebū Sehl Şālih-zāde Nu‘mān Efendi, who participated in the Ottoman-Habsburg boundary negotiations in 1741 concerning the Danube River, Orşova, Walachia, and Hungary, the Ottoman commission had fewer cartographers and modern surveying instruments than their Habsburg counterparts (Nu‘mān Efendi 1999, 65). Although the Ottoman commission included engineers, they lacked practice in surveying. From the capital, *re’isülküttāb* (secretary of state) Rāġīb Efendi sent to this commission the boundary treaty accompanied by a map that delineated the border in red lines. Whether this map was made by the Ottomans or by a foreign draftsman is not known, as it is only attested by literary sources. In the same year, the khan of Crimea called for a conference in which the Russian-Ottoman frontier would be discussed with reference to some

coğrafiyas (geographies), which implied maps in addition to a current boundary treaty. There are some Russian maps (Istanbul, Başbakanlık Osmanlı Arşivi [BOA], Haritalar Kataloġu 185, 188–190) produced in accordance with the treaties of Belgrade (1739) and Küçük Kaynarca (1774) that are briefly annotated in Turkish and carry the seals of both empires. Among the engineers of the boundary commission assigned to survey the vacant area surrounding Ochakiv and the castle of Kılburun in 1775, Ebübekir Hālife was the leader. After five months’ work, the borderer Meġmed Şerif dispatched to the Ottoman capital a map (BOA, Nāme-i Hümāyün Defterleri 9, 48–55) displaying the borderline based on triangulation and settled in conformity with the Russian party. Yet again, the producer of this map is not known. In the texts prepared by the boundary commissions, the distances were recorded in time and *verst*, the standard Russian unit of measurement.

For marine boundaries in the Ottoman Empire, the limit of territorial waters was traditionally determined by the range of a gun located seaside. In other words, it was important to establish the farthest spot in the water that could be protected by artillery fire discharged from the guns placed on shore (*Kal’a/Top altı*). Among the several negotiations held between the Ottomans and Venetians to settle a naval frontier, the arrangement following the Treaty of Passarowitz (1718) is distinctive for fixing the territorial limits of both states at thirty nautical miles in Dalmatian, Herzegovinan, and Albanian waters and in the Mediterranean Sea. They agreed to use a nautical mile equivalent to 1,856 meters.

As yet, no Ottoman map created as a result of boundary surveying has been identified. Nevertheless, there are several maps depicting Ottoman borders that had been reorganized according to mutual agreements. Among those that provide the distances in time and miles, the unsigned manuscript map drafted after the Treaty of Belgrade (1739) depicts the new boundary that emerged after the Ottomans regained Adakale (Istanbul, Topkapı Sarayı Müzesi Arşivi, E. 10201/2). The anonymous map delineating the Ottoman, Habsburg, and Russian lands with the Black Sea placed in the center contains explanatory notes about the fortifications that changed hands between the Ottoman and Russian armies, and it marks the Russian territories with red crosses. These notations make it apparent that the map shows the existing borderline during the Russo-Ottoman war of 1787–92 (fig. 116).

When considering Ottoman boundary maps, a prominent place is held by Enderūnlu Muşafā, who translated and adapted numerous maps of this kind. His manuscript map of 1768 showing all European boundaries exists in two copies (Istanbul, Topkapı Sarayı Mü-

zezi Kütüphanesi, E.H. 1455, and İstanbul Arkeoloji Müzesi Kütüphanesi, no. 1074). In another work of 1768–69, he depicted the Ottoman-Polish border zone that encircled the frontier castles of Khotyn, Tighina, and Bilhorod-Dnistrovskiy and the Russian border in Ukraine, Crimea, and Azov. Enderünlü Muştafâ's manuscript map of 1773–74 drafted on silk cloth delineates the new borders that had come into existence after the partition of Polish lands between Russia and Prussia in 1772 and the Ottoman border along the Danube River (fig. 117). The unsigned map depicting the Turco-Russian frontier settled in accordance with the Treaty of Küçük Kaynarca (1774) (BOA, Haritalar Kataloğu 187) was in fact translated from a foreign source. The manuscript boundary map of the Treaty of Jassy that was signed between the Russian and Ottoman empires in 1792 (BOA, Haritalar Kataloğu 184) is elaborated with a supplementary text. Given the sparse evidence and the stimulating contact between the Ottoman engineers and their foreign counterparts, the question of the contribution of the engineers who played an increasing role in boundary surveying from the latter half of the eighteenth century, as well as to general mapmaking and land surveying, requires further investigation.

FİKRET SARICAOĞLU

SEE ALSO: Karlowitz, Treaty of (1699); Ottoman Empire, Geographical Mapping and the Visualization of Space in the

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Boundary Surveying in Portugal. Portugal's land border was established by the Treaty of Alcañices, signed by Portugal and Castile in 1297, fixing the Portuguese territory in the Iberian Peninsula between the Atlantic Ocean on the west and south and the kingdoms of León and Castile (Spain) on the north and east. The borderline,

or "Raia," more than 1,200 kilometers in length, was based on natural features such as rivers and mountains wherever possible but without an established demarcation line. During the medieval period, castles and (from the seventeenth century onward) fortresses and forts were the effective border landmarks. Some attempts to establish an effective borderline were made during the reign of Manuel I; in 1509 Duarte de Armas undertook a survey to depict the border castles, and both local and central authorities tried to implant markers along the border. The first cartographic representation of the Portuguese borderline was shown on the map of Fernando Álvaro Seco, after 1561 (Alegria et al. 2007, 1039–41, 1047–48).

Between Portugal's independence in the twelfth century and the end of the eighteenth century, there were many wars with Spain (Castile). Most military actions between Portugal and Spain were limited to the frontier territories and employed siege warfare. Thus, boundary surveying in Portugal was based on the recognition of its main defensive works. Beginning with the Portuguese Restoration War (1640–68), the Portuguese renewed their interest in controlling the country and consolidating state autonomy, which presupposed a strong military defense of the border. To this end, cartographic rendering of the border was of vital importance and was controlled by both the king's Conselho da Guerra and the Junta de Fortificações.

Manuscript maps meant for military use, mostly made by foreign engineers in the service of Portugal, were drawn either at a large scale, depicting the space surrounding the main fortresses to be used for tactics and battle movements, or at the smaller regional or national scale to be used for defense strategy. Nevertheless, the most important map showing the entire Portuguese border with a double dotted colored line, was the *Descripcion del Reyno de Portugal y de los Reynos de Castilla que parten con su frontera*, printed and edited in Madrid in 1662 by the Portuguese cartographer Pedro Teixeira Albernaz, who worked for Spain's Felipe IV (Alegria et al. 2007, 1044–45).

At the beginning of the eighteenth century, Portugal participated in the Anglo-Austrian Grand Alliance in the War of the Spanish Succession (1701–14), which led to invasions by Franco-Spanish forces. Maps were particularly useful tools in the planning of these military actions, many of which occurred along the borderlands where forts and castles demarcated the frontier. The work of Manuel Pinto de Vilalobos, chief military engineer for the province of Entre Douro e Minho, exemplifies boundary mapping of this period. Vilalobos drew maps on site of the military fortresses throughout the northwest region of Portugal between 1713 and 1715 (Soromenho 1991). Besides representing the physical

geography and waterways of the region, these exemplary manuscripts detail the principal existing fortifications and also identify possible routes of invasion. Several copies of his maps are now housed in Lisbon at the Biblioteca Nacional de Portugal, the Arquivo Histórico Militar, and the Sociedade de Geografia de Lisboa (Teixeira and Valla 1999, e.g., 41, 169, 187, 204 [pls. 1, 40, 48, 56]).

Along the borders of the Alentejo region in the south, João Tomás Correia made several relatively detailed maps of the forts involved in the principal military sieges: Moura (1707), Olivença (1709), and Campo Maior (1712). The maps of these three forts, engraved and printed by Charles de Granpré, were included in the second volume of *Geografia histórica de todos os estados soberanos de Europa* (1734–36) by Luís Caetano de Lima, published when the two Iberian countries were once again on the brink of military conflict, with both armies concentrated along the Alentejo border.

During the second half of the eighteenth century, representations of the border seemed to be limited to the

fields of war. Maintaining boundary defenses served as a pretext for new projects under the direction of the king's chief military engineer, Manoel de Azevedo Fortes, who personally undertook to survey the border, reinforce the defensive capacity of the fortresses, and plan new fortifications. He created the oldest known plan of Almeida, the strategically important fortress in the central region of Beira province as well as a plan to build a new fort in Zebreira in 1736–37 (Conceição 2002, 85–87, 289–90). Similar motivation encouraged topographical studies in Minho in the north and in the Alentejo in the south between 1755 and 1759 (Dias et al. 2005, 212–15).

New military boundary maps were created at the time of the so-called Guerra Fantástica (1762–63), when Portugal participated in the Seven Years' War (1756–63). Facing a Franco-Spanish invasion, the Portuguese government solicited England's support; the combined forces were commanded by Count Wilhelm de Schaumburg-Lippe, whose engineers included Paul Joseph Champalimaud de Nussane, Robert de Bassenond, Louis d'Alincourt, Jean Benoit Python, Francisco d'Alincourt,

