

MAPMAKING BY THE LAST FLEET OF NEW SPAIN (1776-1778): PRODUCTION AND DISSEMINATION OF CARTOGRAPHIC AND GEOGRAPHIC KNOWLEDGE ABOUT THE EASTERN NOVO-HISPANIC COAST

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ABSTRACT – During the Enlightenment, the idea of scientific and political progress was closely related to geographic knowledge. In this context, in the second half of the 18th century, significant cartographic and geographic advances were made in Hispanic America, especially regarding its coasts. As a geo-historically dated social construction, this cartography reflects the political, military, economic and religious powers then active in the American territory. Indeed, military engineers and officers in the Spanish Royal Navy contributed to those cartographic advances through their practical experience and surveys, which were used, together with Creole knowledge, to improve previous work, to make later smaller-scale maps, to support shipbuilding projects and facilitate communications by sea across vast portions of Hispanic territories. With an eminently practical purpose and subjected to colonial political and economic interests, they succeeded in producing and disseminating geographic knowledge. This article studies the specific case of the Atlantic coast of New Spain during the stay of Antonio de Ulloa and members of the last Spanish Fleet of the Indies to connect the ports of Cadiz and Veracruz, between July 1776 and January 1778.

Keywords: Historical cartography; historical Geography of coasts; maritime routes; geographical interconnections.

RESUMO – A CARTOGRAFIA DA ÚLTIMA FROTA DA NOVA ESPANHA (1776-1778). PRODUÇÃO E DIFUSÃO DE CONHECIMENTOS CARTOGRÁFICOS E GEOGRÁFICOS SOBRE AS COSTAS LESTE NOVO-HISPÂNICAS. Durante o Iluminismo, a ideia de progresso científico e político estava amplamente relacionada com o conhecimento geográfico. Neste contexto, na segunda metade do século XVIII na América Latina, ocorreram significativos avanços cartográficos e geográficos, em particular no que diz respeito às suas costas. Enquanto construção social datada geo-historicamente, estes avanços cartográficos são reflexo dos poderes políticos, militares, econômicos e religiosos inscritos no território americano. Oficiais e engenheiros militares da Armada Espanhola contribuíram para essas melhorias cartográficas a partir de trabalhos de reconhecimento e experiências práticas, utilizadas, assim como o conhecimento de colaboradores crioulos, para melhorar trabalhos prévios, elaborar mapas em menor escala, apoiar projetos de estaleiros e facilitar as comunicações por mar entre amplas porções do território hispânico. A partir de uma finalidade eminentemente prática, sujeita aos interesses políticos e econômicos coloniais, conseguiu-se a produção e difusão de conhecimentos geográficos. Este artigo analisa de forma específica o caso das costas atlânticas da Nova Espanha durante a estada de Antonio de Ulloa e os restantes membros da última Frota espanhola das Índias que efetuou o percurso entre Cadiz e Veracruz, entre julho de 1776 e janeiro de 1778.

Palavras-chave: Cartografia histórica; Geografia histórica de costas; rotas marítimas; interconexões geográficas.

HIGHLIGHTS

- During the Enlightenment, the idea of progress was closely related to geographic knowledge.
- This scientific and practical knowledge laid the foundations for the development of modern thought.
- The geographic dimension is essential in the study of the process of historical evolution.
- Cartography, as a social construction, reflects the geo-historically situated power relations within a territory.
- Latin America and the Atlantic Ocean were laboratories of scientific experimentation and evidence of the global exchange of ideas.

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1. INTRODUCTION

In the second half of the 18th century, during the Enlightenment, significant cartographic and geographic advances were made in Hispanic America, especially regarding its coasts. Over this period, the idea of scientific and political progress was closely related to geographic knowledge (Heffernan, 1994; Livingstone & Withers, 1999). As a social construction (Harley, 2001), this 18th century cartography reflects the political, military, economic and religious powers in the American territory at that time.

The present study is set in the final period of the Spanish Fleet of the Indies (*Flota de Indias*). This navigation system, maintained for over two hundred and fifty years, was about to disappear owing to the liberalisation of trade with America promulgated by the Regulation and royal customs for free trade from Spain to the Indies, on 12 October 1778 (Pérez Herrero, 1987). In this setting of the transformation of the functioning of the Spanish Empire, which was interconnected by sea, this study focuses on the cartographic production of Fleet officers under the command of Antonio de Ulloa from 1776 to 1778, participants in the last Fleet of the Indies to connect Cadiz with Veracruz.

Spanish military engineers and naval officers played an outstanding part in the production and dissemination of cartographic and geographic knowledge of the coasts of America (Capel Sáez *et al.*, 1988; Moncada, 2018). These officers contributed to the transmission of the idea of scientific progress with the information they obtained in their transoceanic voyages and during surveys in America (Alonso Báquer, 1972; Moncada, 1993). In addition, the Atlantic circuit played a role in the transmission of ideas of human progress (Lambert *et al.*, 2006).

In his book about the representation of nature in the New World, Caraccioli (2021) argues that colonial Latin America was fundamental in the development of modern political thought, through the singular overlapping of politics, science and faith. For Caraccioli, the scientific advances made in America in the Enlightenment were based on previous political, philosophical and theological discussions in Europe. This emphasises the major role of America in international geopolitics in the 18th century.

In fact, the New World offered formidable potential for scientific development (García-Martín, 2018) that, however, posed clear conflicts with the interests of material exploitation. Additionally, following the approach of Caraccioli (2021), the study in Hispanic America of the geo-historical relations between political theories and science can help to understand the later emergence of significant issues, such as the destruction of ecosystems or indigenous and anti-slavery issues (Barrera de la Torre & Torre Villalpando, 2022; Castañeda, 2002; Cowling, 2018; Menjívar, 2006; Nemser, 2017; Urteaga, 1987).

2. GEOGRAPHICAL BACKGROUND AND HISTORICAL CONTEXT

This article aims to contribute to the study of geographical and historical processes in the acquisition of knowledge and understanding of the territory of Hispanic America during the Enlightenment. To be precise, the research focuses on the coasts of New Spain in the second half of the 18th century, through a critical review of the cartography of the eastern Novo-Hispanic coast produced by the military engineers and officers who worked under the orders of Ulloa in 1776 and 1778.

Therefore, the sources used for this purpose include the plans, nautical charts and hydrographic maps drawn by those professionals. The main purpose of their production was to defend the strategic Spanish possessions governed by the Bourbon monarchy against foreign powers and to support the organisation and control of New Spain. In their work, the mappers used information from several Creole cartographers.

Moreover, the work of these military professionals, who underwent strict academic training, contributed to the dissemination of geographic knowledge within the geographic and geodesic advances of the time. Consequently, their plans and charts are related to the history of geographic thought and can be framed within the field of historical geography (Moncada, 2003). Scientific and technical progress was the key to the development of increasingly precise cartography and this, in turn, to a better understanding of the Americas.

2.1. Sources and methodological approach of the research

The main part of the present study, focused on the years 1776 to 1778, is based on the cartographic and documentary sources related to the stay of the last Fleet of the Indies, commanded by Ulloa, on the eastern coasts of New Spain. In order to contextualise the study, a wider documentary and cartographic record was established from that initial search of sources.

