

THE CARTOGRAPHY OF ALEXANDER von HUMBOLDT:
IMAGES OF THE ENLIGHTENMENT IN AMERICA

by

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Alexander von Humboldt's maps and images are from *Atlas géographique et physique du royaume de la Nouvelle-Espagne*, 1808, courtesy of the David Rumsey Map Collection. David graciously allowed me full access to his magnificent library in San Francisco, and librarian Philip Hoehn was an invaluable source of information during my four days of research there. Humboldt's sketch of *General Chart of the Kingdom of New Spain* and Zebulon M. Pike's *Map of the Internal Provinces of New Spain* are from The Virginia Garrett Cartographic Collection, courtesy of The University of Texas at Arlington Libraries. A study of Southwest cartographic history cannot be complete until one visits the Virginia Garrett Cartographic History Library at the University of Texas at Arlington. Similarly, the works of UTA professors Richard Francaviglia, David Buisseret, Dennis Reinhartz, and Gerald Saxon are required reading. It has been my good fortune to work under the tutelage of these distinguished cartographic historians for the past several years.

I am grateful to my colleagues who made important contributions to this study. Ann Jennings of the Center for Southwest Studies at the University of Texas at Arlington printed copies of the dissertation as it progressed over time. Of at least equal importance, Ann interpreted my expense report and corrected the math following my research travel to the David Rumsey Library in San Francisco. Ann Kelley of the UTA Libraries provided needed direction with foreign language spelling and punctuation. Dr. Douglas W. Richmond corrected my use -- and lack of -- accent marks with foreign names. Ben Huseman, cartographic archivist in UTA Special Collections, read a preliminary draft of the dissertation and made helpful suggestions. Manuscript collections archivist Brenda McClurkin provided a useable image of José Antonio de Alzate y Ramírez's map of New Spain.

Sarah McCoy is an accomplished art historian who provided background information about paintings that appear in the first chapter. Sarah accompanied me to David Rumsey's Library and took photographs that appear in both the appendix of the dissertation and in *Fronteras Magazine*. Sarah also took extensive hand-written notes from the Rumsey atlases that are cited throughout this study.

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ABSTRACT

THE CARTOGRAPHY OF ALEXANDER von HUMBOLDT: IMAGES OF THE ENLIGHTENMENT IN AMERICA

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The Cartography of Alexander von Humboldt: Images of the Enlightenment in America offers a cartographic perspective of Alexander von Humboldt's journey to the Americas, 1799-1804. Presented in the context of the European Enlightenment, this doctoral dissertation includes Humboldt's romanticized view of the natural world that was an essential part of his science and philosophy. It interprets Humboldt's maps and images as part of a transatlantic exchange, incorporating the theme of old Europe and the New World found throughout his work.

Two of Humboldt's maps, *General Chart of the Kingdom of New Spain* and *Points of Separation and Projected Communications Between the South Sea and the Atlantic Ocean* are the focus of my research. Both maps were published with Humboldt's *Political Essay on the Kingdom of New Spain*, 1811, the primary source for this study. The method of inquiry is a close reading of Humboldt's maps and texts, supported by the secondary literature. Humboldt effectively used images in the presentation of his ideas. I have adopted the concept throughout the dissertation. When combined with text, images permit a closer reading of the subject matter than text alone. The Enlightenment is not easily defined or understood. Just as the vivid and dramatic paintings of David and Goya provide clarity to the philosophical writing of the age, Humboldt's maps and illustrations serve as visual images of the Enlightenment in early nineteenth-century America.

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INTRODUCTION

In the first half of the nineteenth century, Alexander von Humboldt was considered by his contemporaries to be Europe's greatest scholar, the icon of Enlightenment science. He was what Albert Einstein would become to later generations.¹ This study examines Humboldt's science and philosophy in a collection of historical vignettes -- snapshots of Humboldt in the context of his time. The time of the Enlightenment is subjective. Historian Norman Davies uses 1650-1789. Norman Hampson prefers 1715-1740. Others use "eighteenth century."² Humboldt's time is less challenging, 1769-1859.

Humboldt rarely appears on the radar screen of Enlightenment studies. He is not mentioned at all in Norman Hampson's *The Enlightenment: An Evaluation of its Assumptions, Attitudes, and Values*.³ In the first chapter of this study Humboldt is represented as a product of the Enlightenment and its transition into the Age of Romanticism. The purpose is to demonstrate how the Enlightenment made Humboldt's scientific inquiries possible, and how Romanticism conceptualized his science as part of a philosophical whole.⁴ People and events that influenced Humboldt's science and philosophy are paramount. Visual image is presented as both scientific document and metaphor for Humboldt's ideas. Humboldt embodied the spirit of the Enlightenment. He used the technological advancements of his age to better understand nature. His work epitomized the science of Copernicus, the economics of Adam Smith, and the Romanticism of Goethe.⁵

A study of the Enlightenment in itself does not adequately explain Humboldt's science and philosophy. The second chapter looks at Humboldt's journey to the Americas, 1799-1804, which biographer Helmut de Terra described as an epoch of science and which served as the basis of Humboldt's voluminous texts. Humboldt was relatively unknown when he traveled to the New World. Historian David McCullough writes that by mid-century Humboldt had been elevated above all others as the high priest of modern science.⁶