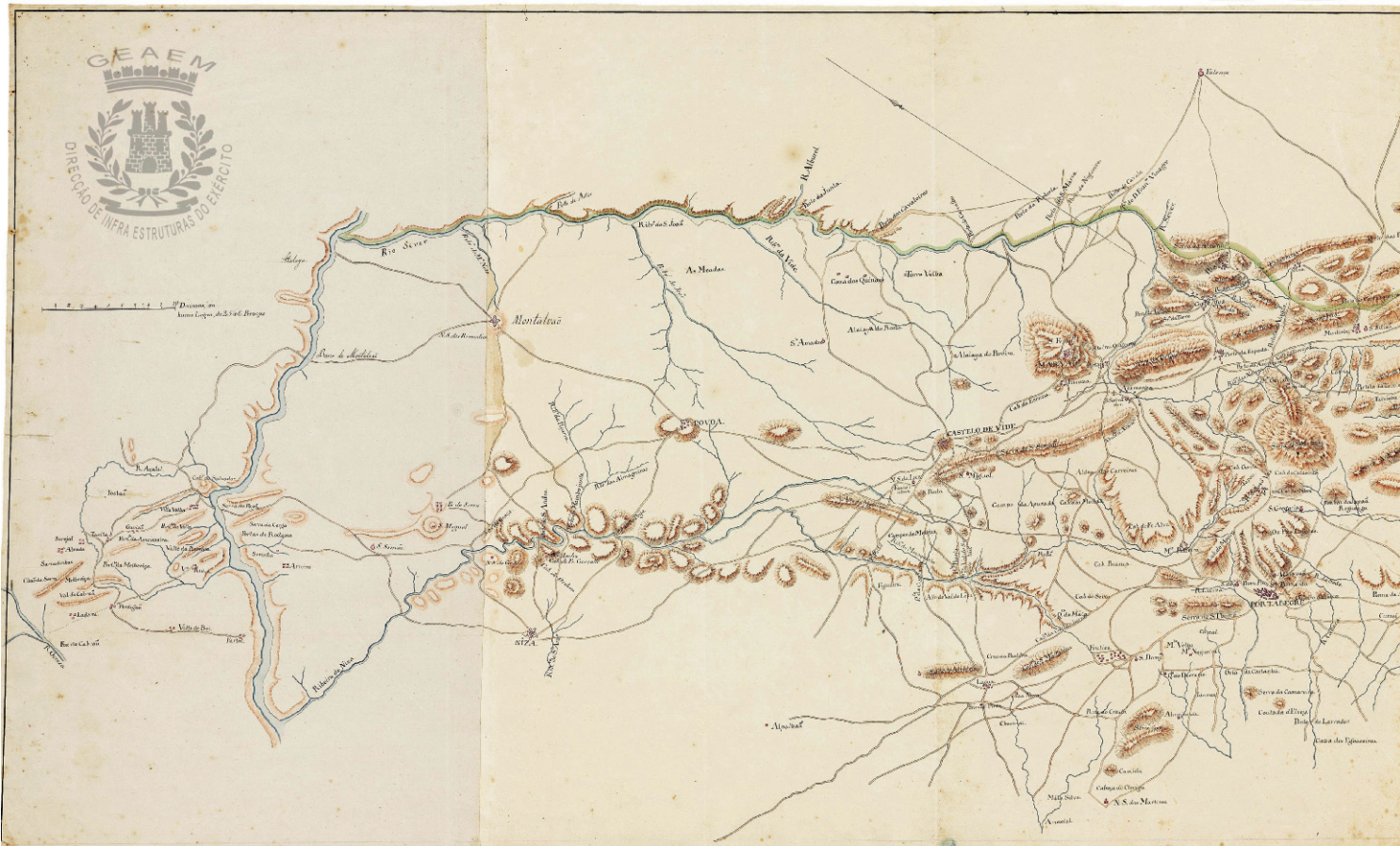


FIG. 118. “CARTA DO RECONHECIMENTO MILITAR FEITO NA FRONTEIRA DO ALEMLEJO EM 1797,” BY LUÍS CÂNDIDO CORDEIRO PINHEIRO FURTADO. Manuscript, ca. 1:62,000, 10 decimos, or a league, of 2,540 braças = 9.0 cm.

Size of the original: 57 × 189 cm. Image courtesy of Portugal/Gabinete de Estudos Arqueológicos da Engenharia Militar/Direção de Infraestruturas do Exército (498-1-4-7).

Gustave Adolphe Hercule de Chermont, and Jacob Crisóstomo Pretorius, all of whom followed the theater of war and executed important surveys of the border, both during the conflict and in the following years (Dias 2009, 56–57). These foreign engineers made various sketches along the land borders with relatively few geographic details but showing the region's hydrographic aspects, possible routes of invasion with roads and bridges, the principal settlements, and various defensive works. They represented relief in a graphic form closer to the French technique of hachures, but the cartographic rendition of borders altered little from previous depictions: dotted, dashed, or continuous lines, colored according to Azevedo Fortes's handbook for military engineers (Azevedo Fortes 1722, 197). The "Copia do mappa de huma parte do Alemtejo, e da Beira" (1763) by Louis d'Alincourt, a Frenchman serving Portugal, shows not only the border (with a green line), but also a strip of Portuguese territory defended by several fortresses and forts connected by a road network, providing useful documentation for the defense of this section of the Portuguese border (Dias

2007, 38). Until the end of the century, the rebuilding of principal land and sea fortifications continued to occasion new maps and topographical studies, such as the work of José de Sande Vasconcelos and Baltazar de Azevedo Coutinho in the Algarve.

Spanish threats to Portugal's territory strengthened from 1795 until 1801, when the War of the Oranges again focused the attention of Portuguese authorities on the land border, effecting multiple topographical surveys throughout the kingdom. These large, detailed studies were based on networks of triangulation and baseline measurements carried out primarily by Portuguese military technicians with the aid of foreigners. They were completed within the purview of the Real Corpo de Engenheiros, whose officers had graduated from the Academia Real de Fortificação, Artilharia e Desenho, created in 1790. The "Carta do reconhecimento militar," coordinated by Luís Cândido Cordeiro Pinheiro Furtado, shows the results of the triangulation methods (fig. 118). Three teams, comprising three or four engineers each, worked along a section of the border, start-



ing from the baseline of the map established in the town of Marvão (Dias 2007, 41).

After Portugal's defeat in the War of the Oranges, the terms of the Treaty of Badajoz (1801) transferred to Spain one of the main border fortresses in the Alentejo, the town and environs of Olivença, a territory still claimed by Portugal. In 1802, the prince regent created the Inspeção-Geral das Fronteiras e Costas Marítimas do Reino under the direction of Louis-François Carlet de La Rozière; the Inspeção-Geral included other foreign officials who had accompanied Carlet de La Rozière in 1797 to aid Portugal in the war. In its brief two years of activity (suspended in 1804), the Inspeção-Geral directed innumerable projects, from topographical studies to geographic accounts, especially concerning the defense of the border of the provinces of Beira and the Alentejo. Some maps made under the orders of Carlet de La Rozière were given to Jean-Andoche Junot's engineering corps during the first French invasion of Portugal in 1807–8 and sent to the Dépôt de la Guerre in Paris (they are housed in the Service historique de l'armée de terre at the Château de Vincennes) (Vicente 1984, 116–17). The manuscript "Carta militar de huma parte da fronteira do Alemtejo" (1803) made by José Maria das Neves Costa while he was working for the Inspeção-Geral demonstrates perfectly the boundary cartography of Portuguese technicians; it illustrates a geographical-military description of the border based on field observations that followed the existing itineraries in order to prepare an effective future defense of this border (Dias 2007, 39–40).

In 1803, Portugal and Spain cooperated in creating several maps to establish the border in contested populated locations, including the "Planta do terreno e limites da contenda de Moura" (1803) by Conrado Henrique Niemeyer describing the Alentejo and the "Desenho topographico de huma porção do Conselho de Lindoso" (1803) in the Minho by Custódio José Gomes de Vilas Boas (Dias 2009, 23–24, 60–62). However, these territorial disputes were resolved only in the second half of the nineteenth century.

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SEE ALSO: Portugal

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Boundary Surveying in Portuguese America. The process of surveying the boundaries of Portuguese America was marked by a series of vicissitudes, particularly concerning the resolution of disputes regarding Spanish territorial claims and possessions. The Treaty of Madrid (1750) established the Luso-Hispanic demarcation lines, which took effect in 1752 but were disrupted by the outbreak of war with the Guaraní tribes. The Treaty of El Pardo (1761) annulled the terms established by the Treaty of Madrid, and the lines of demarcation were redrawn following new negotiations for the Treaty of San Ildefonso (1777). Both treaties set up joint cartographic surveys, but the ensuing negotiations were especially heated and ended without definitive conclusions. Yet although the results could seem to be a failure from a political perspective, the practical outcome was exactly the opposite. Both in technical as well as human terms, the demarcation lines represented on cartographic products provided the most complete picture to date of Portuguese America; these boundaries had long-term effects and exemplified the multiple purposes of cartographic work of the eighteenth century.

Portuguese cartography of the sixteenth century demonstrated meticulous knowledge of the Atlantic coast of South America, but settlement of the continent's inte-

rior did not enjoy similar cartographic documentation, causing some urgency in the eighteenth century for new maps of the region's interior boundaries. This lacuna was understandable given the enormous extent of the region, which covered more than eight million square kilometers. Specific articles in the treaties of Madrid (XI, XXII, XXVI) and San Ildefonso (III, IV, V) established commissions for both sides consisting of military officers who were familiar with the region, and astronomers and military engineers who were charged with surveying the frontier based predominantly on rivers, mountains, and other natural features. The commissions' three objectives were demarcating the lines, cataloging the astronomical observations made during the survey, and cataloging the physical observations of the terrain and its natural history. In addition, visual markers, such as stones, were also to be established in appropriate areas (fig. 119). These objectives reflected the interplay between scientific concerns and the political agenda of the Portuguese administration (Martín-Merás 2005–7).

The first surveys, following the instructions of the Treaty of Madrid, were carried out from 1752 to 1753 and 1758 to 1759. They relied on the standard surveying instruments of *tavoletta Praetoriana* (plane table) and compass or graphomètre, while the astronomers used telescopes, quadrants of various sizes, pendulums, clocks, compasses, thermometers, and barometers for their observations. The Treaty of Madrid set up two commissions: the northern one was headed by Francisco Xavier de Mendonça Furtado, brother of Sebastião José

de Carvalho e Melo, marquês de Pombal, the governor of Grão-Pará e Maranhão; and the southern by Antônio Gomes Freire de Andrade, governor of Minas Gerais and Rio de Janeiro (Ferreira 2001, 130–42). Their instructions directed the officers in the field to keep notebooks (some now held in Rio de Janeiro, Biblioteca Nacional do Brasil) and make observations of the physical and natural history of the areas explored, including the flora and fauna of the region and especially plants with medicinal properties. The instructions of the later Treaty of San Ildefonso required more sophisticated instruments for measuring and drawing, which were ordered and purchased from the best European instrumentmakers, along with the most up-to-date bibliography relevant to the expeditions.

During the preparatory meetings for the Treaty of Madrid, the absence of Portuguese geographic and cartographic specialists necessitated the recruitment of Italian and German engineers and surveyors for the commissions. After the Treaty of San Ildefonso, the majority of military surveyors were Portuguese, indicating the considerable increase in training that had occurred during the twenty-five years between the treaties, no doubt a result of the *aulas de fortificação* (schools of fortification) established in the colony.

Although the Portuguese officials had been instructed to follow a certain method in their cartographic work, including scales, the maps themselves do not demonstrate a standard scale or specific typology of drawing. The surveyors' work resulted primarily in manuscript



FIG. 119. “RIO JAURÚ DESDE A SUA CONFLUENCIA NO PARAGUAY, ATHE A BOCA DOS BAGRES HUMA LEGOA ACIMA DO REGISTO; PLANTA DE VILLA MARIA DO PARAGUAY; MAPA DO RIO PARAGUAY DESDE A BOCA DO RIO JAURÚ ATHE A CONFLUENCIA E PARTE DO RIO SEPO TUBA; MARCO DO JAURÚ QUE SE COLOCOU EM

14 DE JANR.^o DE 1754,” 1784. Manuscript on two sheets; two maps (ca. 1:110,000, ca. 1:120,000), one plan (no scale specified), and a profile of a boundary monument (ca. 1:23). Size of the original: 42 × 113 cm. Image courtesy of the Núcleo Museológico da Casa da Ínsua, Penalva do Castelo (cota 68 A, rolo n^o 5).

maps; printed versions, at least at first, were not of interest to the political powers. Some maps are very colorful and detailed, suggesting that they were produced for the court or for meetings between chief commissioners. Others are much simpler, their principal concern being the correct indication of coordinates and boundary connections, mostly between rivers, to establish the lines of demarcation. In all cases, attention was to be consistently given to recording observations and measurements in notebooks so that they could be checked and rechecked, which distinguished this cartography from earlier efforts to depict the frontier and reflected an Enlightenment emphasis on observation, measurement, and incorporation of multiple sources of information. The collaborative nature of these maps should also be noted, as they are for the most part unsigned, indicating that the engineers worked in groups, checking each other's work. There were many difficulties during the survey, as the teams often navigated previously unexplored river courses and encountered many problems taking measurements or making astronomical observations, all while contending with the unhelpfulness of the indigenous people in the area.