This general collection of sources was assembled indirectly through the literature and directly in archives such as the *Archivo General de la Nación de México* (Naval Collection), the *Archivo General de Simancas*, *Archivo General de Indias*, Madrid Naval Museum, Spanish National Library and the library of the *Real Academia de la Historia*, whose catalogues and collections are now largely accessible online. Using this material, a database was created to synthesise the information and select the most significant texts, maps and plans that would allow an interpretation of the logic and interconnection of the documents and cartographic materials. This selection is discussed throughout the article. Their chronological correspondence with the period of study and the spatial and historical relevance of the places, projects and activities were among the criteria used for their selection.

The primary documentary sources include minutes of official dispatches, such as the one Bucareli sent to Ulloa on 12 September 1776, reporting that Miguel del Corral and Joaquín de Aranda were travelling from Mexico City to Veracruz to map the Alvarado and Coatzacoalcos rivers, letters like those Ulloa sent to the captain of the Port of Veracruz between April and October 1777, and such documents as the one dated between March and August 1777 about the most favourable times and conditions for the Fleet's return from the port of Veracruz to Spain.

Four types of cartographic sources can be differentiated: topographic maps of large areas of land and sea (such as those in figs. 2 and 6); maritime navigation and routeing charts (figs. 1 and 7); nautical charts and hydrographic maps with their adjacent coasts (figs. 3 and 4); and plans of cities and fortifications, like that of Veracruz (fig. 5). Several of these cartographic sources contain information that is not found in the documentary sources and often locate specific places and geographic features mentioned in documents and reports more precisely (water bodies, rivers, place names, etc.). This combination of documentary and cartographic sources enables an understanding, from complementary points of view, of historical and geographical processes of organisation and articulation of the territory in New Spain.

2.2. Crossing the Atlantic: The Spanish Fleet of the Indies and the Fleet of New Spain in the 18th century

The Spanish Fleet of the Indies was made up of a number of ships that followed different routes to connect the American viceroyalties with Iberian Spain, from the first decades of the sixteenth century to 1778. It was a complex system for the control and defence of the maritime trade of the kingdom of Spain, in the Iberian Peninsula, with its overseas territories, and formed a key element of the Spanish colonial maritime monopoly.

The ships in the Fleet of the Indies were dependent on two institutions: the Spanish Royal Navy and the Royal Consulate of the Shippers of the Indies. The latter was founded in 1543 by the *cargadores* or shippers, that is to say important merchants or wholesalers who loaded large volumes of raw materials and manufactured products in what was called the Career of the Indies between Spain and America (Díaz, 2018; Rodríguez-Lorenzo, 2016). This commercial monopoly was organised by the Contracting House which was based first in Seville and then in Cadiz (after May 1717) (Crespo, 2018). To supervise those activities, the Spanish monarchy depended on the Royal and Supreme Council of the Indies, with a legal and executive function but without a fixed headquarters or centre. In the 18th century this Council of the Indies underwent major reforms commissioned by the Bourbon monarchy (Escudero, 2005).

The Fleet of New Spain for that viceroyalty was established in the sixteenth century (Egoávil, 2023). By the late 18th century, the viceroyalty controlled large areas of Central and North America, as well as the island of Luzón and its capital Manila, in the Philippines. They were divided administratively into a complex division of Captaincy Generals (Yucatán, Santo Domingo, Puerto Rico, Guatemala, Cuba and Philippines), General Commands (in the east, with the provinces or governorships of Alta and Baja California, Nueva Navarra, Nuevo México (Barrett, 2012) and Nueva Vizcaya, and in the west with Nueva Philipinas, Nueva Extremadura, Nuevo León and Nuevo Santander) and Kingdoms (the Kingdom of Mexico included Veracruz, Puebla, Oaxaca and San Luis de Potosí while the Kingdom of Nueva Galicia was made up of Zatecas and Guadalajara) (Gerhard, 1972)ⁱ.

Since 1717, the Fleet of the Indies had sailed from the port of Cadiz, after the Contracting House and the Consulate of Shippers of the Indies moved there from Seville (Iglesias, 2017). In 1743, the Marquis of Ensenada, Zenón de Somodevilla y Bengoechea, was named head of the Ministries of State, Finance, War, Navy and the Indies, which involved major reforms in the regulation of trade with the Indies. They included measures to reduce contraband and fraud in the export of foreign goods from Cadiz and to increase control over customs duties (Heredia, 2022).

The routes used for those voyages and the positions of the merchant and war ships were recorded in numerous sea charts, formed by general maps and detailed plans that accompanied and illustrated the ships'

logs of squadron leaders and captains. One example is the map sent by the captain José Montero de Espinosa to the Marquis of Ensenada in a letter dated 23 April 1748, explaining the courses taken between Cadiz and Madeira (fig. 1). The map gives a schematic representation of the south-west coast of the Iberian Peninsula, the north-west of Africa, the south-east coast of North America, the Gulf of Mexico and the islands of Cuba and Hispaniola. The lower part shows the positions of the Spanish ships and the English squadron seen on 18 March of the same year.

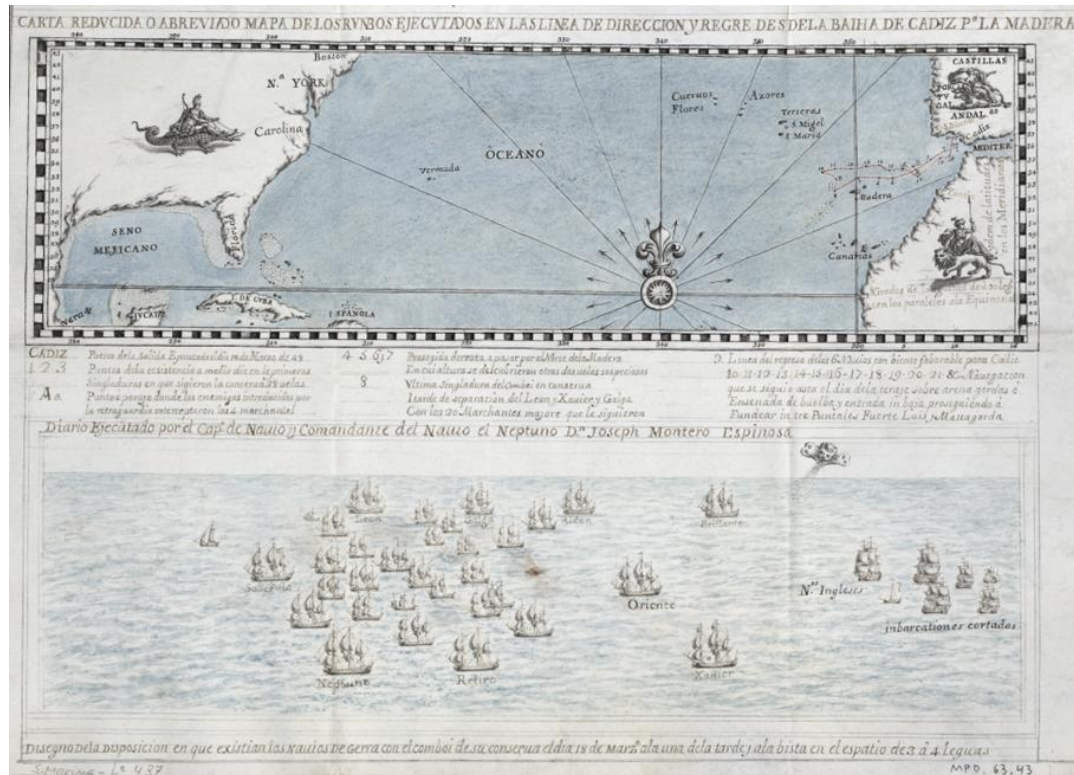


Fig. 1 – Reduced chart of the courses followed in the lines of direction and return from the Bay of Cadiz. Logbook of the Captain and commander of the ship *El Neptuno*, Don José Montero de Espinosa, in a letter to the Marquis of Ensenada, Cadiz, 23 April 1748.