Historian Douglas W. Richmond notes that Humboldt's four volume *Political Essay on the Kingdom of New Spain* remains unsurpassed and is still the key source for early nineteenth-century Mexican history.⁷ An accompanying map, *General Chart of the Kingdom of New Spain*, was prepared by Humboldt with the assistance of Mexican scholars, using documents that he found in the Mexican archives. The scholars who assisted Humboldt, both directly and indirectly, are recognized in chapter three for putting their distinctive New World imprimatur on a collaborative transatlantic study. Historian David Buisseret writes of a fusion of European and New World cartographic styles in "Meso-American and Spanish Cartography" in *Mapping of the Entradas into the Greater Southwest*.⁸ Humboldt's use of New World source material was an important part of the fusion. Up until that time, permission to visit the Spanish possessions by non-Spaniards had been restricted.⁹ The notion of a foreign scholar, Humboldt, collaborating with New World authorities on a broad range of scientific, economic, and political studies was extraordinary. The publication of that research for both European and American readers was unprecedented and spoke to the changing transatlantic discourse of the early nineteenth century.¹⁰

Humboldt and his *General Chart of the Kingdom of New Spain* are often cited in studies of the division of land between the United States and México, as is the

expedition of Zebulon M. Pike in 1806-1807. There is a considerable amount of secondary literature on Pike's adventure and his very good map of the Southwest -- borrowed from Humboldt. By using Humboldt's map -- and improving upon it -- Pike became an important part of the transatlantic collaboration.

Humboldt's texts and maps expressed a distinct geopolitical discourse on the eve of U.S. expansion and settlement. Denis Cosgrove writes in *Apollo's Eye: A Cartographic Genealogy of the Earth in the Western Imagination*, that Humboldt's ideas inspired Americans to search for structuring principles as they explored the land and sought a systematic understanding of place. In chapter four the nature of Humboldt's new geography is examined, focusing on the technical precision of survey, observation, and collection that legitimated both the culture of exploration and the manifest destiny of an American empire.¹¹

José Antonio de Alzate y Ramírez (1737-1799) was a member of the prestigious *Academe des sciences de Paris* whose scientific and political interests were published in *la Gazeta de Literatura*. But Humboldt criticized Alzate's work. He was incredulous that Alzate's maps had been considered the best maps of México. Humboldt cites a manuscript map by Alzate, *Mapa del azobispado de México* drawn in 1768 and revised in 1772. Humboldt declares, "As far as I have examined it is very bad."¹²

My deconstruction of Alzate's maps in chapter five finishes what Humboldt started.¹³ It traces the origin of Alzate's map, *Plano de la Nueva España*, published in 1770, beginning with the journey of Capitan Hernán Cortés to the Aztec capital of Tenochtitlán in 1519, and including the inspection expedition of Pedro de Rivera y Villalón, 1724-28. The genealogy of Alzate's maps provide an understanding of Spanish colonial mapping in a way that Humboldt's *General Chart of the Kingdom of New Spain* does not. Richard V. Francaviglia notes in *Mapping and Imagination in the*

Great Basin: A Cartographic History, that Humboldt consulted maps drawn by Bernardo de Miera y Pachéco in 1778 for the northern portion of *General Chart of the Kingdom of New Spain*.¹⁴ But Humboldt found many of the earlier Spanish maps to be of limited value and only used a few of them in the preparation of his map. The foundation of Humboldt's map of New Spain are seventy-four astronomical observation points, of which fifty are situated in the interior regions. Humboldt determined thirty-three of these points by his own observation.¹⁵ Only fifteen such points were known before Humboldt arrived in México. After accurately fixing these points, Humboldt was able to both identify and avoid many of the "extraordinary errors" of previous maps of New Spain.¹⁶

The passage of time has allowed historians to both examine and reflect upon Humboldt's work. By the same process it has been determined whether or not historical events have meaning. The fact that Humboldt made the first important study of an inter-oceanic canal to facilitate trade and improve the economic fortunes of people throughout the world is meaningful. The first in-depth analysis to date of Humboldt's canal study is presented in chapter six. The primary source for this study is Humboldt's *Points of Separation and Communication Between the South Sea and the Atlantic Ocean*, 1808, a monumental work that features nine projected water passages on eight separate maps. Humboldt viewed trade as the foundation of economic development. He mapped canal routes that would shorten navigational distances between China, Japan, and the West, thus creating vast new markets for European and U.S. traders. However, Humboldt viewed the New World as more than simply a rest stop on the way to the Orient. He used his maps to link the riches of the New World with the economic fortunes of Europe.

Humboldt's studies provided scientific information through texts and images which allow for subjective interpretation beyond the scientific data. This interpretation includes readings of Humboldt's maps and illustrations along with textual analysis of his Enlightenment philosophy. Humboldt's interests were wide-ranging, and accounts of his work encompass those varied interests. Helmut de Terra's *Humboldt: The Life and Times of Alexander von Humboldt, 1769-1859* (New York: Alfred A. Knopf, 1955) focuses on Humboldt's geological studies, and includes a psychological interpretation of Humboldt's science. Physicist Lottie Kellner presents Humboldt's geomagnetic observations in *Alexander von Humboldt* (Oxford University Press, 1963). Aaron Sachs's *The Humboldt Current: Nineteenth-Century Exploration and the Roots of American Environmentalism* (New York: Viking, 2006) evaluates the impact of Humboldt's geoscience on subsequent environmental studies.

Little if any research published in English has been singularly devoted to Humboldt's cartography. Hanno Beck and Wilhelm Bonacker's annotated edition of Humboldt's *Atlas géographique et physique du royaume de la Nouvelle-Espagne* (Mexico, 1971) has never, to the best of my knowledge, been translated in English. David McCullough's *The Path Between the Seas: The Creation of the Panama Canal, 1870-1914* offers only a glimpse of Humboldt's canal study, *Points of Separation and Projected Communications Between the South Seas and Atlantic Ocean*. Humboldt makes reference to this study throughout his thirty-four volumes, and it is a significant part of his cartographic legacy.