The Treaty of Madrid demarcation teams worked in three large border areas: in the south around the Colônia do Sacramento at the mouth of the Río de la Plata, in the southwest along the Paraná River, and in the north along the Amazon basin. The southern commission, working in the best-known and most disputed area, produced the largest number of maps, frequently drawn under the threat of war with the indigenous peoples. The work of engineer José Custódio de Sá e Faria stands out, along with that of José Fernandes Pinto Alpoim (engineers and first commissioners), Michel (Miguel) Angelo de Blasco, Manuel Vieira Leão (engineers), and Miguel António Ciera (astronomer), among others. The northern Amazon region required mostly hydrographic surveys, which effected an absolute change in the cartographic representation of the region. João André Schwebel, Henrique Antonio Galluzzi (engineers), and Ignácio Sermatoni (astronomer) worked with the commissions of the Treaty of Madrid, and Teodósio Constantino de Chermont, Henrique João Wilkens (engineers and first commissioners), José Simões de Carvalho, Pedro Alexandrino Pinto de Sousa, and Manuel da Gama Lobo d'Almada worked with the commissions of the Treaty of San Ildefonso. In the center of the country, along the Guaporé, Madeira, Mamoré and Paraná Rivers, Portuguese technicians produced a new cartographic interpretation of the treaty, advancing the previous lines and claiming exclusive Portuguese navigation of the rivers. The founding of villages and forts along the western border of those rivers, which were also mapped at the same time, corroborated this advance. The maps of this commission, including work by Ricardo Franco de Almeida Serra, Joaquim José Fer-

reira (engineers), Francisco José de Lacerda e Almeida, and António Pires da Silva Pontes Leme (astronomers), passed into the collections of the governors of this part of Brazil (Mato Grosso), such as that of Luís de Albuquerque de Melo Pereira e Cáceres in the Casa da Ínsua and that of Luís Pinto de Sousa Coutinho in the Biblioteca Pública Municipal do Porto. The maps became basic elements in the region's political activity during the eighteenth century (fig. 120).

Defining the border with the Spanish colonies ultimately implied defining the very territory of Portuguese America. Similarly, demarcating the external border cannot be separated from the general cartographic surveys of the interior borders that occurred throughout the second half of the eighteenth century. The most elegant synthesis of this process is the "Carta geografica de projecção espherica da Nova Lusitania ou America portugueza e estado do Brazil," produced under the direction of Pontes Leme from 1797 and based on the cartography of the boundary surveys (see fig. 633). Although not established politically until the nineteenth and twentieth centuries, Brazil's borders largely correspond to the lines drawn up during the surveying expeditions of the eighteenth century, and their demarcation depended on the maps produced at that time.

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SEE ALSO: Madrid, Treaty of (1750); Portuguese America; Society of Jesus (Rome)

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FIG. 120. “CARTA GEOGRAPHICA DOS EXTENÇOS TERRITORIOS E PRINCIPAIS RIO DO GOVERNO, E CAPITANIA GENERAL DO MATO GROSSO, QUE MAIS CENTRALMENTE CONFINAM A OS DOMÍNIOS ESPANHOIS D’AMERICA MERIDIONAL,” 1781. Manuscript map on two sheets.

Size of the original: 126 × 89 cm. Image courtesy of the Núcleo Museológico da Casa da Ínsua, Penalva do Castelo (cota CG 13 e nº 13).

Boundary Surveying in Russia. Inventories of the Rossiyskiy gosudarstvennyy arkhiv drevnikh aktov in Moscow and other archives suggest that by the 1570s nearly all the western frontier of Muscovy from the Arctic Ocean to Putyvl and Chernigov had been depicted in a series of local geographical drawings called *chertëzhi*. Later scholars have argued that some of these *chertëzhi* date to the early 1500s (Rybakov 1974, 9–10).

In the early 1700s the expansionism of Peter I created many boundary changes. In his quest for Westernization, he incorporated European practices for the delimitation and demarcation of boundaries within conquered countries, including the compilation of boundary maps approved by official representatives of the countries involved in the settlement or treaty.

Important boundary surveying under Peter I took place at Ingria, a much-contested region south of the Gulf of Finland. Although Russia had earlier ceded the land to Sweden under the Stolbovo Treaty of 1617, in 1702 Peter conquered Swedish-occupied portions of Ingria and promptly built his new capital of St. Petersburg there. The new acquisitions were represented in the “Karta ostrova zund i blizlezhchikh ostrovov”

(1718; Moscow, Rossiyskiy gosudarstvennyy arkhiv drevnikh aktov) in manuscript compiled by Russian topographers using Swedish materials. A similar process involved Finland. Under the Treaty of Nystad (1721), Russia took control of the Finnish regions of Ingria, resulting in new boundary surveying.

By the Treaty of Åbo (1743), which ended the Russian-Swedish war of 1741–43, Russia, under the Empress Elizabeth, added part of Swedish Finland running alongside the Kymi River, which became the new Swedish-Russian border. Swedish maps flowed into Russian hands during this war, influencing Russian map design. The traces of such materials have survived in several Russian-made maps of Russian Finland and its boundaries with Sweden, described archivally as “Karta granitsy mezhdru Rossiyskoy imperii i Korolevstom Shvetsii, 1744 g” (fig. 121), “Karta proliva villen-zunda i nekotorykh,” and “Karta Finlyandi i chasti Baltiyskogo morya, 1744 g.”

Before his death in 1725, Peter I also sought to delimit and demarcate the Empire’s boundary on the Siberian east. Under the Treaty of Nerchinsk (1689), the Russian-Chinese border was established along the Ar-



FIG. 121. DETAIL FROM A 1744 MANUSCRIPT MAP OF THE BORDER BETWEEN THE RUSSIAN EMPIRE AND THE KINGDOM OF SWEDEN ACCORDING TO THE 1742 TREATY. The border is delineated in this detail by the red line arcing northward alongside the Kymi River and then eastward through the Finnish lakes. The map is described in a cartouche (not shown) as “Yeneral’naya karta Rossiyskoy

Finlyandi s pokazaniyem Rossiyskoy s Shvedskoyu granitsy uchrezhdennaya 1742.”

Size of the entire original: 130 × 145 cm; size of detail: ca. 63 × 115 cm. Image courtesy of the Rossiyskiy gosudarstvennyy voyenno-istoricheskiy arkhiv, Moscow (f. 846, op. 16, d. 25394).



FIG. 122. DETAIL OF PART OF UKRAINE FROM KARL IVANOVICH OPPERMAN, *NOVAYA POGRANICHNAYA KARTA ROSSIYSKOY IMPERII*, 1795. Published probably in St. Petersburg, this large and highly detailed new boundary map of the Russian Empire summarized the westward growth of the empire under Catherine II. The boundaries of each major expansion were indicated by letters in Latin script, including the empire's boundaries on Catherine II's accession in 1762 (A...A, red), after the First and Third Partitions of Poland-

Lithuania in 1773 (a...a, yellow) and 1793 (d...d, yellow), and after treaties with the Ottomans in 1774 and 1783 (b...b, light green) and 1791 (c...c, red); the contemporary boundaries of the empire were also marked (B...B, green).

Size of the entire original: 67 × 55 cm; size of detail: ca. 10 × 20 cm. Image courtesy of the Rossiyskaya gosudarstvennaya biblioteka, Moscow (Cartographical Department, Code No. Ko 7/IV-14).

gun River and the Stanovoy Range. The Chinese subsequently undertook elaborate surveys under the Kangxi emperor, collecting information for maps that they may have later shared with Russian officials (Cams 2017, 184; Fuchs 1943). In 1727, Russia and China extended their earlier agreements through the Treaty of Kyakhta. The Russians wanted to establish good relations with the new Yongzheng emperor, as well as open up regular trade between the two countries. The treaty called for new maps: "Lands, rivers, and [boundary] pillars should be written down with their names and drawn on a land maps. This should be done in languages of both Empires. The envoys should exchange these maps between them and bring them to their superiors" (Myasnikov 2004, 31). A follow-up document written two months later confirmed that the maps had been compiled, "and the envoys from both sides had described and drawn the delimitation and these descriptions and drawings exchanged between them and carried to their superiors" (Myasnikov 2004, 42–43). Although copies of these drawings have not been found in Russian archives, one source for these later drawings may have been the Chinese-language map consisting of thirteen manuscript sheets (dated 1721), located in Paris (from the wood-

block version of the Kangxi Atlas; Bibliothèque nationale, Cartes et plans, Ge CC 4461) in the papers of Joseph-Nicolas Delisle, a scholar in the St. Petersburg Akademiya nauk at the time.

On the Russian side, the collegium for foreign affairs, *Kollegia inostrannykh del*, attended to the boundary mapping of Siberia under Prince Savva Lukich Raguzinskiy-Vladislavich, who, from 1724, employed three geodesists—Pëtr Nikiforovich Skobel'tsyn, Ivan Stepanovich Svistunov, and Vasiliy Shatilov. In 1726, the team was doubled to six to cover the large terrain. Indeed, these geodesists were surveying the regions adjoining China from the Argun River to Lake Baikal and the Yenisey River, a distance of more than 1000 miles. Ivan Kirilovich Kirilov used these materials in his celebrated *Atlas userossiyskoy imperii* (1731–34). The *Karta Russko Kitayskoy granitsy*, 1728 g. in two sheets and the same title in one sheet were the first Russian boundary maps ever published.

The events of the latter half of the eighteenth century presented boundary challenges on several fronts for Russia. The three partitions of Poland resulted in changes along the western frontier. The Russian-Ottoman wars (especially 1735–39, 1768–74, 1787–92) shifted the fo-

cus to the southern regions, from the regions west of the Black Sea, where boundaries changed rapidly in response to events, to the Crimean Peninsula, which incorporated its own coastal boundary giving access to the Black Sea (fig. 122). The very short time between these events and the large spaces involved did not allow for careful surveying and mapping on behalf of central, provincial, or military powers. In addition, the cartographic materials in the foreign policy archive, Arkhiv vneshney politiki Rossiyskoy imperii in Moscow, have not been well explored or thoroughly researched, leaving much still to be learned for this period.

ALEXEY V. POSTNIKOV

SEE ALSO: Russia

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Boundary Surveying in Spain. Spain's current frontiers were established during the second half of the seventeenth century. Even with the loss of hegemony in Europe, Spain still had an important empire to preserve; defending borders became one of the focal points of Habsburg policy and of the Bourbons during the eighteenth century after the Treaty of the Pyrenees (1659). Military engineers played a prominent role in this task by taking responsibility for ground reconnaissance and topographic surveying of boundaries as well as the design and construction of fortifications to defend them. From 1675 there had been an Academia Real y Militar del Ejército de los Países Bajos in Brussels, where professionals in the most advanced sciences of that period could train. It closed down in 1706, when the Spanish presence in the Low Countries came to an end. The Real Academia Militar de Matemáticas de Barcelona was set up shortly afterward in 1716 and trained most eighteenth-century Spanish military engineers. The profession also became institutionalized after the establishment of the Cuerpo de Ingenieros in 1711 and publication of the royal *ordenanza* of 4 July 1718, which defined and governed its functions, in particular the marking out of boundaries (Capel, Sánchez, and Moncada Maya 1988, 14–39, 102–11). The engineering corps produced reports and

cartography related to the work of the diplomatic commissions responsible for delimiting and demarcating the frontier, projects and plans of frontier fortifications, and diverse cartography of a general nature.