Fig. 1 – Carta reduzida ou abreviado mapa dos rumos executados nas linhas de direção e retorno da Baía de Cadiz. Diário executado pelo Capitão de Navio e comandante do navio *El Neptuno* Don José Montero de Espinosa, em carta ao Marquês de la Ensenada, Cádiz, 23 de abril de 1748.

Source: Ministerio de Cultura. Archivo General de Simancas. MPD, 63, 043

After crossing the Atlantic, the Fleet of New Spain arrived at the port of Veracruz in the Gulf of Mexico. In addition, from 1565, although both routes were autonomous, the Manila Galleon, a group of ships that sailed each year between New Spain and the Philippines (Manila), provided access to Asia without taking the Portuguese route (i.e., sailing round Africa, the *Carreira da Índia*) as had been agreed in the Treaty of Tordesillas (1494). They left port from Acapulco and crossed the Pacific Ocean. In this way, for over two centuries a system of maritime communication was established on a world scale, which may be critically interpreted as an early globalisation process because it connected the continents of Europe, America and Asia by sea (Mombelli, 2018).

In this context, it can be said that coasts, seas and oceans constituted a challenge to geographical conceptualization and representations of the world. Hence the interest in studying historical cartography and the geographical thought related to these features.

From the mid-18th century, the Spanish elite in the maritime trade with America gradually adapted to the liberalisation process, which entailed a series of challenges to maintain Cadiz as the main commercial port in the Iberian Peninsula (Iglesias Rodríguez *et al.*, 2022). Political-administrative changes and conflicts in Europe worsened the crisis of the *Ancien Régime*, and contributed to the spread of liberal ideas and, subsequently, to the independence movements in America, which would be consolidated in the 19th century. In this regard, during the Enlightenment, the Atlantic Ocean acted as conduit for new scientific, economic, political and social ideas from Europe to America and vice versa (Rodríguez, 2010).

In connection with this general situation of change, several enlightened naval officers in the Spanish Royal Navy made significant scientific progress in geography. Some of these officers were commanded by Antonio de Ulloa.

2.3. A prototype of an enlightened officer at the head of the last Fleet of New Spain: Antonio de Ulloa and his geographical training

The Sevillian Antonio de Ulloa y de la Torre Guiral (1716-1795) is known for taking part in his youth, together with the naval engineer Jorge Juan y Santacilia, in the Franco-Hispanic Geodesic Mission to Quito in what was then the Viceroyalty of Peru. This expedition took place from 1735 to 1746, at the proposal of the *Académie Royale des Sciences* in Paris, in order to determine the exact shape of the Earth. As a result of this expedition, Ulloa and Juan were commissioned by the Spanish Government to carry out a detailed confidential diagnosis of the situation of those dominions of the Crown, as well as the condition of the indigenous populations, in order to put into practice a series of reforms. The instigator behind the reforms was the Marquis of Ensenada. These were proposed in a manuscript in 1749, titled *Discurso y reflexiones políticas sobre el estado presente de los Reinos del Perú, escritas de Orden del Rey Nuestro Señor. Por D. Jorge Juan, [...] y D. Antonio de Ulloa, miembros de la Real Sociedad de Londres, socios correspondientes de la Academia Real de las Ciencias de Paris y capitanes de navío de la Real Armada* [Archivo del Museo Naval de Madrid: AMN Ms.0483].

The contents and their critical analysis, the reflection of enlightened discontent (Silva, 2017), came to light nearly a century later, in the Spanish text published in London in 1826 by the editor David Barry, with the title *Noticias secretas de América sobre el estado naval, militar, y político de los reinos de Perú y provincias de Quito, costas de Nueva Granada y Chile. Gobierno y régimen particular de los pueblos de indios. Cruel opresión y extorsión de sus corregidores y curas: abusos escandalosos introducidos entre estos habitantes por los misioneros. Causas de su origen y motivos de su continuación por espacio de tres siglos* (Press of R. Taylor). New versions would later appear and achieve lasting notoriety for their criticism of the Spanish colonisation of America, like the one titled *Noticias secretas de América (siglo XVIII)* (Editorial América, 1918) by the Venezuelan writer Rufino Blanco Fombona (1874-1944).

The promotion of Ulloa in the Spanish Royal Navy was due to his scientific work, recognised by institutions like the Royal Society of London, of which Ulloa was a member. In Spain he was a driving force behind the *Real Casa de la Geografía y Gabinete de Historia Natural*, founded in Madrid in 1752, as an antecedent of the Royal Museum of Natural Sciences (Calatayud, 1986). In addition, from 1766 to 1768 he was the Governor of Louisiana.

Ulloa was at the head of the Fleet of New Spain, as commander or squadron leader, between 8 May 1776 when the Fleet sailed from Cadiz and 29 July 1778 when it returned to that port. It was the 18th Fleet to make that voyage in the 18th century, but above all, it was the last Fleet of the Indies to connect the Iberian Peninsula with the American viceroyalties (Newton, 1987; Walker, 1979). The royal order liberalising maritime traffic with America was published on 12 October 1778, three months after the Fleet's return to the port of Cadiz (Bernal, 1987). From then onwards, it was no longer compulsory to form Fleets for transoceanic trade and the monopoly of the port of Cadiz disappeared at the same time. This liberalisation benefitted different ports in the Iberian Peninsula, like Santander, which began its urban expansion (Pozas, 2015).

In 1776, Ulloa was 60 years old, with a long history in science but little experience in leading maritime convoys (Ferragut, 2017). Despite this, the Fleet he commanded transported one of the heaviest loads to cross from Cadiz to Veracruz in the 18th century (Lang, 1998). It was formed by 15 merchant ships and two ships of the Royal Navy; the flagship, the *España*, captained by José de Urrutia, on which Ulloa sailed, and the rearguard ship, the *Dragón* (Vázquez de Prada, 1968).

After passing the Canary Islands on 18 May and crossing the Atlantic below 20°N latitude, the ships followed the course to the north of Hispaniola, entered the Caribbean Sea by the Windward Passage and advanced along the Yucatán Channel. They reached Veracruz on 25 and 26 July 1776 (Orte-Lledó, 2006). When Ulloa set off in 1776, the viceroy of New Spain was the military officer Antonio María de Bucareli, appointed to the post in 1771, after being the head of the Captaincy General in Cuba. As viceroy (1771-1779), Bucareli conceived several naval projects for New Spain. One of the most significant was the creation of a navigable canal between the oceans through the Isthmus of Tehuantepec (Tlaxani-Segura, 2022), to improve the connection between the so-called North Sea and South Sea (Atlantic and Pacific Oceans). He also proposed founding a shipyard near the port of San Blas on the coast of Nueva Galicia (and later the *Intendencia* of Guadalajara) on the Pacific to encourage navigation on the west coast of New Spain, repair damaged ships and maintain an operative base to limit the expansion of Russian and English powers on the northern part of that coast. The maritime department of San Blas was founded in 1768. The choice of the

location was due to the existence of cedar, ebony and other timber suitable for shipbuilding on the banks of the River Santiago, which flowed into the sea a short distance to the north of San Blas (Pardo, 2008). Bucareli was also interested in reinforcing the port of Veracruz, the most important in New Spain, on the Gulf of Mexico, and finding an appropriate site on its coasts for a shipyard.