Humboldt's voluminous texts underscore the importance of his maps. *Political Essay on the Kingdom of New Spain*, trans. John Black (1811) is not an easy read. Humboldt's rambling, disjointed style of writing would incur the disapprobation of many college professors. But Humboldt's maps are quite another matter. Humboldt

constructed maps that both depicted the geography and chronicled his travels. Angela Perez-Mejia describes them as "complete narratives" in *A Geography of Hard Times: Narratives About Travel to South America, 1780-1849*, trans. Dick Cluster (State University of New York Press, 2002). Wherever he traveled -- down the Orinoco, or up Chimborazo, or along the *cordillères* -- Humboldt used his scientific instruments and skills to develop geographic texts from information passed along by guides and local sources, maps in which native knowledge was combined with European technology to construct what Perez-Mejia describes as "the perfect metaphor of the wilderness."¹⁷

Humboldt's maps were not perfect. He did not travel to many of the places depicted on his maps, and they repeat many of the errors of previous maps of the New World. Humboldt took accurate measurements -- Enlightenment science, after all, provided the foundation for his inquiries -- but some of his maps are scientifically inaccurate. Nonetheless, Humboldt's maps and images are the single most illuminating part of his American narrative. Humboldt's maps span the length of the Americas, from the Beaufort Sea to Patagonia, illustrating the insights he developed and the knowledge he created in the course of his travels, and he used those maps to share knowledge with others in the interests of progress. This study is uniquely focused on the cartography of Alexander von Humboldt. After reading the text and examining the maps and images, it is hoped that the reader will gain a better appreciation of what, for a student of cartographic history, is the most enduring part of Humboldt's legacy.

CHAPTER 1

HUMBOLDT IN THE CONTEXT OF HIS TIME

In the view of some Enlightenment philosophers, much of Europe in the Middle Ages had been a place of pessimism and despair. Italian thinker Giovanni Botero (1544-1617) wrote that many of the ideas advanced by Western philosophers were flawed; they didn't work, were amoral, or lacked a Christian foundation. Botero predicted that the European population would outgrow its food supply, leading to catastrophic famine.¹

Cynics rejected claims of knowledge and truth. Fatalists believed that human existence was without purpose or value.² Friedrich Heinrich Jacobi (1743-1819) wrote that the concept of rationalism was a compensation devised by humans who had discarded any hope of finding meaning in the world.³ Established authority excluded much of the population from the political process. Tradition and superstition slowed social progress and inhibited reform, denying Europeans the opportunity for a better way of life.

The Enlightenment thinkers argued that all human affairs should be ruled by reason and result in the common good, rather than being ruled by tradition and established authority. German philosopher Immanuel Kant (1724-1804) encouraged Europeans to rebel against social order and experience the personal liberties that Enlightenment thinking afforded them. He wrote, "The Enlightenment is man's

emergence from immaturity and dependence upon others, using reason as its foundation." Building on this age-related metaphor, he noted that, "Immaturity and dependence result from the inability to use one's own rationality without the direction of others." As he concluded, "Its cause is not a lack of intelligence or education, but a lack of determination and courage to think outside of societal constraints."⁴

Rationalist movements against prevailing political practice in the eighteenth century resulted in new methods of representative government that weakened monarchs and the church and gave the vote to a wider segment of the population. English parliamentary monarchy, U.S. representative democracy, and various forms of the French government after the Revolution were all attempts to make the political system more inclusive. This led to reforms in education, taxation, and religious tolerance, as well as movements to abolish slavery in the late eighteenth and early nineteenth centuries.⁵ New discoveries in the sciences and technology redefined society. Thinkers such as Humboldt sought to use reason and scientific method in their inquiries, and valued observation as the measure of knowledge.

The scientific advancements of the Enlightenment encouraged Europeans to abandon their sense of pessimism and superstition in favor of reason and progress. But the recognition of individual freedoms by Enlightenment thinkers created a wave of emotionalism that became known as *Romanticism*. Those who rebelled against social order could adopt the power of reason, or they could pursue an emotional experience. Their common denominator was a desire to achieve an aesthetic harmony with nature. The rationalist acclaimed nature as the ultimate source of reason, while the Romanticist

worshiped nature as unbound, wild, and ever-changing. In the interests of nature, Romanticists exalted liberty, power, love, violence, Greek mythology, the Middle Ages, or anything else that aroused them.⁶

The Enlightenment and the Romantic movement served to cast off the framework of traditional authority which confined society. The consequence of this freedom to question all values is everywhere around us. Our knowledge is now vastly greater than in Humboldt's time, but we continue to search for identity and for meaning in life.⁷ Humboldt found meaning by combining the science and technology of the Enlightenment with a skeptical, modernist attitude and a taste for nature and idealism, expressed as a commitment to the betterment of society. Humboldt's approach to natural history exemplified the continuity between Enlightenment concepts of rationality and Romantic assertions of the unity of nature and the essential role of the naturalist in revealing that unity.⁸

Humboldt dedicated himself to Enlightenment principles of rational thought and empirical observation, drawing on the most advanced science, while demonstrating an aesthetic harmony "to show the simultaneous action and connecting links of the forces which pervade the universe."⁹ The aesthetic harmony demonstrated in Humboldt's work is similarly depicted in the paintings of Fragonard, David, and others on the following pages. Representing Enlightenment principles of liberty and freedom, these works idealize Romanticism and help us to better understand Humboldt in the context of his time.



Fig. 1.1 Alexander von Humboldt
Painting by Joseph Stieler, 1843

In the context of his time, Alexander von Humboldt (1769-1859) was Europe's greatest scholar, the icon of Enlightenment science. He was to his contemporaries what Albert Einstein (1879-1955) would become to later generations.