Despite diplomatic agreements (the 1659 Treaty of the Pyrenees with France and the 1668 Treaty of Lisbon with Portugal), boundaries were not delimited precisely, formally, and completely until well into the nineteenth century. Some partial work was carried out on the French frontier in the eighteenth century, such as the work done in the eastern Pyrenees after the Seven Years' War (Capdevila Subirana 2008). Of particular note is the work of the Comisión Hispano-Francesa de Límites, also called the Caro-d'Ornano Commission, set up in 1784, whose main objective was to demarcate the entire frontier. The work started on the west side of the Pyrenees, where confrontations between local communities in the area could result in unwanted diplomatic problems for both parties. Headed by *mariscal de campo* Ventura Caro for Spain and by François-Marie, comte d'Ornano, for France, the commission was behind the Treaty of Elizondo in 1785, created to resolve such conflicts. However, the outbreak of the French Revolution prevented the treaty from being implemented, and the commission was dissolved. Some rough drafts and the manuscript series of maps devised to establish the frontier have been stored in the Archivo Cartográfico y de Estudios Geográficos del Centro Geográfico del Ejército (Madrid). The sheets are drawn up at an approximate scale of 1:14,000, covering the Atlantic to the border with Aragon. It is a joint French and Spanish work, carried out under the supervision of Engineer Colonel Antonio de Zara and Lieutenant Colonel Paul Louis Gaultier de Kerveguen (fig. 123) (Sermet 1983, 142).

Far greater effort went into strengthening frontier defenses, mainly the border with France and along the coast. As a result, there are many reports and maps on both Spanish and foreign fortresses and citadels in these areas. One paradigmatic example is Gibraltar, taken by the British in 1704 and ceded formally by Felipe V in the Treaty of Utrecht in 1713. Numerous attempts to recapture the fortified territory throughout the eighteenth century gave rise to important graphic documentation on the fortress and defenses finally used to establish the boundary. There is similar work available for the Spanish cities of Ceuta and Melilla in North Africa, as shown in the catalog of maps of the Biblioteca Nacional de España (Líter Mayayo, Sanchis Ballester, and Herrero Vigil 1994).

Marking the boundaries on smaller-scale cartography was based on the aforementioned documents and other similar surveys. The best example is in the work of the military engineer Antonio de Gaver, who inspected the frontier with Portugal in 1750 (Hevilla 2001; Arroyo



FIG. 123. DETAIL FROM THE SERIES “MAPA TOPOGRÁFICO DE LOS MONTES PIRINEOS PARA EL ESTABLECIMIENTO DE LOS LÍMITES ENTRE ESPAÑA Y FRANCIA.” Caro-d’Ornano Commission map number 3, manuscript in two sheets, ca. 1:14,000, 1789. The double line represents the border, blue on the French side and red on the Spanish side. In

the center is indicated the position and number of boundary markers (in red).

Size of the entire original: 180 × 279 cm; size of detail: ca. 18.5 × 31.5 cm. Image courtesy España, Ministerio de Defensa, Archivo Cartográfico y de Estudios Geográficos del Centro Geográfico del Ejército, Madrid (Ar.H.T.5 C.8 n° 241).

Berrones 2003). He subsequently produced much cartographic work in the area, of which there are extant five ca. 1:36,000 and four ca. 1:144,000 maps (fig. 124) (CGE 2001, 13–19). No work of this type was performed by Spanish engineers in the Pyrenees. Tomás López, who prepared and published the most complete and well-known cartographic series in Spain at the end of the eighteenth century, used the work of the French engineers Roussel and Jean-François de La Blottière for his boundary depictions.

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SEE ALSO: Spain; Topographical Surveying: Spain

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Boundary Surveying in Spanish America. Between 1494 and 1750 the boundaries between the overseas territorial possessions of Portugal and Spain were regulated by the Treaty of Tordesillas. Established exactly two years after the unexpected arrival of Christopher Columbus



FIG. 124. DETAIL FROM “MAPA, Y DESCRIPZION . . . DE ESTREMADURA,” BY ANTONIO DE GAVER, 1751. Manuscript, ca. 1:144,000. The Spanish territory up to the border is represented. In the Portuguese part, only villages and points of interest are drawn.

Size of the entire original: 102 × 140 cm; size of detail: ca. 18.5 × 25.5 cm. Image courtesy España, Ministerio de Defensa, Archivo Cartográfico y de Estudios Geográficos del Centro Geográfico del Ejército, Madrid (Ar.1 T.6 C.1 6a).

to a “new” continent, King João II and Queen Isabella settled their disputes by dividing the lands and oceans to “discover and win” in Africa, Asia, and America (Columbus 1992, 81). While a much-debated countermeridian was established as the official boundary in the Philippines, after some Portuguese reclamations the boundary in Brazil was settled by a meridian located 370 leagues west of Cape Verde. Until 1640 these boundaries did not represent a serious political problem, but the independence of Portugal from the Spanish monarchy meant that it was only a matter of time before Portuguese expansion would collide with Spanish posts and missions in the area of the Amazon and the Río de la Plata. Two Spanish Franciscans had traveled from Quito to Belém de Pará in 1636; in response, Portuguese captain Pedro Teixeira led a great expedition of 2,500 people, half of them natives, with some seventy canoes to the Viceroy-

alty of Peru in 1637. Soon after their arrival in the *audiencia* of Quito, Luis Jerónimo de Cabrera, conde de Chinchón, viceroy of Peru, ordered Teixeira to return with all his people by the same route to Pará. The 1668 Treaty of Lisbon ratified Portuguese independence from the Spanish Crown, and they continued their frontier expansion into the South American continent, rendering the old Tordesillas boundary largely irrelevant.

From the beginning of the eighteenth century Jesuit missionaries confronted Portuguese expansion on the Spanish side of the Tordesillas line. As their missions were the only real obstacle to slave hunters and their well-equipped *sertanistas* (scouts), the missionaries mobilized support in the court and organized military resistance wherever and whenever possible. They relied on historical arguments to support further diplomatic action, at the same time taking advantage of their own

cartographic traditions and knowledge of the region to support their view. For example, Father Samuel Fritz, SJ, published *El gran río Marañón, o Amazonas con la misión de la Compañía de Iesus* (1707), a compilation of his extensive and difficult explorations in the region, as a defense of Spanish control of the Amazon basin (Buisseret 2007, 1162–65, fig. 41.23; Almeida 2003, 117). The map reached a European audience when published in London (in Edward Cooke, *A Voyage to the South Sea, and Round the World*, 1712, engraved by John Senex) and in the Jesuit *Lettres édifiantes et curieuses* (12:213 [1717]); it set a new standard for regional cartography until a completely new organization, the scientific expedition, redefined the production process for medium- to small-scale cartography in this region. Under the guidance of Charles-Marie de La Condamine, an expedition was sent to Quito in 1735 to determine the length of a degree of latitude; their work was published in the *Relation abrégée d'un voyage fait dans l'intérieur de l'Amérique méridionale* (1745). La Condamine's book contained a revised chart of the Amazon (see fig. 431), using Fritz's map for comparison, and paved the way for a new method of dealing with border disputes by using geometric means and by signaling boundaries with physical markers set in the terrain, such as pyramids or obelisks.

In 1746 negotiations between the Crowns of Spain and Portugal started to settle their boundary disputes in the Americas and Asia; from these deliberations emerged a reevaluation of historical and diplomatic traditions, Jesuit cartography, and arguments emphasizing observation and measurement to support their positions. Both sides acted upon presumptions based on new ideas about political reform, which asserted the extension of power of the Crown to the South American frontier. Both sides therefore agreed that Portugal could legally control the Amazon, and Spain, the Río de la Plata (Lucena Giraldo 1993, 79). In the middle of these negotiations, Jorge Juan and Antonio de Ulloa, two Spanish naval officers, scientists, and veterans of La Condamine's expedition, published their *Dissertacion historica, y geographica sobre el meridiano de demarcacion* (1749). This important book marked the beginning of a Spanish American "scientific" literature on the subject of geometric and geodetic measurement. It combined the traditional justification of the limit of Tordesillas with geographical and astronomical arguments to support the Spanish position in the negotiations about the situation of boundaries, especially in the Amazon region (Lafuente and Mazuecos 1987, 218). As a result of the Treaty of Madrid, signed in 1750 and represented in the so-called Mapa das Cortes (Guerreiro 1999, 26–29; and see fig. 447), Spanish and Portuguese commissioners organized two expeditions to carry out the boundary demarcation in South

America. The expedition to the Orinoco was to settle the boundary in the north, from Guiana to the Jaurú River; the expedition of Gaspar de Munive, fourth marqués de Valdelirios, operated in the south up to the Castillos Grandes mountains in Uruguay. Each expedition was composed of three parties of Spanish and Portuguese commissioners assigned to explore; to mark part of the border; to measure latitude, longitude, and temperature; and to prepare maps and charts.

The most important explorer and cartographer in the Orinoco expedition (1754–61) was naval officer José Solano, who was accompanied by a team of geographers and astronomers who drew many sketches and maps from the middle and upper Orinoco. In 1762, they prepared a map titled "Curso del río Orinoco," now unfortunately lost. This map and others from this expedition heralded a new type of regional cartography, one that combined Spanish, Creole, and aboriginal ideas about the geography of the Amazon. Solano allied himself closely with several indigenous groups and used their language and nomenclature for lands and new cities (fig. 125). Even more important, Solano's lost map indicated a new cartography operating in the Amazon forest, based on astronomical observations and measurements taken as carefully as possible with calibrated instruments. It was a source for the famous *Mapa geográfico de America meridional* (1775) compiled by Juan de la Cruz Cano y Olmedilla (see fig. 765), which became the standard Spanish representation of the southern part of the continent at that time. Solano's work also served as the basis for the *Mapa coro-gráfico de la Nueva Andalucía* (1778) by Luis de Surville (Capel 1982, 189). Its long, influential life continued in 1832, when Felipe Bauzá used it for his manuscript "Mapa del curso del río Orinoco" (Museo de América, Madrid).

Meanwhile, the Valdelirios expedition (1751–60), charged with establishing the boundary in the south, did not explore but made war against the indigenous Paraguayan Guaraníes and those Jesuits who opposed the treaty. After defeating the native peoples in 1756, the commissioners explored the Ibicuí and Pepirí Rivers without much agreement and few scientific results.

In 1761 the Treaty of El Pardo cancelled the Treaty of Madrid, and a frontier war began. In 1777, the reformist Portuguese minister, Sebastião José de Carvalho e Melo, marqués de Pombal, and the Portuguese Crown found their position weakened by the outbreak of the American Revolutionary War and the consequent failure of the traditional British alliance. In order to make peace with Spain, they signed the preliminary Treaty of San Ildefonso and duly negotiated a future alliance. New boundary expeditions were organized to survey the borders established between Spanish and Portuguese America. In the southern part of the continent, the brilliant



FIG. 125. VICENTE DOZ AND NICOLÁS GUERRERO, PLAN OF APURE AND PORTUGUESA RIVERS, 1761. Manuscript plan of the confluence of the two rivers with population sites; created as part of the Orinoco expedition under

the leadership of José Solano. The map reflects the Spanish, Creole, and aboriginal participation in the expedition. Size of the original: 38.8 × 49.0 cm. Image courtesy of the Museo Naval de Madrid (Signaturas 32-B-10).

astronomer, cartographer, and naval officer José Varela y Ulloa commanded the expedition, which was divided into five parties. From 1781 to 1801 they explored and mapped unknown regions in present day Uruguay, Paraguay, and Argentina. Naturalist and engineer Félix de Azara, third commissioner, wrote his *Memoria sobre el Tratado de Límites de la América meridional* on the political and scientific problems related to the establishment of boundaries (posthumously published in 1847 in his *Memorias sobre el estado rural del Rio de la Plata en 1801*). Based on explorations, he drew charts of the Salado and Paraná Rivers, and in 1793 he prepared the *Descripción é historia del Paraguay y del Rio de la Plata*, with a map of the province of Paraguay and, most important, the first measured plan of the capital, Asunción. The two-volume *Descripción* was also published posthumously (1847). A pilot and cartographer of the

expedition, Andrés de Oyarbide, surveyed the Río de la Plata extensively. A professor in the Academia de pilotos established by the Consulado de comerciantes in Buenos Aires, he was a key figure in training river pilots and cartographers.