For all this, the viceroy relied on Ulloa's support, who had witnessed shipbuilding techniques at the French bases of Toulon, Rochefort, Lorient and Brest as well as at Prussian ports and arsenals (López-Vázquez, 2020). He had also taken part in the renovation of Spanish maritime bases, especially in the construction of the arsenal at Cartagena on the Mediterranean coast of Spain (Camarero, 1993) and at the shipyard and arsenal of La Carraca in Cadiz (Quintero, 2005). Moreover, the multifaceted Ulloa had participated in the work on the Canal of Castile (Helguera, 1995).

Against this background, during the nearly eighteen months of his sojourn in New Spain, Ulloa worked with the officers in his Fleet to draw sea charts, plans of coastal towns and hydrographic maps of the Novo-Hispanic Atlantic coast, especially of the port of Veracruz and surrounding area. Ulloa was equally interested in aspects of the geography, natural history, pre-Hispanic antiquities, mining, metallurgy and botany. He collected data using a questionnaire authorised by the Ministry of Indies and then drafted, following the previous tradition but including new methods and knowledge, a geographic account or description, of which several handwritten copies survive. Their contents, published in Veracruz (Ulloa, 1777), are structured in three geographic areas: settlements in the area around Veracruz and Guanajuato, the journey from Guanajuato to Pachuca, and Mexico City, the capital of New Spain.

One of these undated copies would form part of the compilation of documents made by the scribe Juan Bautista Muñoz y Ferrandis, named Higher Cosmographer of the Indies by King Charles III of Spain in 1770 and given the task of organising the General Archive of the Indies (*Archivo General de Indias*) in 1784. This copy of Ulloa's list, preserved in the Royal Academy of History in Madrid, was used by Francisco Solano (1979) together with the correspondence between Ulloa and Bucareli.

3. GEOGRAPHIC DATA AND CARTOGRAPHIC METHODS, THE CHANGING VIEW OF THE ENLIGHTENMENT

3.1. Hispanic America in cartography in the 18th century: the main precedents of the work of engineers and officers under the orders of Ulloa

The circulation, revision and correction of the cartography of America during the 18th century, in connection with scientific and mathematical advances (Capel Sáez *et al.*, 1982), can be regarded as evidence of the global exchange of ideas and geographic knowledge (Pinzón, 2022). At the same time, these maps were representations of power (Harley, 2001) and part of the imperial policy of the Spanish Crown, used to influence or increase commercial activities between Iberian Spain and the different viceroyalties.

As regards Hispanic cartographers, in 1764, Juan de la Cruz Cano, who had trained in France, began work his well-known *Geographical Map of South America*, on the commission of the first Secretary of State of the Spanish Crown, Jerónimo Grimaldi, when they were attempting to define the boundaries between Spanish and Portuguese territories. After several modifications, the work finished in 1775. Among other information, the studies and astronomical observations of Jorge Juan and Antonio de Ulloa during their aforementioned expedition to the Viceroyalty of Peru were used to create the map.

In the case of the Spanish possessions in North America, maps had been made between 1746 and 1768 by two Creoles born in New Spain, Antonio Villaseñor (born in San Luis de Potosí) and José Antonio de Alzate (born in Ozumba)ⁱⁱ. The latter map was “dedicated to the Wise Members of the Royal Academy of Science in Paris” who published it in 1775. To be precise, in the time of the viceroy Juan Francisco de Güemes (1746-1755), Villaseñor's map of New Spain (fig. 2) covered from 16°N to 34°N latitude and from 263° to 289° longitude from the meridian of the island of Hierro, the westernmost of the Canary Islands and one of the first and most used meridians, in order to set the longitude of any place, from the sixteenth century until the late 19th century (International Meridian Conference, held in Washington in 1884), when the use of the Greenwich meridian became widespread.

Villaseñor's map included the coast of the Gulf of Mexico from the Apalachee territory on the coast of Florida, the western point of the island of Cuba, the coast of Honduras and the Yucatán Peninsula. The part corresponding to the South Sea (Pacific Ocean) covered part of the peninsula of Baja California and the Sea of Cortés (Gulf of California) to Guatulco (Huatulco), near where three decades later Bucareli would propose the construction of the Tehuantepec Canal to connect the Pacific and the Atlantic.

This part of the isthmus was strategic for the Spanish Crown, because it was scarcely inhabited, distant from Veracruz and Mexico City, and intricate because of the abundance of water courses, natural canals and coastal lagoons.

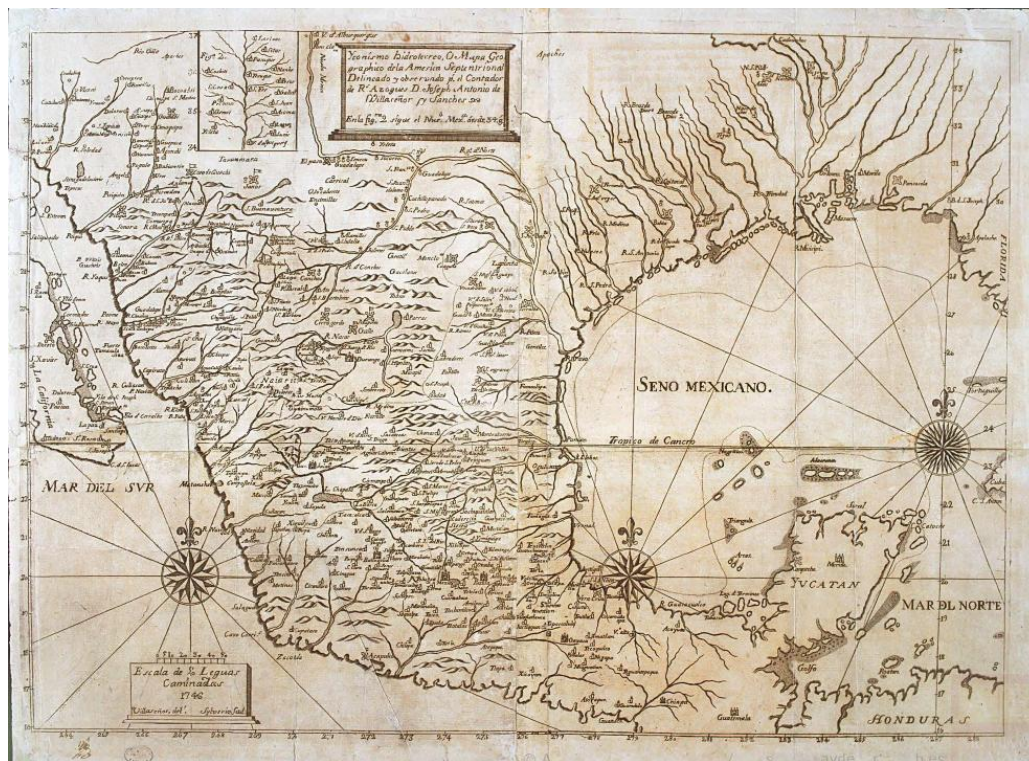


Fig. 2 – Geographical Map of North America. José Antonio de Villaseñor, ca. 1746.