Fig. 1.2. *The Swing*

Painting by Jean Honoré Fragonard, 1766

The intellectual, technological, and social progress of the Enlightenment gave Europeans a sense of personal liberty and economic freedom that we take for granted today. But they were new and exciting concepts in Humboldt's time.¹⁰



Fig. 1.3. *The Oath of Horatti*
Painting by Jacque-Louis David, 1785

The Enlightenment liberated not only reason but helped set the stage for the revolutionary crisis of the late eighteenth century and the rise of Romanticism.¹¹ The word Romanticism derives from tales of medieval adventure such as *King Arthur*, or the *Holy Grail*, called “romances” because they were written in a Romance language, rather than Latin. Romanticism was a series of attitudes. Jacque-Louis David’s painting, *The Oath of Horatti*, epitomizes one such attitude, Romantic nationalism, embodying the ideals of the French Revolution . . . *liberté, fraternité et égalité*.¹²

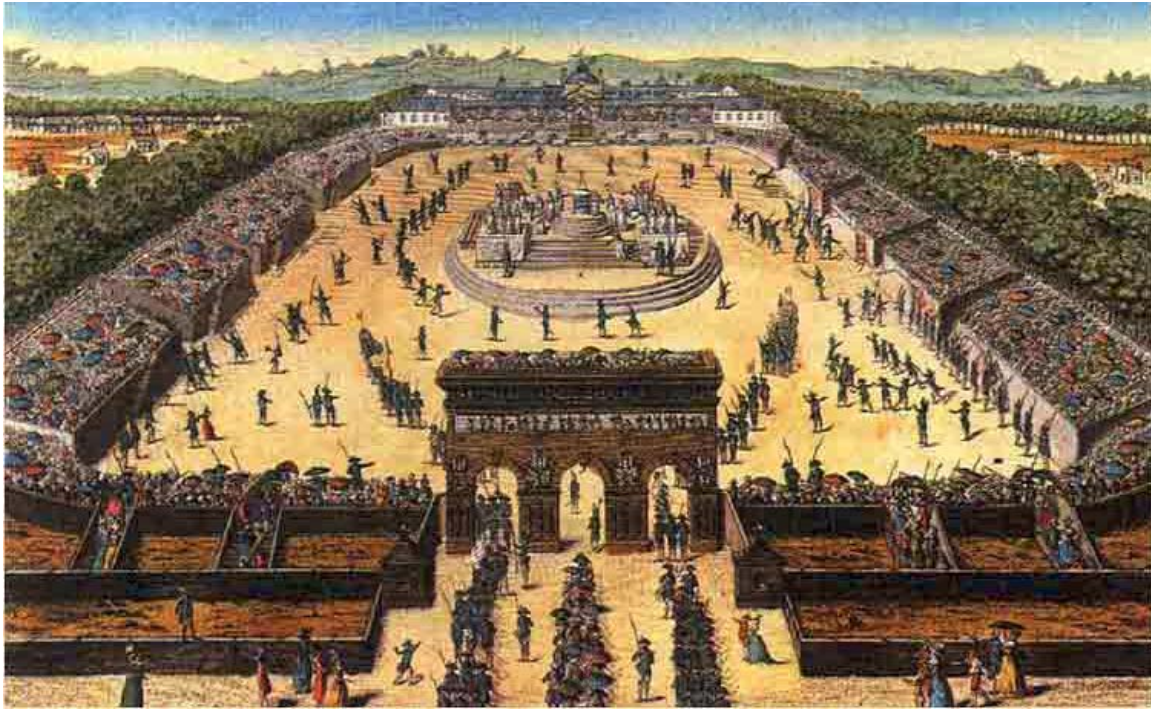


Fig. 1.4. *Quatorze Juillet*

The Fourteenth of July, *Quatorze Juillet*, is the French national holiday celebrating the storming of the Bastille. Humboldt visited Paris in the summer of 1790. The streets of Paris were full of jubilant crowds, and the enthusiasm of the people and their sense of unity and purpose had a lasting impact on Humboldt.¹³ For the rest of his life he considered himself a man of the Revolution.



Fig. 1.5. Storming of the Bastille, 1789
Painting by Charles Thévenin



Fig. 1.6. *La Liberté guidant le peuple*
Painting by Eugène Delacroix, 1833

Romantic nationalism came of age during the American Revolution of 1776 and matured during the French Revolution of 1789. These events were preceded by a revolution of the mind that had been planted fifty years earlier by Jean-Jacque Rousseau (1712-1778), who argued that society was corrupt and that freedom is the ultimate source of value.¹⁴ His views were taken up by the leaders of the French Revolution, and his writing inspired the Romantic nationalism movement.



Fig. 1.7. *Schmadribach Falls*
Painting by J.A. Koch, c. 1822¹⁵

Humboldt embraced a different kind of Romanticism, a state of mind, manifest in his desire to escape the mundane and travel to exotic places. Man's harmony with nature became paramount and for this reason the rural landscape was idealized by Europeans.¹⁶

Rousseau judged travel to be an indispensable part of the education of the enlightened European man. But the Enlightenment called for a new kind of traveler. Before, there had been only merchants, missionaries, conquerors, and soldiers. None of them, according to Rousseau, possessed the capacity for observation.¹⁷ Humboldt grew up in an age of travel and discovery. He read the exploits of eighteenth-century European explorers as a youth and developed an interest in scientific travel. At the age of ten, Humboldt read Georg Forster's vivid account of the South Sea islands. Forster (1754-1794) sailed with English Captain James Cook to the South Seas. Forster's descriptions of nature combined scientific investigation with aesthetic awareness, giving Humboldt a romanticized view of the natural world.¹⁸ Humboldt later befriended Forster and traveled with him to Paris during the Revolution.