In the northern part of the continent, the Comisión del Marañón (1778–1804) was led by Francisco Requena, military engineer and governor of Mainas. This fascinating figure spent sixteen years in the Amazon and wrote important diaries recording the exploration of the Caquetá (Japurá), Engaños, and Apaporis Rivers (Beerman 1996, 30–45). Already a significant cartographer before his arrival in the region, Requena prepared maps and drawings of the Amazon River and its tributaries, culminating in his map of 1796 (fig. 126), which could be compared to Cano y Olmedillas's work for other South American regions. These maps represented the



FIG. 126. FRANCISCO REQUENA, MAPA DE PARTE DE LOS VIRREYNATOS DE BUENOS AIRES, LIMA, S^{TA} FE Y CAPITANIA GRAL. DE CARACAS EN LA AMERICA MERIDIONAL CON LAS COLONIAS PORTUGUESAS LIMITROFES, MADRID, 1796. Paper, printed, ca. 1:4,300,000. Requena compiled a variety of geographical knowledge and

added it to his own observations made while leading the Comisión del Marañón to survey the Amazon. Size of the original: 78 × 64 cm. Image courtesy of the Geography and Map Division, Library of Congress, Washington, D.C. (G5200 1796.R4 Vault).

emergence and refinement of a new type of cartography of the interior of the continent, not based on secondhand sources compiled by European geographers, but based on firsthand field experience of trained cartographers, Spanish military, and Spanish American Creoles. With local knowledge and using sophisticated equipment and techniques, these observers established the boundaries of Hispanic America.

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SEE ALSO: Madrid, Treaty of (1750); Society of Jesus (Rome); Spanish America; Ulloa, Antonio de, and Jorge Juan

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Boundary Surveying in Sweden-Finland. In the course of the seventeenth century the Swedish realm had expanded by the acquisition of extensive new territories. Skåne (Scania), Halland, and Blekinge were completely wrested from Denmark in 1679. The Öresund became the frontier between the two countries. From Norway, Sweden gained Bohuslän together with the two provinces Jämtland and Härjedalen to the east of the mountain chain running from north to south through the Scandinavian peninsula. On the other side of the sea, the Baltic provinces Kexholm län (county of Karelia), Ingria, Estonia, and Livonia and large areas in north Germany had become part of the realm and served as outposts of the empire. At the close of the century there were more than fifty fortresses and some forty redoubts guarding the country's frontiers to the west, south, and east. The dominions were linked together by a Baltic Sea that had become, in effect, a Swedish lake.

Following the Great Northern War (1700–1721), in the Treaty of Nystad (Uusikaupunki) (1721), Sweden lost Estonia, Livonia, and the area of Karelia and Ingria around the interior of the Gulf of Finland, where Czar Peter I had founded his new capital, Saint Petersburg. A boundary commission convened in 1722–23 with Major-General Axel von Löwen and Jacob Johan Faber as Swedish commissioners (Stockholm, Riksarkivet [RA], SE/RA/81007/3/3.3). In treaties of 1719 and 1720 Sweden lost Bremen-Verden to Hannover and parts of Pomerania and Stettin to Prussia.

After the Great Northern War a defensive policy was pursued in Sweden, but one party in the Diet (called the Hats), wanted revenge on Russia and hoped to recover the lost Baltic territories. They were able to launch the Russo-Swedish War of 1741–43, which, however, resulted in another Swedish defeat and the loss of additional Finnish territory. Following the Treaty of Åbo (Turku) (1743), yet another boundary commission was authorized, and by the conclusion of its work in 1761 it had produced at least twenty-two maps of the boundary (SE/RA/81007/3/3.4; Stockholm, Krigsarkivet [KrA], SE/KrA/0410/K/002–004). Krigsarkivet holds a leather-bound volume of thirty-three boundary maps by Filip Nordencreutz, the commander-in-chief of fortifications in Finland, who was taken prisoner by cossacks and killed (SE/KrA/0410/K/001 01–033).

The stretch of the border between Sweden and Norway that separates Østfold from Dalsland and Värmland is the longest in Europe and is supposed to be the oldest in the world, being largely uncontested since the tenth century. Boundary commissions in 1658, 1661, and 1690, including work by the surveyors Kettil Classon Felterus and Christofer Jakobsson Stenklyft, produced some nine maps of the boundary (SE/RA/81007/2/2.1–2.1). But it was not until the mid-eighteenth century that boundary commissions and the border treaty of 1751 led to mapping that established the national border in full detail. Of particular concern was the boundary in the far north, separating the Saami under Norwegian and Swedish sovereignty (elaborated in the Lapp/Saami Codicil). A printed map by Georg Biurman was the first to show the contentious areas along the whole border with the Saami villages (*Svea ock Göta riken med Finland ock Norland*, 1747; see fig. 324).

Three men from each country were responsible for the boundary mapping, while local manpower looked after the clearance work. The series of twenty-seven maps (at scales of between 1:20,000 and 1:22,000 for the southern parts of the border and 1:40,000 from Nasafjäll northward) have come to be known as the Marelius maps, because it is thanks to the land surveyor Nils Marelius that it became a very cohesive work of extremely high quality throughout (fig. 127). For a long time after they

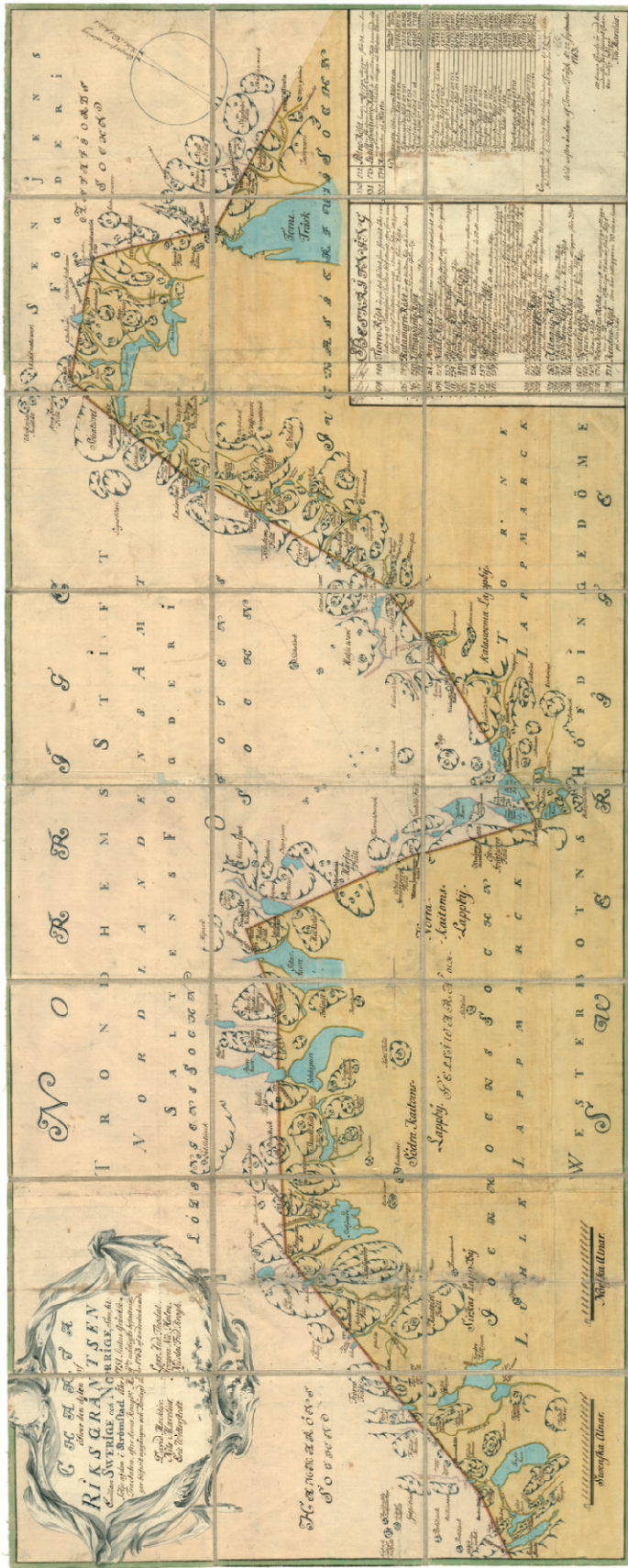


FIG. 127. NILS MARELIUS ET AL., "CHARTA ÖFVER DEN DELEN AF RIKSGRÄNTSEN EMILLAN SWERIGE OCH NORRIGE," 1763. Manuscript map, 1:40,000, part of a series of twenty-seven boundary maps 1752–66. The boundary between Sweden and Norway is delineated, showing boundary stones numbers 248–74, close to the northern tip of Sweden. Size of the original: 77 × 194 cm. Image courtesy of Krigsarkivet, Stockholm (SE/KrA/0400/26/038).

were drawn up, these maps served as the basis for later revisions of the Swedish-Norwegian border. Marelius was well-served by his second-in-command, engineer Kilian Ratkind (SE/RA/81007/2/2.4/2.4.3/2.4.3.1).

The Napoleonic Wars of 1792–1809 brought with them great changes for the European states. Sweden's refusal to join the Continental System embargo that Napoleon had proclaimed against the United Kingdom led to the Russian army attacking Finland in 1808. By November the Swedish army had evacuated the eastern half of the realm, and Finland and the Åland Islands were ceded to Russia in the 1809 Treaty of Fredrikshamn (Hamina). The Swedish realm had lost one third of its territory and one fifth of its population, and a new series of boundary surveys commenced in 1810.

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SEE ALSO: Sweden-Finland; Topographical Surveying: Sweden-Finland
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Boundary Surveying in Switzerland. Before 1798, the Swiss Confederation was a federation of thirteen sovereign cantons as well as localities and allied and subject territories. Its independence, which had existed de facto since 1499, had been recognized de jure in the Treaty of Westphalia signed at Münster in 1648. Every canton was more or less autonomous; only the common bailiwicks (Thurgau, Italian bailiwicks, etc.) were administered collectively by multiple cantons. When border disputes arose, Switzerland acted as one entity only for those territories. After the Thirty Years' War, not a single war was fought with a foreign country until the 1798 invasion by French troops. Military conflicts only occurred domestically, the most important of which were the two confessional civil wars of 1656 and 1712. Therefore neither major external nor internal border adjustments were made. Only in 1712 was the Freie Ämter in contemporary Aargau divided by a straight borderline that delimited the area in which the reformed Protestant cantons were to gain more influence. Boundary surveys in Switzerland thus generally entailed only the negotiation of disputed borders between parts of municipalities, as opposed to the boundaries with foreign countries or between cantons, departments, dominions, or municipalities. Only rarely did treaties define larger borderlines with any precision.

In the Swiss context, border maps are nearly all manuscript maps that serve to illustrate a text. They show the course of the border as a supplement to march (border) descriptions, serve as records for border negotiations, or constitute parts of border treaties. Text and map always form one unit; that is to say the text must always be taken into account when dealing with border maps. Border maps generally contain sketches of border markers and often contain figures on distances. Annotations can form parts of the maps to some extent; for example, they may contain indexes of border markers or the reasons for border disputes. In rare instances maps exist in which administrative division boundaries within a domain are closely detailed. As complements to border treaties, copies of survey schedules, plans in which territorial claims are depicted, and plans that depict the contractually fixed border are issued for all parties. The quality of border maps in Switzerland with regard to surveying and graphic techniques markedly improved during the eighteenth century.