Fig. 2 – Mapa Geográfico da América do Norte, ca. 1746.

Source: Archivo General de Indias. MP-MEXICO, 161

The map drawn in 1768, when Carlos Francisco de Croix was viceroy (1766-1771), by the priest Alzate covered from 13°N to 42°N latitude and from 249° to 285° longitude from the Hierro meridian. This map, of which different versions are known (García-Redondo, 2021), mentions the Province of Texas (*Provincia de los Texas*) for the first time, although the whole territory of Louisiana, whose name appears on the map, was left blank.

This French possession had been ceded to Spain in 1763 by the Treaty of Paris, in compensation for the losses in the confrontation with England and motivated by the so-called Family Pact between the French and Spanish monarchy. As noted above, Ulloa was the governor of Louisiana from 1766 to 1768. Furthermore, on Alzate's map, the coast of the Gulf of Mexico was traced as far down as Campeche and Términos Lagoon but does not include the Yucatán Peninsula as Villaseñor's map had done. On the Pacific coast, Alzate added the whole peninsula and Gulf of California, although from 32°/34°N (port of Todos Santos and port of San Diego) the coastline is imprecise and, as the map itself states, the delineation of this coast "has been drawn by the only reconnaissance made of it in the year 1602 by Sebastián Viscayno" (Rodríguez-Sala, 1995).

In 1770, also during the viceroyalty of Carlos Francisco de Croix, the military engineer Miguel Constanzó or Costanzó (Moncada 1994 & 2012), author of the 1768 plan of the port and new town of San Blas, drew the Reduced Chart of the Asiatic Ocean or South Sea, which was engraved in Madrid by Tomás López in 1771. This encompasses from 20° to 43°N latitude and from 242° to 268° longitude west of the Tenerife meridian, also called the Teide meridian.

It goes up the Pacific coast from Cabo Corrientes to the south of the port of San Blas, and further north includes the whole peninsula of California, including the Gulf of California or Sea of Cortés. Above the isthmus of California, the Bay of Todos Santos is in the centre of the map, and is followed by the ports of San Diego, Monterrey and San Francisco. As the map states, it was drawn based on previous documents, mainly the observations in the logbooks of pilots in the Royal Navy: those of Vicente Vila and Juan Pérez, who took part in Gaspar de Pórtola's expedition (Costanzó, 1770).

3.2. Geographic surveying during the stay of the Fleet in New Spain: the Gulf of Mexico and the Atlantic Ocean as laboratories of scientific geographical experiences

As stated above, from the beginning of the 18th century, military engineers and officers had been sent to the American territory to make maps, construct ports and forts, repair roads, etc. Many of them were graduates of the College of Military Engineers of Barcelona, opened in 1752, in order to train officers for the Royal Corps of Engineers (Capel Sáez, 1983). Previously, the College of Guardiamarinas was created in Cadiz in 1717, as a scientific training centre, and the Royal Institute and Naval Observatory in 1753. All the military engineers and officers who worked with Ulloa were related to both institutions (González, 2011).

Against this background, the data collected by Ulloa and officers in his Fleet aimed to complete and improve the existing cartography, through new systematic hydrographic mapping and the detailed delineation of different parts of the coast of the Gulf of Mexico, using astronomical observations and mathematical calculations (Moncada, 1990). This was for both scientific and practical purposes; that is, for administrative control and to facilitate navigation and commercial practices.

In correspondence from Ulloa to Bucareli, dated in Veracruz on 30 April 1777, he speaks of the intention of creating “the hydrographic plan of the coast from here to the north”, “[...] that is very important because the charts in this area are very faulty” (Solano, 1979, pp. 265-266, translation of original Spanish text).

Novo-Hispanic ports and maritime enclaves were subjected to imperial policies, in accordance with the interests of the home country. However, their later development gradually responded to their own physical, social and economic conditions (Ita, 2003). In 1776, Ignacio de Pazos, a trainee in the Royal School of Navigation, following Ulloa’s instructions, had drawn a sea chart of the coast and port of Veracruz, destination of one of the major trade routes of the Spanish Crown. It was dated on 24 September of that year; only two months after the Fleet had arrived at the port, which shows the speed with which the work was carried out (fig. 3).

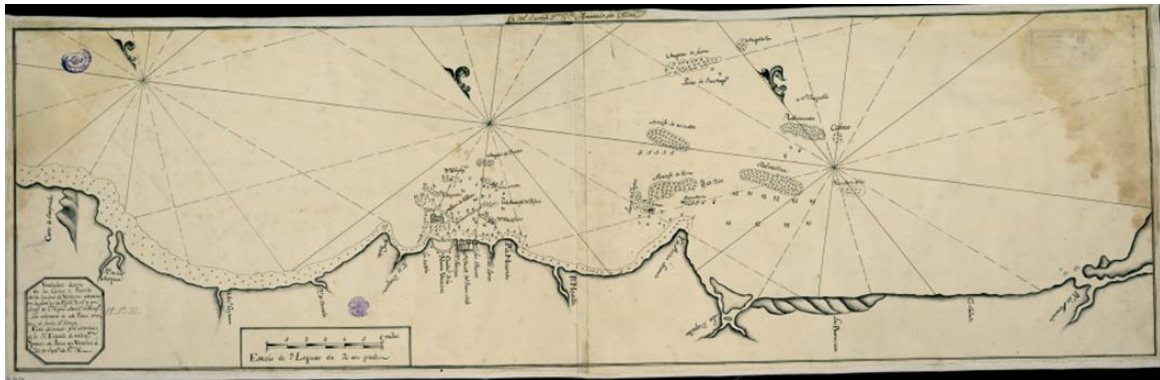


Fig. 3 – Nautical chart of Veracruz, 1776. Ignacio de Pazos on the orders of Ulloa.

Fig. 3 – Carta náutica de Veracruz, 1776. Ignacio de Pazos sob as diretrizes de Ulloa.

Source: Biblioteca Nacional de España. MR/43/119

The coastline, which is shaded, covers from the town of La Antigua or Old Veracruz, where the hill of Zempoala is marked, to the so-called River Alvarado (Alvarado Lagoon). Nearly in the middle of the chart, between Punta Gorda headland and Punta de Mocambo headland, at 19°10'N latitude and 276° longitude west of the Tenerife meridian, New Veracruz is represented by its wall and bastions. Outside the walls, the chapel of Holy Christ of the Good Voyage is drawn. To the south-east, the River Medellín (now called the River Jamapa) is located halfway towards the Headland of Antón Lizardo. Opposite New Veracruz, the castle or fortress of San Juan de Ulúa was represented. Of this Ulloa would say in his *Descripción geográfico-física de una parte de Nueva España* that it was “built on a placerⁱⁱⁱ that at low tide, the water covered about a foot or a foot and a half, and at high tide, four to five, depending on whether the tide rises more or less” (Solano, 1979, p. 18). Ulloa also noted that boats accessed the fortress of San Juan de Ulúa by the south-west, as it was impossible to reach it on the other sides. As nautical elements, the chart includes soundings, anchorages and bars, and the main reefs and islands, as well as navigation courses.