Humboldt studied science under the tutelage of Marcus Herz, who was a disciple of Kant and who taught Humboldt physics and philosophy illustrated with scientific experiments, including a demonstration of the principles of Benjamin Franklin's lightning conductor. Moses Mendelssohn (1729-1786), the composer's grandfather, educated Humboldt in classical philosophy. Humboldt gained an appreciation of the natural world while studying German idealism, developing concepts of precision and accuracy that would define both his scientific research and his mapmaking.¹⁹

Humboldt studied at the Mining Academy at Freiberg, one of the foremost scientific institutions in Europe. It attracted students from all over the world on account of the reputation of its director, Professor A.G. Werner (1749-1817). Under Werner's tutelage, Humboldt became proficient in mathematics, physics, and chemistry, thus developing the skills needed to conduct his scientific investigations



Fig. 1.8. Johann Wolfgang von Goethe
Painting by Johann Heinrich Wilhelm Tischbein, 1787

Humboldt and Johann Wolfgang von Goethe (1749-1832) shared the common goal of observing the forces of the universe interacting with one another -- the unity of nature.²⁰ Humboldt acknowledged Goethe as a great influence in his life, a talented scientist whose descriptions of nature ranked with Forster's.²¹ In a letter to Goethe, Humboldt wrote, "You may recognize yourself, the influence of your writings upon me, the influence of your powerful presence!"²² Goethe said of Humboldt, "He has no equal in information and knowledge . . . he overwhelms one with intellectual treasures."²³ Goethe believed that all human progress is based on humanitarian acts.²⁴ Humboldt would incorporate that belief with the notion that the scientific advancements of the Enlightenment advanced human progress.



Fig. 1.9. Henriette Hertz
Painting by Anna Dorothea Lisiewska, 1778

Henriette Hertz was the witty, flirtatious, and beautiful wife of Humboldt's tutor, Marcus Hertz. She was a Jew who made a practice of surrounding herself with brilliant young men. Henriette and Humboldt shared the same humor, temperament, and quick intelligence. Humboldt called her, "The most beautiful and also the cleverest . . . no, I must say the wisest woman I know." It was not socially acceptable for a Berliner to be seen in the company of Jews, but they offered almost the only intellectual life in the city. The small, dazzling circles of Herz and Moses Mendelssohn, with their emancipated women, modern science, and avant-garde poetry, were for Humboldt an oasis in a desert.²⁵



Fig. 1.10. *Tahiti Revisited*
Painting by William Hodges, 1776

Cultural conflict, relativism, and the fate of indigenous peoples in primitive lands were important questions for Enlightenment thinkers. German philosopher Immanuel Kant argued that primitive man in a state of nature was free from the vices that plague humans in civil society. Humboldt would conclude from his travels to the New World that human beings in a state of nature were neither virtuous nor vicious, but they could benefit from the scientific advancements that civilized society and the Enlightenment would bring to them.²⁶

Rousseau wrote that slavery contradicted the idea that human beings had rights by virtue of their common humanity.²⁷ Humboldt embraced the view of Condorcet (1743-1794) that human beings possessed reason and would gradually discard slavery and superstition and bring human affairs into harmony with the natural world.



Fig. 1.11 *Napoleon crossing at the St. Bernard Pass*
Painting by Jacques-Louis David, 1801

To understand Humboldt in the context of his time, one needs to take into account the Emperor Napoléon Bonaparte (1769-1821), whose wars had changed life in Europe. Because the old establishment was slow to accept the new, Napoléon thought that European society needed a champion for modernity. The Emperor saw himself as a Romanticist warrior who had brought the established European powers to their knees in the interest of progress.²⁸

Napoléon 's ideology emanated from the *esprit* of the French Revolution. Humboldt had also been inspired by the Revolution, but he disdained the idea of a single individual having at his command the resources, economies, and technologies of Europe in order to dominate the rest of the world. Humboldt advanced the idea that European technologies could be used to improve economic fortunes on both sides of the Atlantic. Napoléon 's war machine required the looted treasuries of conquered nations in order to sustain his empire. Humboldt's concept of progress contrasted with Napoléon 's view that war opened the way to overseas wealth. Humboldt would travel throughout the Americas not to conquer but to find new economic opportunities in the places he visited. Humboldt was interested in how the geopolitical landscape of the Americas fit into the European economic system. For his part, Napoléon overlooked the geopolitical value of Humboldt's maps. For Napoléon , maps were mostly strategic military tools.²⁹

Humboldt and Napoléon, born in the same year, met just once. Humboldt wrote afterward that Napoléon “behaved with icy coldness and seemed full of hatred toward me.”³⁰ Napoléon 's disdain for Humboldt was likely rooted in jealousy. Napoléon ruled France, but Humboldt was the toast of Europe and a subject of great admiration in America. Napoléon regarded Humboldt, a foreigner from an enemy nation, as both excessively popular and politically suspect. Humboldt viewed the politics of Europe with increasing skepticism by the beginning of the nineteenth century, and he seemed indifferent to the Romantic nationalism of Napoléon. Writing and scientific activity were Humboldt's antidote for the political, social, economic and cultural lethargy that surrounded him. Napoléon had plundered the libraries and archives of Europe to make