On behalf of the city of Basel, Hans Bock and his son Niklaus drew over thirty plans of the borders of the territory of Basel from Gross-Hüningen to Augst on a scale of about 1:4,500 in 1620, of which seventeen have survived. In addition to the border markers, data on distances can also be found on these maps (Burckhardt 1906, 301–2).

Several border maps of smaller domains drawn by Hans Conrad Gyger exist, which subsequently constituted one of the bases of his large 1664–67 map of the territory of Zurich, *Einer loblichen Statt Zurich* (ca. 1:32,000) along with a *Marchenbuch*. This map details the boundaries of high courts (*Hochgerichtsgrenzen*) with gold dots and the boundaries of bailiwicks with red dots. Similarly, in 1688 Heinrich Peyer prepared thirty-one plans of all the borders of the territory of Schaffhausen in scales from 1:8,800 to 1:11,500. Moreover, he constructed a wooden model for each border marker (Wyder 2000).

Samuel Bodmer, a wealthy baker by trade who learned surveying as an artillery engineer, recorded the approximately 1,100-kilometer national border of Bern between 1705 and 1710 using step and simple angular measurement, although in so doing he made major mistakes. In 1714–17, he recorded the result in a four volume *Marchenbuch* of 1,007 pages (Martig 1995; Höhener and Klöti 2010, 23).

The landgraviate of Thurgau and the princely abbey of St. Gallen commissioned Daniel Teucher to ascertain the precise definition of their mutual boundaries. His map of the entire border on a scale of about 1:10,000 served as the basis for the border agreement of 1727. About 1730, Gabriel Hecht authored a border atlas of



FIG. 128. MANUSCRIPT MAP FROM THE SERIES SHOWING THE BOUNDARY BETWEEN THE THEN AUSTRIAN DUCHY OF MILAN AND SWITZERLAND, 1754. This is one sheet of sixteen and depicts the southernmost part of the region, the Canton of Ticino. The series was made in connection with the border treaty of Varese of 1752. On the left is a list of boundary stones (*dichiarazione de numeri*). This sheet title is “Tipo rappresentante la fissazione de termini territoriali fra Bizzarone, e Rodero della Pieue d’Uggiate Contado di Como, Ligurno, e Clivio della Pieue d’Arcisate Ducato di Milano confinanti con Nouazzano, Genestrerio, e Stabbio, e Ligornetto Stato Svizzero.”

The authors are the Milanese engineer Gaudenzo Portigliotti and the Swiss engineer Giuseppe Caresana, and the map is sealed by Ignazio Martignoni of Milan and the Swiss landvogt Gian Lodovico (Johann Ludwig) de Peyer. No sheets of the series are known to have been published. Size of the original: 59.5 × 88.0 cm. Image courtesy of the Staatsarchiv des Kantons Zürich (PLAN N 194).

sixty-one sheets (fifty-nine containing maps, two blank) detailing all borders of the princely abbey of St. Gallen on the same scale (Höhener 1992).

A conference was called in 1752 in Varese to solve the problems over the disputed border between the then Austrian duchy of Milan and the Swiss bailiwicks of Locarno, Mendrisio, and Lugano. At first, both parties presented maps showing their claims in the disputed areas. The Milanese used maps of the Milanese *censimento* dating from 1720–23. On additional maps of these areas drawn at 1:2,000, the newly agreed upon borderline was added to the existing lines of both parties. At last in 1754, sixteen maps notarized using seals from both sides were added as supplements to the border treaty. They were drawn at 1:8,000 under the supervision of

engineers Gaudenzo Portigliotti for the Milanese and Giuseppe Caresana for the Swiss (fig. 128).

Between 1762 and 1768, the border was adjusted between the cantons of Bern and Solothurn, about which ambiguities had arisen in many places. Geometricians Johann Joseph Derendinger and Johann Abraham Visaula produced eighty-five plans on a scale of 1:3,000 that record the precise course of the border amidst a small strip of adjoining terrain with great exactitude.

HANS-PETER HÖHENER

SEE ALSO: Switzerland; Topographical Surveying; Switzerland
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British America. Britain's initially hesitant and sporadic interests in America consolidated rapidly after 1650. After a century of imperial expansion at the expense of native peoples and other colonial powers—the period of growth was neatly bracketed by the annexations of New Netherland (1664) and New France (1763)—the British controlled widely diverse colonies stretching along the entire Atlantic seaboard from Labrador and Hudson's Bay in the north to the West Indies and the littoral of the Caribbean in the south. At both geographical extremes, these colonies possessed simple economic foundations: resource extraction (fish and furs) sustained relatively low levels of European immigration in the northern colonies, such as Newfoundland and Québec (formerly New France); plantation monoculture (sugar), sustained by the massive importation of African slaves, supported the colonies around the Caribbean, such as Guyana, and on the many West Indian islands, notably Jamaica. Between them lay the economically diverse and more demographically balanced thirteen colonies that would, after 1776, break away from British rule to form the United States of America, while the remaining regions of Canada, islands in the West Indies, and establishments along the Caribbean coast and South America remained in British hands. The geography of British America is well illustrated and discussed by D. W. Meinig (1986).

The distinctiveness of the several colonies has promoted a fragmented historiography, as historians each study a specific colony or region. In Canada and the West Indies, historians have treated the colonies only as the prelude to their later imperial incarnations and to the eventually independent states. In the United States, historians further developed a master narrative in which the frontier experience in the thirteen original colonies purified British culture such that it became uniquely and exceptionally "American" and could triumph over

nature, native peoples, and Old World tyranny. In reaction, British (and some U.S.) historians wrote the history of the formation and loss of the "first British empire" from the point of view of developments within the British metropol. After 1945, however, increasing interest in economic, demographic, environmental, and world history led scholars to discard their nationalistic parochialism and instead to understand early British America as an arena of great geographical and sociological diversity (effectively summarized by Meinig 1986 and Taylor 2001). The growth of Atlantic history further reconstituted British America as comprising a series of regional networks intertwined with others of transatlantic and global reach.

The historiography of cartography in British America has recapitulated the same fragmentation as colonial history, but it has done so within a general narrative of the inevitable progress of Western science, civilization, and cartography. Empire and mapmaking were seen to march forward in lockstep after 1600. Mapping activities in British America were understood through a simple and direct model of information transfer from America to London, from manuscript surveys and journals in the colonies to printed maps issued in the metropol. Assuming print to be the sole effective medium for disseminating knowledge, historians used printed geographical maps (almost all prepared as commercial products in London) to trace the progress of British exploration, discovery, settlement, expansion, and territorial control in the colonies (Brückner 2011). Within this general framework, scholarship was aligned according to the same modern nationalistic divisions that fractured general historiography. Through exhibitions, cartobibliographies, and general narratives, historians defined sequences of geographical maps to trace the progressive transformation of undifferentiated continental spaces into modern regions, provinces, and states (e.g., Ruggles 1991; Kershaw 1993–98; Cumming 1998; McCorkle 2001). Furthermore, U.S. scholars replicated the general historiography by recasting map history in terms of the development of an American identity and an autonomous agency for the colonial settlers. In particular, the sporadic instances of map printing in North America were seen to mark the transfer of European civilization to the New World, while the revolution and independence formed the inevitable culmination of general narratives (e.g., Winsor 1884–89; Fite and Freeman 1926; Cumming 1974; Pritchard and Taliaferro 2002, 54–311).

Since 1980, map historians have steadily abandoned their traditional fixation on the maps made of the colonies, wherever produced, and have begun to address the cartographic work accomplished within the colonies themselves. This new work points to a multiplicity of early American cartographies (Brückner 2011). To begin



FIG. 129. CYPRIAN SOUTHACK, TO HIS EXCELLENCY SAMUEL SHUTE ESQ^R. . . . THIS CHART IS MOST HUMBLY DEDICATED & PRESENTED (BOSTON, 1717). Southack, captain of the *Massachusetts Bay* galley, made this map to promote the message of Governor Robert Hunter, before the New York legislature in June 1716, about the threat

posed by encirclement by the French. Southack drew and labeled the French forts in the continent's interior but downplayed the extent of British settlement on the map by labeling them with only numbers keyed to the index at lower right. Size of the original: 68.0 × 76.8 cm. Image courtesy of the John Carter Brown Library, Brown University, Providence.

with, there were significant temporal variations in the degree of mapping activity in British America. Mapping activities were generally sporadic and unsustainable in the colonies before 1714. Thereafter—with increasing demographic, economic, and political stability—property and regional maps became an ever more pronounced element of colonial life. Through the eighteenth century, mapping endeavors increasingly underpinned the expansion and consolidation of British power in Amer-

ica, the imperial conflicts between the British and other European powers, and British encounters and negotiations with indigenous peoples (e.g., Lennox 2011; Mapp 2011).

Spatially, mapping activities differed among groups of colonies. In particular, the plantation economies of the Caribbean and southern mainland colonies emphasized the production of large-scale maps of plantations and the importation of other kinds of maps from the

metropol. More profound spatial variations lay between the coastal and interior settlements. The patterns of map production, circulation, and consumption align with social and spatial distinctions drawn by David D. Hall (1996, 151–68) and Stephen J. Hornsby (2005). Hall distinguished between elite and traditional forms of literacy. Hornsby distinguished between three economic regions: the resource extraction of the interior American frontier; the Atlantic, dominated by merchants and mariners from Britain itself; and the strip of coastal ports (e.g., Boston, New York, Philadelphia, Charleston) that connected and mediated between the two. Thus, colonial merchants, ship captains, royal officials, lawyers, and major planters were concentrated in the coastal centers and participated in the transatlantic circulation of capital, people, goods, and knowledge; they read widely among imported printed materials, and some of their own maps and writings accompanied their exports across the Atlantic world and to London. By contrast, settlers, slaves, and native peoples in the interior participated in small local networks of exchange within each port's hinterland; if they read at all, they read the few locally produced works, both manuscript and print, and their own writings did not circulate beyond the ports.

Most cartographic activities in British America were undertaken by or for members of the coastal elites. They actively circulated geographical maps, overwhelmingly of the colonies themselves. By the 1750s, when the economies of the central colonies had grown sufficiently sophisticated to support a public sphere of cultural and political exchange, the coastal elites became the mainstay of the trade in printed geographical maps and urban plans, whether imported from Europe or published locally. And government officials commissioned a variety of geographical maps, topographical plans of fortifications and estuaries, and surveys of the boundaries between colonies. All members of the coastal elites participated in the property market, especially as a hedge against the inflation endemic to the colonial currencies.

The interior settlers were much less cartographically engaged than the coastal elites. If they dealt with any maps, it was most likely to have been with property plans, yet their practices in producing and consuming manuscript property plans were nonetheless regulated by the coastal elites who invested heavily in frontier lands (Benes 1981, xv–xvi). It is in property mapping that we find the most obvious cartographic role for the interior settlers. Despite the new appreciation of native sources and of the importance of native agency in mapping (e.g., Lewis 1998), the cartographic activities of native peoples within British America remains largely unexamined; it is nonetheless clear that at least some native groups adopted European practices of property mapping in an effort to resist encroachments (Pearce 2004).