During 1777, Sebastián Canel, frigate lieutenant and first pilot of the *Dragón*, the rearguard ship in the Fleet, drew more sea charts and hydrographic maps of the coast of Veracruz, at Ulloa’s request. One of them, dated in September and structured with other fragments, extended from Tampico and Tamiagua

(Tamiahua) lagoon in the north to the port of Veracruz, and the point and reefs of Antón Lizardo in the south (fig. 4).



Fig. 4 – Hydrographic map from the Port of Veracruz to Tampico, 1777. Sebastián Canel.

Fig. 4 – Mapa hidrográfico do Porto de Veracruz até Tampico. Sebastián Canel.

Source: Biblioteca Nacional de España. MR/43/117

This hydrographic map was accompanied by an inset with a long description of that part of the coast, which in the stretch from Tampico to Veracruz was described as clean and nearly all of sand, forested with dense shrubs and small trees. The abundance of streams was also noted and the fact that, on clear days, the inland mountains were visible from the coast. Throughout 1777, along this stretch of the Veracruz coast, Canel drew specific sea charts of islands like Blanquilla Island at $21^{\circ} 50'$ N latitude, reefs like the one at Tanhuijo at $21^{\circ} 22'$ N, and cliffs and bays like those at Bernal at $19^{\circ} 42'$ N. Previously, in June 1777, also on the orders of Ulloa, Canel drew the map of the port and city of Veracruz, showing the gates and defensive bastions, the parish church, the Navy Hospital, the Town Hall (*Casa del Cabildo*) and Governor's House, several convents and squares and the Jesuit's college. The Castle of San Juan de Ulúa stands out in the area of the reef (fig. 5).

Similarly, in the first half of 1777, Miguel del Corral, colonel in the Corps of Engineers, and Joaquín de Aranda, frigate captain and head pilot of the Fleet, were appointed by Ulloa to carry out a reconnaissance of the sand banks at the mouths of the Rivers Alvarado (Papaloapan) and Coatzacoalcos, in the Gulf of Mexico. Later, on Bucareli's direct orders, Corral and Aranda drew a map called *Descripción Geográfica de parte de la costa del Seno de México* (Geographical Description of part of the coast of the Gulf of Mexico) (fig. 6). It covers the area of the isthmus between the so-called North and South Sea, from 15° to 20° N and from 278° to 281° west of the Tenerife meridian. The map, dated 16 July 1777, shows all the rivers and hills "placed with the greatest exactness by means of several astronomical observations".

Before that, on 25 June, Ulloa had written to José Gálvez, Minister of the Indies, to inform him of his arrival in Mexico City to direct the commission in charge of establishing the foundation of a shipyard on the coast of Veracruz. In turn, José de Gálvez sent a letter to Bucareli, dated in Madrid on 24 December 1777, announcing the delivery of plans of ships and of a naval engineer to begin building the vessels in the most appropriate place. The proposed location was Tlacotalpan (on the bank of the River Papaloapan, next to its mouth in the lagoon of Alvarado), where the soundings showed that it would be possible to build frigates for thirty or forty cannons. The area was also suitable for a shipyard because the nearby hills could provide timber for the ships.

Corral and Aranda's map includes Tehuantepec lagoon on the South Sea (Pacific Ocean), from where it was thought that the navigable canal connecting with the North Sea would start. It would make use of part of the course of the River Coatzacoalcos, which rises in the Sierra de Niltepec, in that strategic area of the isthmus.

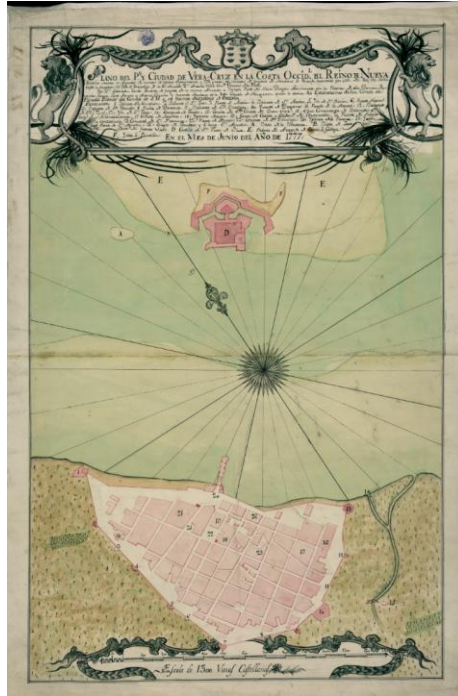


Fig. 5 – Plan of Vera Cruz, 1777. Sebastián Canel.

Fig. 5 – Plan de Vera Cruz, 1777. Sebastián Canel.

Source: Biblioteca Nacional de España. MR/43/23

After all these manuscript cartographic materials had been produced, the voyage home (*tornaviaje*) took place. The Fleet left Veracruz on 16 January 1778 for Havana, nearly a year after the date that had originally been set. Spain had been at war with Portugal (1776-1777) and Great Britain faced the rebellion of its Thirteen Colonies in North America (1775-1783).

Several ships and frigates captained by the general squadron commander, Juan Bautista Bonet, set sail from Havana to await Ulloa's Fleet and escort it to that port (Orte-Lledó, 2006). The rendezvous point was Tortuga Bank (*Sonda de la Tortuga*), after passing Cape San Antonio. Convoys were frequently attacked in this area in the 18th century^{iv}. The two formations met on 8 February 1778 and entered Havana on the thirteenth day of the month (fig. 7).



Fig. 6 – Geographical Description covering part of the coast of the Gulf of Mexico, 1777.

Miguel del Corral and Joaquín de Aranda.

Fig. 6 – Descrição geográfica que inclui parte da costa do Golfo do México, 1777. Miguel del Corral e Joaquín de Aranda.

Source: Biblioteca Nacional de España. MR/43/150

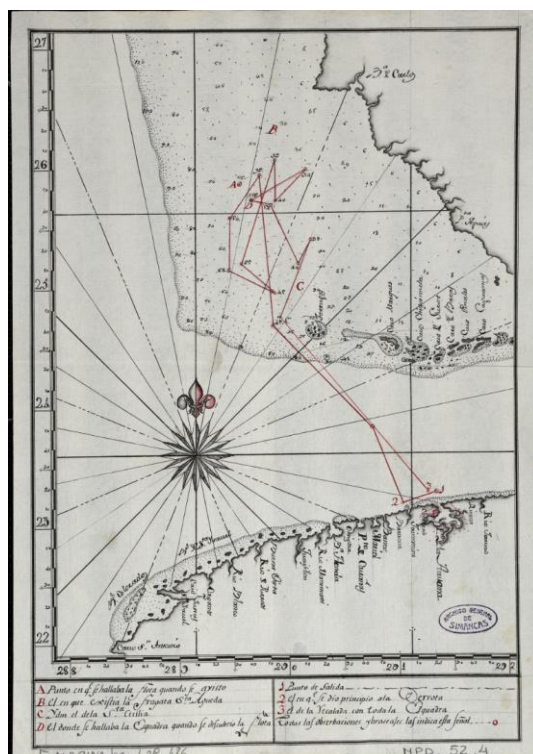


Fig. 7 – Manuscript plan of the course followed from Havana by Juan Bautista Bonet to meet Antonio de Ulloa's Fleet.