Paris the unrivaled center for scholars seeking books and documents.³¹ Paris was also the book publishing center of Europe, and Humboldt would not let feelings of patriotism or family conflict with his devotion to science. Humboldt's Romanticism tended to cross ethnic and national lines -- he never expressed any overt patriotism for Germany. Humboldt was a citizen of Europe, both politically and intellectually.³² When he said that he was coming home, he meant that he was coming home to Europe.³³ The restrictions of his upbringing in Berlin bridled a desire to visit foreign lands . . . the farther away from Germany the better.³⁴



Fig. 1.12. *Napoléon Crowning Himself Emperor*
Painting by Jacques-Louis David, 1804

When Humboldt left for the Americas in 1799 the ideals of the Revolution were more or less intact and France was still a republic. When he returned, the ideals of the Revolution had been distorted by the Reign of Terror and Napoléon occupied an imperial throne. Wherever he traveled, Humboldt was always skillful at adapting to the government in power and surviving under an unsympathetic regime. Humboldt attended Napoleon's coronation but it is not known if he is in this painting.³⁵

CHAPTER 2

OLD EUROPE AND THE NEW WORLD: HUMBOLDT'S JOURNEY TO THE AMERICAS, 1799-1804



Fig. 2.1. *Chiranthodendron pentadactylon*

Plantes équinoxiales aux voyages de Humboldt et Bonpland, 1808

The illuminating symbol of Humboldt's science was his American expedition, in which the European Enlightenment and Romanticism were brought to perfect completion.¹

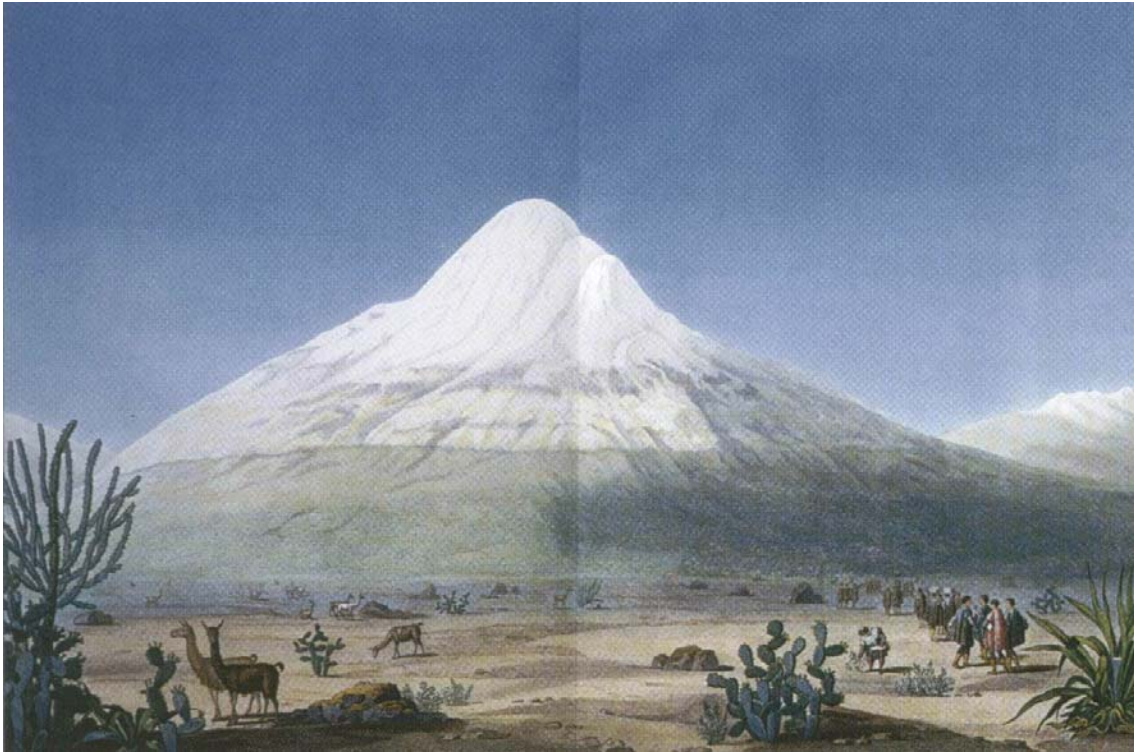


Fig. 2.2. Plant Collecting at the Base of Mt. Chimborazo
Vue des cordelleres et monumens des peuples indigene de l'Amerique, 1810

Humboldt devoted himself to learning about nature. Classification and collecting were important steps toward understanding the natural world and its inhabitants. Humboldt embarked on his exploration of the New World to collect material for scientific study. His goal was to observe the forces of nature interacting with one another and find out how the geographic environment influenced plant and animal life -- the unity of nature. The purpose of Humboldt's wide-ranging scientific studies and exploration in the Americas was not to further any particular scientific field of study but to look for connectivity between all disciplines. He declared, "I shall try to develop an understanding of nature as a whole, proof of the working together of all the forces of nature."² Humboldt advanced a scientific approach to the study of the Americas in contrast to the existing view, which placed Europe at the center of civilization and used its environment as a yardstick to measure and assess other places. Humboldt's exploration opened up the Americas to a stream of scientific explorers and travelers in the wake of the European Enlightenment, which had inspired an interest in scientific inquiry and primitive and non-European cultures.³



Fig. 2.3. Humboldt's Drawing of a Red Howler, c. 1800
One of the largest primates found in Central and South America
Ewell Sale Stewart Library

Humboldt's work influenced a generation of scientists including Charles Darwin. Humboldt inspired Darwin to make his voyage of exploration and provided him with his basic orientation concerning how and what to observe and how to write about it.⁴ The question of man's beginnings predated Darwin (1809-1882) by centuries but had no scientific basis at the time of Humboldt's journey to the Americas. Humboldt observed the intellectual powers of primates in the South American jungle and noted their similarity to humans.⁵ His observations blossomed in the inquiring mind of Darwin into the evolutionary synthesis.⁶