There was relatively little marine charting within the colonies. More precisely, there were only occasional efforts by colonial-based mariners to inscribe their own knowledge about the coasts in pilot books and charts (fig. 480 shows a rare instance). Colonial mariners used charts made in London as part of a system dominated by the metropol.

Thus mapping in British America had no common or consistent character. The cultural and economic divisions within and among the colonies and regions prevented the formation of an independent British American cartographic culture. In the early eighteenth century, the coastal elites of the mainland colonies shared a sense of unity based on a common fear of being surrounded by the French. This sense was occasionally expressed in locally produced geographical maps, from Cyprian Southack's 1717 wall map of the eastern part of North America (fig. 129) to Benjamin Franklin's 1754 political cartoon map (fig. 130). But the 1763 annexation of New France removed the common threat from British Amer-

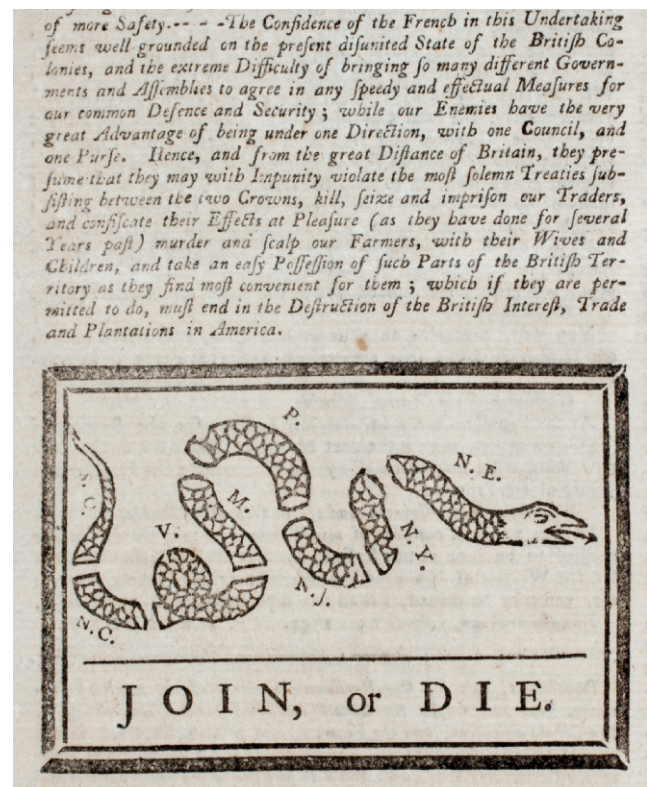


FIG. 130. BENJAMIN FRANKLIN, "JOIN, OR DIE," *PENNSYLVANIA GAZETTE* (9 MAY 1754). In the woodcut engraving the divided snake represented the mainland British colonies from "N.E." (New England) to "S.C." (South Carolina) and accompanied Franklin's political statement of the importance of unity in the face of the French threat to British America on the eve of the Seven Years' War. Image courtesy of the American Antiquarian Society, Worcester. © American Antiquarian Society.



FIG. 131. WILLIAM DOUGLASS, *THIS PLAN OF THE BRITISH DOMINIONS OF NEW ENGLAND IN NORTH AMERICA* (LONDON, [1755]). Douglass fitted the surveys of New England towns to surveys of the lines of colonial boundaries and presented the whole as if it were the product of a single regionwide survey. It remained unfinished on his death in October 1752, and his nephew Cornelius eventually

had it printed in London in mid-1755; it was then used as the basis for John Green's *Map of the Most Inhabited Part of New England* (London: Thomas Jefferys, 1755). Size of the original: 93 × 102 cm. (in four sheets). Image courtesy of the Geography and Map Division, Library of Congress, Washington, D.C. (G3720 1753 .D6 Vault).

ica and with it the sense of territorial unity. Indeed, the revolutionary sentiments that subsequently flourished in the colonies' nascent public sphere lacked geographical expression: other than the sporadic repackaging of Franklin's motif of the divided snake (Cook 1996), geographical maps were absent from colonial political rhetoric.

Mapping activities in British America were not simply

less stylistically or technically refined versions of those in Britain. Although the colonials drew extensively on metropolitan mapping traditions and consumed geographical maps and marine charts imported from Europe, their cartographic practices diverged significantly. In the West Indies and the southern mainland, the estate maps fostered by a plantation economy were remarkably similar in form to those of Britain; elsewhere in

British America, property mapping was geared more toward creating property. Less dense settlement and less intensive land use resulted in a particular plain style that required less sophisticated instruments to achieve. The delineation and maintenance of boundaries between the mainland colonies entailed more cartographic activity than similar work in Britain. Boundary surveys applied the techniques of property surveying at regional scales. Hybrid regional maps of the mainland colonies created from boundary and property maps combined two otherwise distinct cartographic modes. Maps such as William Douglass's plan of New England, published posthumously in 1755 (fig. 131), might appear to validate the traditional narrative of cartographic progress, in which smaller-scale abstractions give way to extensive surveys (Edney 2003, 166–72), yet such a hybrid regional map was clearly a distinct and specific formation of the colonial experience and not a product of an ill-defined civilizing force.

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SEE ALSO: Administrative Cartography; Boundary Surveying; Geographical Mapping; Great Britain; Hudson's Bay Company (Great Britain); Map Trade; Property Mapping; Revolution, American; Topographical Surveying; Trade and Plantations, Board of (Great Britain); United States of America; Urban Mapping; Utrecht, Treaty of (1713)

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Buache, Jean-Nicolas. Born at La Neuville-au-Pont (present-day Marne) on 15 February 1741, Jean-Nicolas Buache (often called Buache de la Neuville by contemporaries) was the nephew of Philippe Buache and the cousin of Charles-François Beautemps-Beaupré twice over (their mothers were sisters, Marie-Claude and Marie-Catherine Collin; and Jean-Nicolas married their mutual cousin, Marie-Louise Collin, who was his uncle's daughter). This extended family of Buache (Delisle)–Collin–Beautemps-Beaupré may be considered one of the most important dynasties of French geographers, with the transmission of knowledge occurring essentially within the family (Chapuis 1999, 274–81, 762–64). In 1751, Jean-Nicolas was sent to his relative Marc-Dieudonné Collin, who kept a private secondary boarding school at Picpus on the outskirts of Paris. After receiving the core of his education, Buache taught there himself before joining his uncle Philippe in geographic work. From 1 January 1762, Jean-Nicolas visited Philippe regularly at Versailles, preparing maps for the lessons of the future Louis XVI, Louis XVIII, and Charles X. After Philippe's death (1773), Jean-Nicolas inherited his Paris shop and purchased his geographic collection. Jean-Nicolas had just published his *Géographie élémentaire* (Buache 1772), based on the course he had given at Picpus. He placed astronomy and mathematics at the forefront of geographical concerns, which was contrary to his uncle's point of view. Moreover, by

taking an interest in the Northwest Passage, he continued a long tradition of the Delisle and Buache families, and not without repeating some of their errors. These large geographic questions—marked by considerations of strategy, ego, and national prestige, often within the framework of a French-British rivalry (with Alexander Dalrymple in particular)—lay at the heart of his preoccupations, as demonstrated by his communication on the Solomon Islands, presented to the Académie des sciences in January 1781 and about which he was still arguing when Charles-Pierre Claret de Fleurieu took up the problem in 1790.

In 1775, Jean-Nicolas Buache entered the *Dépôt des cartes et plans de la Marine*, where he ran the *Entrepôt général*, created on 30 September 1776 for the sale of maps and other works. He became *premier ingénieur hydrographe*, the title used in those years for the *ingé-*

nieur hydrographe de la Marine, on 1 October 1779 (kept secret until 1 April 1789), and *garde adjoint* (administrative and financial vice-director) in May 1780; shortly afterward (5 June), he sold his private map business to Jean-Claude Dezauche and also handed over to him the management of *Entrepôt général* in the same year. In 1782, Buache replaced Jean-Baptiste Bourguignon d'Anville, who had died, at the Académie des sciences and followed d'Anville as *premier géographe du roi*, becoming the last to hold that prestigious title. Named geography professor of the Dauphin in February 1783, in the spring of 1785 he was entrusted to prepare maps for Jean-François de Lapérouse (fig. 132). After some difficulties under the Terror (Chapuis 1999, 465–66, 569–73), he was confirmed as *hydrographe de la Marine* and *conservateur* of the *Dépôt* on 26 August 1795. He was the only geographer in the Bureau des



FIG. 132. DETAIL FROM THE MAP OF THE PACIFIC OCEAN PREPARED FOR JEAN-FRANÇOIS DE LAPÉROUSE'S EXPEDITION, [JEAN-NICOLAS BUACHE] (PARIS, 1785). Manuscript map in six sheets, ca. 1:10,000,000. Prepared by Buache with Charles-François Beautemps-Beaupré as designer and under the direction of Charles-Pierre Claret de Fleurieu, this map of the Pacific Ocean was prepared in three sections (northern, equatorial, and southern) of two sheets each, or six large (*grand-aigle*) sheets for the whole chart. Only five copies were made, destined for the two commanders of the ships for the expedition of Lapérouse, for the naval minister

Charles-Eugène-Gabriel de la Croix, marquis de Castries, for Fleurieu, and for King Louis XVI. This document compiles the best information about the Pacific Ocean known after the three voyages of James Cook, whose routes are shown. Detail shown is from the equatorial section with Hawaiian (Sandwich) Islands upper right and a portion of Australia (Nouvelle Hollande) lower left.

Size of the original section: 59.5 × 182.0 cm; size of detail: ca. 46.5 × 75.0 cm. Image courtesy of the Bibliothèque nationale de France, Paris (Cartes et plans, Ge SH 18E pf 174 P. 1/2, vue 2).

longitudes, established on 25 June 1795, and in the same year became professor of geography at the newly formed École normale and member of the equally new Institut national, successor to the royal Academies. Until his death on 21 November 1825, he published relatively little but was influential in the activity of institutions (he imagined the future Société de géographie as early as 1785), guaranteeing the continuity of the hydrographic service of France, especially in maintaining collections and improving the quality of map engraving. In this domain with the engraver Étienne Collin, as in other sectors of the Dépôt, he had promoted members of his brilliant family (Chapuis 1999, 569–73).

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SEE ALSO: Geographical Mapping: France; Map Trade: France

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Buache, Philippe. Philippe Buache was born in Paris on 7 February 1700 to a family from the Champagne region. Artistic at an early age, he studied mathematics and fine arts under the supervision of Robert Pitrou, future inspector of the Ponts et Chaussées. In 1721, he received a grand prize in architecture for a church plan, but, influenced by Guillaume Delisle, he preferred geography and entered into the newly founded Dépôt des cartes, plans et journaux de la Marine. After Delisle's death, his widow wanted Buache to continue her late husband's work, because he "knows even more about geometry and astronomy than one asks of a geographer" and has "a deep understanding of M. Delisle's method and of his principles in mapmaking" (Fréret 1726, 490–91). In 1729, Buache married Delisle's daughter Charlotte and, like his deceased father-in-law, became *premier géographe du roi*. The following year, a geographer position was created for him at the Académie des sciences. In 1737, he left the Dépôt and began publishing his own maps at the quai de la Mégisserie, on the right bank of the Seine, near the Pont-Neuf; in 1745, upon the death of his mother-in-law, who bequeathed to him Delisle's stock of copperplates from which Buache sold new pulls, he moved to the opposite bank, on the quai de l'Horloge. During the 1750s and '60s, he devised a geographical curriculum through maps for the Dauphin's sons: the Duke of Burgundy and his three brothers, later Louis XVI, Louis XVIII, and Charles X. Buache died

in Paris on 27 January 1773 (Lagarde 1985, 21–22). The Delisle-Buache cartographic resources were sold to Jean-Claude Dezauche in 1780.