Fig. 7 – Plano manuscrito do trajeto seguido por Juan Bautista Bonet para encontrar a frota de Antonio de Ulloa.

Source: Ministerio de Cultura. Archivo General de Simancas. MPD, 52, 004

Sailing from Havana was delayed until 9 March and the Fleet did not reach Tenerife until 21 May, 74 days after leaving Havana and 125 days after they sailed from Veracruz. In the final stage of the voyage, after leaving the Canary Islands, on 24 June 1778, Ulloa and his collaborators had the opportunity to participate in a novel astronomical experiment, the observation of a total solar eclipse, recorded for the first time from the sea in one of the places with the best visibility: on the line between the Azores and North Africa (Rabat-Salé). More specifically, on the morning of the eclipse, Ulloa's squadron was at latitude $37^{\circ}14'N$, near the cape of San Vicente (Orte-Lledó, 2006). Once they returned to Spain, the observations were sent to different European scientific societies and the following year, Ulloa (1779) published his study *El eclipse de sol con el anillo refractario de sus rayos [...]*, while from New Spain, the Creole astronomer Antonio de León y Gama (1778) published the *Descripcion orthographica universal del eclipse de Sol*. Observations of eclipses of the sun and moon were useful to establish the latitude and especially the longitude of the main ports and cities in America. However, it was not until the late 18th century that precise portable marine chronometers allowed an exact measurement of the time of sighting (Moreno, 1998).

4. GEOGRAPHIC RESULTS AND DISCUSSION OF THEIR RELEVANCE

The present study has shown how cartography and the gathering of geographic information are the product of a given social and historical context and a form of knowledge linked to power and control over a territory. Maps and plans also reveal the structures within which their creators interacted. In this way, the sources used for the present research reflect the prevailing ideas of the Enlightenment in the late 18th century, marked by observation, utility and a practical sense; i.e., a clearly geographical approach.

Cartographic advances made by Ulloa's officers helped to refine detailed geographic knowledge of the eastern coast of New Spain. However, none of the main strategic coastal and watercourse projects supported by Bucareli materialised during his viceroyalty; neither the foundation of the shipyard on the coast of Veracruz nor the construction of the difficult inter-oceanic canal, although proposals for such a canal continued during the 19th century: the inter-oceanic railway between Coatzacoalcos and Salina Cruz was built at the end of the 19th century. President Porfirio Díaz opened the line officially in 1907 (Garner, 2005).

On the Pacific Ocean, the port of San Blas acted as a secondary port after Acapulco for the connection with the Philippines (Pardo, 2008), although in the late 18th century shipbuilding in the area was minimal. Moreover, because the anchorage was so close to the mouth of the River Santiago, the accumulation of sand

washed down the river meant that, in certain times of the year, ships became stranded and vessels with a deep draught could not enter the port.

4.1. Consequences of the cartographic work carried out by Ulloa's Fleet and its later influence: compilation and dissemination of geographic knowledge

Despite these technical difficulties in implementing Bucareli's territorial projects and the fragmentary nature of the cartographic material, the surveying of the coastline and the manuscript plans derived from it were later used to draw more extensive maps. Thus, when José de Gálvez's nephew, Bernaldo de Gálvez, was named viceroy of New Spain (1785-1786), the explorations of José de Hevia (or Evia) between Tampico and Florida completed geographic knowledge of the coasts of the Gulf of Mexico (González-Ripoll, 2013).

Among the new general maps, the *Plano Geográfico de la mayor parte del Virreinato de Nueva España* (Geographical Plan of Most of the Viceroyalty of New Spain) was finished in 1793 by the infantry colonel Carlos de Urrutia. It had been commissioned in 1791 by the then viceroy, Juan Vicente de Güemes (1789 to 1794). It expressly mentions the chart drawn in 1777 by Miguel del Corral and Joaquín de Aranda (fig. 6) (Orozco, 1871). Urrutia also added information from Alzate's 1768 map to his Geographical Plan (Antochiw, 2000).

At the turn of the century, the hydrographic expedition of the Atlas of North America took place with two brigantine divisions commanded by Cosme Damián Churrua and Joaquín Francisco Fidalgo. Once more, the objective was to map the coasts of the Gulf of Mexico and the Antilles (Martín-Merás, 2007).

The cartographic and geographic contributions of Ulloa and his officers were also taken into account in Alejandro Malaspina and José Bustamente's expedition in 1789-1794^v, when cartographic surveys were carried out by such sailors and mapmakers as Dionisio Alcalá Galiano, José Espinosa, Antonio Pineda, Ciriaco Ceballos and Martín de Olavide.

Similarly, between the late 18th century and early 19th century, acting on a royal order of 1791, the sea captain Felipe Bausa (or Bauzá), responsible for the delineation, and the engraver Fernando Selma drew a complete sea chart of the Gulf of Mexico for the Hydrographic Deposit of the Navy. It was titled *Carta esférica que comprende las costas del Seno Mexicano* (Spherical Chart covering the coasts of the Gulf of Mexico), with coordinates referenced to the Cadiz meridian, from 94°50'W and between 31°10' to 17°50'N (fig. 8).

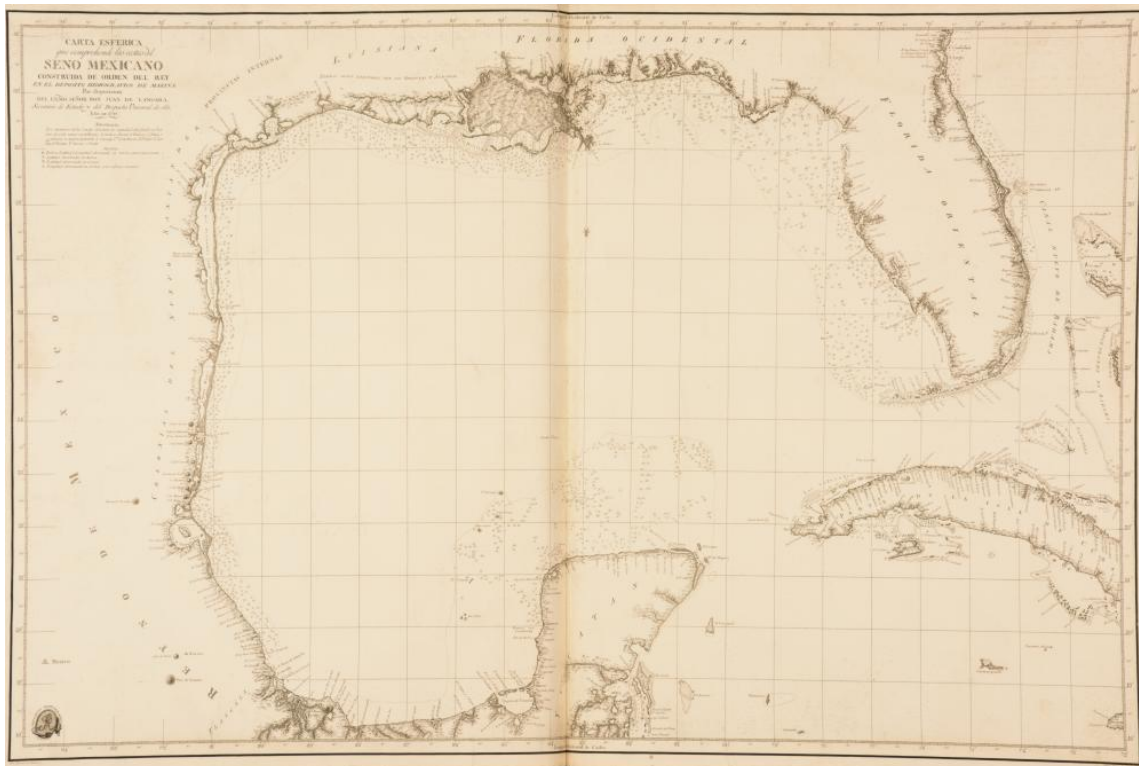


Fig. 8 – Spherical Chart covering the coasts of the Gulf of Mexico. Felipe Bausa [1800].