Fig. 2.4.
Sir Francis Bacon
1561-1626

Humboldt announced in the 1790s that he had discerned the "bare outlines" of a new science, *physique du monde* -- images of the natural world, "a physics of the sort Francis Bacon demanded, one that would unite the branches of natural science."⁷ Humboldt adapted Bacon's philosophical science in the course of his investigations. Bacon was an English philosopher and champion of modern science. He claimed "all knowledge as his province" and dedicated himself to revamping traditional learning. Bacon developed his natural philosophy based on the use of new technology to take the place of the established tradition of scholasticism, humanism, and magic. Bacon's goal was the production of practical knowledge for "the use and benefit of man." Bacon advanced the belief that a hypothesis would emerge from the accumulation of data despite an absence of theory or accurate mathematical tools. Bacon started with axioms -- simple true statements about the way nature works. He used axioms to build

a logical system of nature. In the Baconian method, logic is the authority. If axioms are true, everything that follows will be true.⁸

Humboldt's adaptation differed somewhat from Bacon's model. Humboldt recognized that it is difficult to determine simple true statements about the way nature works. He was concerned that his investigations might be discounted or forgotten because of incorrect explanatory statements.⁹ Only phenomena that could be observed accurately and become part of an analytical theory were important to him. Humboldt's adaptation of Bacon's scientific method started with a few axioms with the goal of proving many true statements -- theorems -- that logically follow from them. His method required observations of nature, with the goal of finding a few universal laws about how nature functions. With Humboldt's method, observation of nature was essential. If an idea conflicted with what happened in nature, the idea had to be changed or abandoned.¹⁰

Humboldt observed that an infinite number of forces act simultaneously to bring order in the natural world. He wrote, "As in all other phenomena of the physical universe, so in the distribution of organic beings. Amidst the apparent disorder which seems to result from the influence of a multitude of local causes, the unchanging law of nature became evident as soon as one surveys an extensive territory, or uses a mass of facts in which the partial disturbances compensate one another."¹¹

Humboldt's science attempted to understand the unity of nature through precise and accurate measurement. He used his methodology in the study of geographical distribution, terrestrial magnetism, meteorology, hydrology, ocean

currents, the structures of mountain chains and the orientation of strata, and solar radiation. He used images -- maps, charts, and graphs -- to give visual meaning to his science. He used an array of scientific instruments to quantify what he observed. Humboldtian science was the accurate, measured study of varied but interconnected real phenomena in order to find a scientific law and dynamic cause.¹² The lasting impact of Humboldt's science is described in *Cultures of Natural History*. "Humboldtian science illuminates the reorganization of knowledge and disciplines in the early nineteenth-century that defined the emergence of natural history out of natural philosophy."¹³



Fig. 2.5. Chronometer, 1799

Humboldt determined longitude with a telescope and a chronometer (above) made by Ferdinand Berthoud, Paris, 1799.

Humboldt's science required hygrometers, dip needles, barometers, maximum and minimum thermometers, and chronometers. On the deck of a ship, he could often be seen with a sextant or an octant -- a brass instrument that can represent the angle of the sun to the horizon at high noon. From these readings, taken repeatedly for accuracy, a mariner who knows math and has the right tables can calculate his ship's latitude, his distance from the equator.¹⁴ Humboldt's equipment was the most up-to-date of his time. He spent much of his time tinkering with his instruments and worrying about error. Humboldt was rationally attached to his instruments. Through them he felt safe in the vastness of ocean and jungle. He embodied the virtues of *instrumental reason*.¹⁵



Fig. 2.6. Humboldt and Aimé Bonpland at the Orinoco, 1799

Painting by Eduard Ender

On the table is an astronomical repeating circle, theodolite, sextant, compass, and microscope.

Humboldt used scientific instruments to create geographical texts about nature, which in turn served as an extension of his science. Humboldt likened the investigation of science with mapmaking, using maps as a metaphor for scientific progress. He wrote, "If the laws of nature are more complicated than they first appeared, we are no less obligated to submit them to exact investigations." He continued, "We did not stop making maps when we ran up against the sinuousness of rivers and the irregularity of coastlines."¹⁶



Fig. 2.7. *Humanitas, Literae, Fruges*

Copperplate engraving by Roger Bathelmy of a sketch by Francois Gérard

Frontispiece of Humboldt's *Atlas Géographique et physique de Nouveau Continent*, 1814. The image represents America being consoled by Minerva and Mercury for the evils committed by the conquistadors. Pliny the younger wrote to Maximus, governor of Achaëa in northern Greece, "Just remember that the Greeks have given all other peoples the gifts of civilization, science, and wheat." Helen von Kugelen wrote, "America can thank the Old World for exactly the same gifts."

The theme of old Europe and a New World was prominent in Humboldt's work. The riches of the Americas provided economic prosperity for Europeans, and the exchange of intellectual information going from the Old World to the New was seen as a model of cultural migration. Humboldt helped bring a European vision of progress and development to the Americas while opening new economic opportunities for Europe. At the same time, he noted that mankind had different worldviews and values.