One of the great *géographes de cabinet* of the eighteenth century, Buache used documents from the Dépôt de la Marine and the Delisle collection. His work at the Dépôt responded to the needs of navigators with maps of the Mediterranean and of the North Atlantic, or following family tradition with a new map of the Gulf of Mexico, or studies on the declinational variations of the compass. During the 1730s his position at the Dépôt became preminent: he reported directly to the *ministre de la Marine* and even developed a publication program, which certainly aroused the jealousy of his colleague Jacques-Nicolas Bellin (Pelletier 2007, 563).

Like his scientific contemporaries, Buache was a systematic thinker, and the Académie des sciences supported his work, which highlighted physical, terrestrial, and marine geography. In a report presented to the Académie in 1752, this former architect viewed the tall mountain ranges that traversed the globe over land and under water "as the girders of the different parts of the globe." To delineate these ranges, he relied upon "the sources of rivers, which naturally indicate the tallest mountains and the highest ground," and he looked to islands, reefs, and rocks as indicators of the existence of underwater mountains (Buache 1756, 401). As an illustration of this theory, he showed his map of the English Channel (fig. 133), already presented to the Académie in 1737, on which he had introduced contours (isobaths) (Lagarde 1985, 23–24).

Buache combined theory with practice. He studied the Seine and its tributaries, which were important waterways to the provisioning of Paris: he noted the river's levels, observed the flood of 1740, and engaged in surveying operations in the capital, attentive as always to land and underwater relief. Around 1730, he prepared a "Carte géographique et physique du bassin de la Seine," completed in 1766, but never printed. On it the various basins are separated by "mountain ranges"—in reality the sills of the basins—which provided useful knowledge for digging new canals and which also appear on the *Carte physique ou Géographie naturelle de la France*, presented to the Académie des sciences in 1744 and published in 1770. In 1749–50, he created a geometrical plan of the city of Paris, also unpublished. In 1743, Buache proposed to the Académie des sciences the formation of a series of maps of the kingdom, a project judged to be interesting. In 1748 he agreed to edit the map of Languedoc, prepared for the États du Languedoc, but the latter subsequently had to have César-François Cassini (III) de Thury's *ingénieurs* resurvey the area.

Buache followed news of explorations closely, which stimulated new ideas. In 1739, he drew the map showing Jean-Baptiste Charles Bouvet de Lozier's voyage to



FIG. 133. PHILIPPE BUACHE, CARTE PHYSIQUE ET PROFIL DU CANAL DE LA MANCHE ET D'UNE PARTIE DE LA MER DU NORD. Engraved in copper by F. Desbruslins; from Buache 1756, pl. XIV. The basins of the Seine and Thames are shown; isobaths are drawn with the depths given in fathoms for the English Channel and the North Sea. Across the top a cutaway view represents the terrain of the sea floor, matching the isobaths of the map below.

Size of the original: 25.2 x 34.0 cm. Image courtesy of the Department of Special Collections, Memorial Library, University of Wisconsin-Madison.

FIG. 133. PHILIPPE BUACHE, CARTE PHYSIQUE ET PROFIL DU CANAL DE LA MANCHE ET D'UNE PARTIE DE LA MER DU NORD. Engraved in copper by F. Desbruslins; from Buache 1756, pl. XIV. The basins of the Seine and Thames are shown; isobaths are drawn with the depths given in fathoms for the English Channel and the North Sea. Across

the Southern Hemisphere and, in 1754, he added his own theories, presented in a 1757 report. Buache's contribution to the growing myth of the Sea of the West (near the west coast of North America) drew criticism from Didier Robert de Vaugondy.

Buache could be reproached for exploiting his father-in-law's fame and for allowing himself to develop some rash hypotheses. Far from being idle, he thoroughly explained his proposals, as the numerous memoirs that he presented to the Académie des sciences demonstrate. These memoirs are supported by a lucid cartography that reveals his blossoming talent for drawing; today, he would be called an excellent "communicator."

MONIQUE PELLETIER

SEE ALSO: Delisle Family; Dépôt des cartes et plans de la Marine (Depository of Maps and Plans of the Navy; France); Geographical Mapping: France; Heights and Depths, Mapping of: Isobath; Marine Charting: France; Sea of the West; Thematic Mapping: France

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Bugge, Thomas. Thomas Bugge was born in Copenhagen on 12 October 1740 and died in the same city on 15 January 1815. He completed a degree in theology at Copenhagen University in 1759. But he had also studied pure and applied mathematics under Christen Hee, and his career focused on astronomy and cartography. He became a leading figure in Denmark, as a scientist, teacher, and administrator. Einar Andersen's (1968) biography remains the main account of Bugge's life and work; Kurt Møller Pedersen and Peter de Clercq provide a useful summary (in Bugge 2010, IX–XIX).

In 1759, Bugge began assisting both Christian Horrebøw, director of the Copenhagen Observatory, housed atop the Rundetaarn (Round Tower), and Peder Koefoed, who was then undertaking a survey of Denmark under the auspices of the academy of sciences and letters, the Kongelige Danske Videnskabernes Selskab. On Koefoed's early death in 1760, Hee and Bugge submitted

an extensive plan for a continuation of Koefoed's work, inspired by the work of the Cassini *Carte de France* (Pedersen 1992, 96–97). The result was the first mapping of Denmark, Schleswig, and Holstein using trigonometry and astronomical operations. The academy formed a commission to take charge of the survey, but Bugge was the actual leader from 1762 until his death, although officially only from 1780. In this capacity he trained many Danish surveyors (Pedersen 1992, 101–2).

The academy elected Bugge as a member in 1775, and urged him to publish an account of the methods and results of his triangulation of Sjælland (Zealand): *Beskrivelse over den opmaalings maade, som er brugt ved de danske geographiske karter* (1779, German edition 1787), including a map of the survey (see fig. 264). He also wrote mathematical textbooks that included much information on geodesy, land surveying, and the construction of geographical maps (fig. 134).

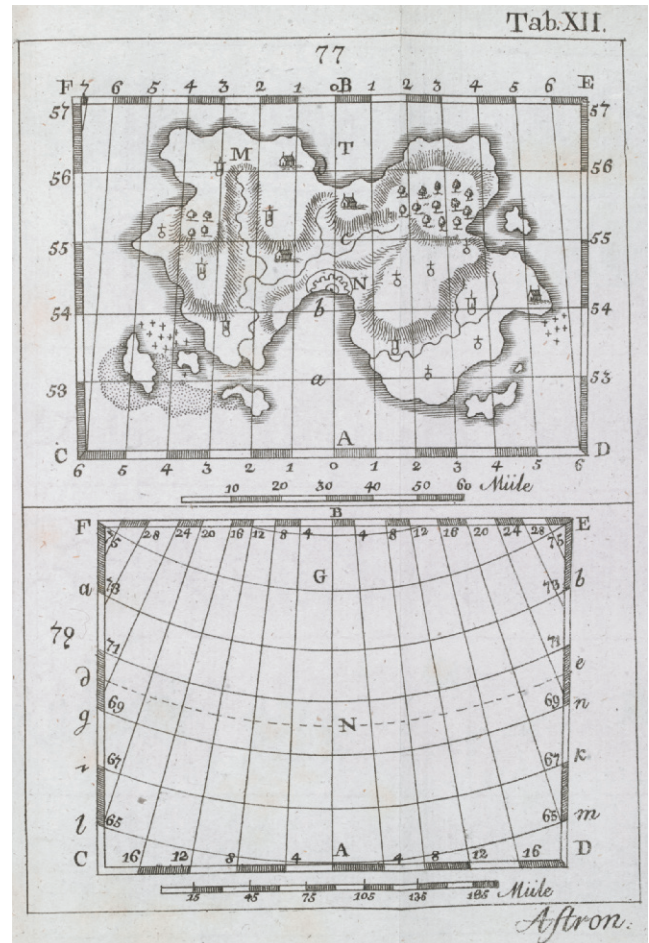


FIG. 134. THOMAS BUGGE'S EXPLANATION OF HOW TO DRAW A GEOGRAPHICAL MAP. From his *De første grunde til den sphæriske og theoretiske astronomie, samt den mathematiskke geographie* (Copenhagen: S. Poulsen, 1796), table 12.

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In January 1777, Bugge succeeded Horrebow as professor of mathematics and astronomy at Copenhagen University and as director of the observatory. The king committed substantial funds to refit the observatory, so that Bugge could integrate its work with that of the academy's survey (Pedersen 1992, 101). For most of 1777, Bugge toured the observatories and met instrumentmakers of Germany, the Netherlands, and Britain to learn the state of the field (Bugge 2010). He then took great pains to determine the latitude and longitude of the Rundetaarn as the basis of the national survey. He described his new instruments, made locally by Johan Ahl, and his observations in *Observationes astronomicæ annis 1781, 1782 & 1783* (1784).

As a knowledgeable, hard-working, practical man, and a good administrator, Bugge became overburdened with different administrative tasks, including serving three terms as rector of the university and, after 1801, as secretary to the academy. In 1798 he traveled to Paris to participate in an international conference on the metric system (1798–99), again keeping a journal of great historical importance. A member of several European academies, he kept up a lively correspondence with scientists throughout Europe. Unfortunately, his house, personal library, maps, and instruments were destroyed during the British bombardment of Copenhagen in 1807.

BODIL BRANNER

SEE ALSO: Geodetic Surveying: Denmark and Norway; Geographical Mapping: Denmark and Norway, with Topographical Mapping; Videnskabernes Selskabs kort (Academy of Sciences and Letters map series; Denmark)

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Büsching, Anton Friedrich. Anton Friedrich Büsching was born the son of a lawyer on 27 September 1724 in Stadthagen. After finishing grammar school in 1740,

he had the good fortune to be taken into private tutelage by Superintendent Eberhard David Hauber, the leader of the Lutheran church in the small principality of Schaumburg-Lippe. Hauber was a founder of cartographic history in Germany and awakened in Büsching a love of geography and cartography. Büsching studied theology in Halle and in 1748 became a home tutor for the family of a diplomat, Rochus Friedrich Graf zu Lynar. Büsching accompanied Lynar to St. Petersburg and to Copenhagen, where he again met Hauber, who had been pastor of the German Evangelical church there since 1746.

From 1754 to 1761 as professor of philosophy at the University of Göttingen, Büsching also taught geography. From 1761 to 1765, he served as pastor and school director of a German-speaking evangelical Lutheran congregation in St. Petersburg (*Petrigemeinde*). In 1766, he returned to Berlin to become director of high schools and chief councilor of the consistory (*Oberkonsistorialrat*), that is, a member of the church leadership in Prussia, as well as inspector of the kingdom's schools. He died on 28 May 1793.

Through translation, adaptation, and unauthorized copying, his multivolume *Neue Erdbeschreibung* (1754) became a handbook for European geography. It contained many maps, among them Daniel Friedrich Sotzmann's *Karte von Deutschland in XVI. Blätt* (1789) and *Karte von Polen* (Berlin 1793). Büsching also published one of the first geographic journals, *Magazin für die neue Historie und Geographie* (1767–93), and the *Wöchentliche Nachrichten von neuen Landcharten, geographischen, statistischen und historischen Büchern und Sachen* (1773–88) (Bond 2017).

JOACHIM NEUMANN

SEE ALSO: Geographical Mapping: German States; Geography and Cartography

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