Fig. 7 – Mapa esférico que abrange as costas do Golfo do México.

Source: Ministerio de Defensa. Museo Naval. A-10169

This map (fig. 8) indicated bathymetric soundings, bars, bottoms, anchorages, coastal placenames and the magnetic deviation observed in different places. Bausa's sea chart is thus a compendium of all the cartographic knowledge of the coasts around the Gulf of Mexico acquired up to that time point in the 18th century, including the work performed by Ulloa's Fleet in 1776 and 1777 and the expedition headed by Malaspina and Bustamante (Puig-Samper, 2012). This sea chart was first printed in 1800 and a second edition with corrections in 1803.

Alexander von Humboldt's visit to the Viceroyalty of New Spain did not take place until that last year of 1803, when he obtained permission to travel across the territory and gathered a large amount of information before returning to Europe in August 1804. His essay was published between 1809 and 1814 (Perdices de Blas & Ramos-Gorostiza, 2015), while the Iberian Peninsula was occupied by Napoleonic troops (1808-1813). In that context, the independence movements in Hispanic America advanced rapidly. However, with the return of the Bourbons to the Spanish throne, Humboldt enjoyed access to a considerable volume of previous documents that he was able to use in his book (Thurner & Cañizares-Esguerra, 2023).

5. CONCLUSIONS

Maritime cartography produced by military engineers and officers in the Spanish Royal Navy served an eminently utilitarian purpose: to control and defend the coast and help ships safely reach the ports that the Spanish Crown established in America, such as Veracruz, or to find favourable coastal sites within Hispanic territories for settlement; places that were still little known but which were indicated on the maps.

In addition to the establishment of external networks, for example with Cuba, Cadiz or the Canary Islands, these Novo-Hispanic coastal enclaves also formed part of internal relationship networks between different places in the viceroyalty. Some of these networks were even connected by inland navigation, in relation to the different rivers in the area (Alcántara, 2016; García de León, 2011). In this way, progressively, the Novo-Hispanic coastal regions facing the Gulf of Mexico and the Caribbean Sea became the setting of exchanges, negotiations, confrontations and even political delimitations.

The gradual compilation of geographical data improved and enriched nautical charts and maps or corrected earlier ones. It enabled clear progress in geographic knowledge, which was of fundamental importance in guaranteeing Spanish trade and sovereignty over those lands, during a time of growing conflict and geopolitical rivalries.

At the same time, the accumulation of partial charts for particular segments of the coast enabled general maps to be drawn later that covered large areas of sea and coast. In this way, cartography advanced from a large scale (with great detail in nautical charts, hydrographic maps and plans of fortifications and cities) to a small geographical scale, covering wide areas and making use of technical innovations available at the time (astronomical observations, mathematical advances and base meridians, among others). Additionally, Creole knowledge of the coastlines contributed to the maps Ulloa's team completed, which could explain how Ulloa's team was able to work so quickly. It may therefore be deduced that this geographic knowledge was built upon multiple collective endeavours and not only that of the individuals who appear as the acknowledged authors of the maps.

Scientific and technical difficulties remained considerable, posing a constant challenge of representation for officers, engineers, astronomers and cartographers, some of whom were locally born, i.e., born in New Spain. In the late 18th century, appropriate scales were used to measure longitude and latitude, and coordinates were established through increasingly precise astronomical observations and the use of a base meridian. River courses, mouths and lagoons, capes, cays, cliffs and bays were also shown more precisely owing to empirical experience.

Regarding New Spain's cartography, García-Redondo (2021, p. 2) notes that "rather than remaining a strictly geographical artefact, maps became visual models for the dissemination and discussion of [geographic] knowledge". However, colonial cartography has been seen as a positivist tool for imperialism deployed at the service of dominating, hegemonic power and elites (Mignolo, 2011). Harley (2001), similarly adopting this critical stance but focusing more on the conquest period, proposes a semiotic analysis and, in the same line, Schlögel (2016) emphasizes social, cultural and geopolitical aspects of maps.

In this regard, during this final period of colonial rule in Hispanic America, the improvements in technical instruments and geographic knowledge transmitted by the maps of coastlines and maritime areas lay the foundations for the development of scientific thought, as expressed by Ulloa in his writings (e.g., the diagnosis proposed by Ulloa and Juan in their manuscript of 1749 on the Kingdom of Peru). This was connected with subsequent political changes, leading to emancipation. Instead of a monolithic conception of Spanish colonisation, this approach shows the importance of continuing to explore critically the geographic

dimension (including subjective and symbolic aspects) in the processes of historical change. More specifically, this article has demonstrated the value of a detailed study of interconnections and external and internal relationship networks in the production of maps and cartographic representations of Hispanic America.

ⁱ The political-administrative divisions of the viceroyalties varied in the course of Spanish colonisation. Gerhard (1972) uses the governorship system established in 1786 and 1789.

ⁱⁱ *Yconismo hidrotérreo, o Mapa Geographico de la America Septentrional. Delineado y observado p[or] el Contador de los R[eale]s Azogues D. José Antonio de Villaseñor y Sánchez*, ca. 1746 [Archivo General de Indias, MP-MEXICO, 161] and *Nuevo Mapa Geographico de la America Septentrional perteneciente al Virreynato de Mexico. Por Don Joseph Antonio de Alzate y Ramirez*, 1768. [Servicio Geográfico del Ejército LM, 8, 1, 54].

ⁱⁱⁱ The term *placer* refers to a quite flat and long bank of sand or stones on the sea bottom. In this case, it was a coral reef of madrepores that were also called *mucaras* in Ulloa's *Descripción*.

^{iv} A quite complete description of Tortuga Bank was made in the book by Gonzalo de Murga (1865). Richmond (1920, pp. 131–132) contains the following text from the logbook of Charles Knowles, rear admiral of the British squadron which fought against the Spanish commanded by Andrés Reggio, in the sea battle of Havana in 1748: "Having received certain intelligence of the time of Spanish ships sailing from Vera-Cruz with the treasure for Havana, I consulted with Governor Trelawny about intercepting them, who concurring in sentiment with me I resolved upon going down off the Tortuga Bank and to Endeavour to do it accordingly".

^v Letter from Alejandro Malaspina to Antonio Ulloa asking for information about navigation on the coasts of central and northern America. Ms 426, f. 74-76 (2nd letter, Questions 22 to 29) (Higueras, 1985).

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