Wherever he traveled, Humboldt observed the context in which people live and the unique history that shaped their lives.¹⁷ Humboldt acknowledged New World cultures and traditions without condemning European colonists. Humboldt never became so enamored with globalization -- a concept he advanced -- that he forgot his origins. His European education and wealth enabled him to travel the world and advance the cause of social, cultural, and economic progress. His European perspective intrigued the citizens of the Americas and validated his ideas. Humboldt brought his European attitudes toward nature to the New World, but as a naturalist he was able to reconcile his views to the New World environment. Humboldt found unity in the nature of both the Old World and the New. He wrote, "The turf spread over the soil, the moss and the fern, the torrents, the sky . . . everything recalls to the traveler sensations of which he has already felt."¹⁸ From his perceived unity in nature, it was logical that Humboldt would also see other unities, including those in the human realm. He linked the external world of nature with the internal lives of humans. "In order to describe nature . . . we must not dwell exclusively on its external manifestations, but we must trace its image, reflected in the mind of man."¹⁹ Humboldt traveled to the New World to find out how the forces of nature interacted with one another and how the geographic environment influenced plant, animal, and human life. His vision was to find unity in the diversity of nature and to place humans within it, because, as Humboldt put it, "Nature exercises a perpetual influence on the moral condition and destiny of man."²⁰



Fig. 2.8. King Carlos IV of Spain
Painting by Francisco Goya

Humboldt met with King Carlos IV of Spain (1748-1819) at his country palace of Aranjuez in 1797 and was granted a royal decree directing all Spanish authorities in the Americas to assist him in carrying out his scientific activities.²¹

Once Spanish rule began to dissolve in the 1820s almost anyone could visit its former colonies. But the royal decree granted Humboldt was unprecedented and may have been based on the king's desire to learn facts about his own empire of which he was not well informed.²² Or perhaps the Spanish monarchy, in its attempt at economic and political restructuring of the viceroyalties, discerned a hope of recovery in scientific and geographic development.²³ Humboldt had traveled extensively in Europe

and undertook several diplomatic missions. But he decided to devote himself to exploration, which he was able to do at his own expense, being a wealthy man. On June 5, 1799, Humboldt set sail from Spain for Cuba. Upon hearing of the yellow fever outbreak in Cuba, Humboldt decided instead to sail to South America before exploring New Spain. He stayed for five years, studying the geography and natural history of the places he visited and filling thirty-four volumes with his observations.

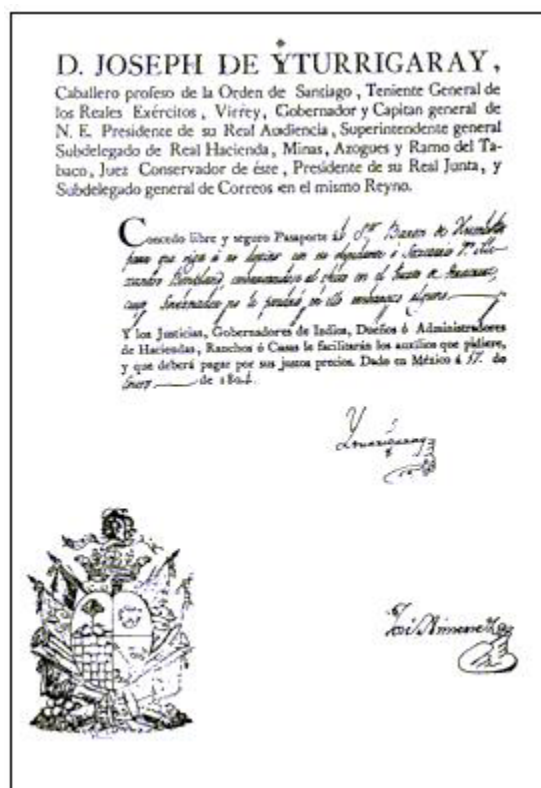


Fig. 2.9. Humboldt's Mexican Passport
Briefe das Amerikas, 1799-1804

Humboldt obtained two passports, one from the *primera secretaria del estado* and one from the Council of the Indies.

In the preface of *Political Essay on the Kingdom of New Spain*, Humboldt wrote a dedication to King Carlos IV so as to pacify the moods of the Spanish government toward Humboldt's Mexican colleagues who had furnished him "with more information than the court would regard proper."²⁴ This preface was removed from some early editions, perhaps by Humboldt himself. Almost concurrently with the book's publication, Napoléon invaded Spain and deposed Carlos, installing his own brother, Joseph Bonaparte, on the Spanish throne. Living in Paris at the time, Humboldt was already under suspicion by Napoléon as a Prussian spy (his brother Wilhelm was the Prussian Secretary of State) and was only allowed to remain in France through the intercession of his scientific friends. Humboldt's dedication praising the abdicated monarch might have been his own *coûp de grâce*. Two years earlier, a bookseller in occupied Bavaria was shot by Napoléon 's soldiers for distributing a pamphlet entitled "On Germany's Deepest Humiliation."²⁵ Further speculation centers on the wording of Humboldt's dedication, in which he notes that none of the previous Spanish monarchs were more liberal than Carlos IV in spreading knowledge of the New World. The dedication may have been removed from the Spanish edition because it appeared to cast reflections on royal predecessors. Whatever the reasons, many of the early editions with Humboldt's dedication to Carlos IV disappeared.

Humboldt lived in a time of great social and political upheaval, and he found expression for his political views in a variety of ways. Humboldt renounced political repression wherever he went, and he fought against slavery at home and abroad. Even

in the presence of the Prussian king, Frederick Wilhelm III, Humboldt was unwilling to give up his enthusiasm for the ideas of the French Revolution that the Reign of Terror had not been able to destroy. Humboldt was a democrat before democracy. Benito Juárez (served five terms as President of México, 1858-1872) called Humboldt a benefactor of the nation, *Benemérito de la patria*, but one might have called him a benefactor not just of México but of humanity.²⁶

Humboldt's empathy with humanity, however, was not boundless. Indians who held him personally responsible for the outbreak of a volcano or Negroes who tried to kill him while he was trying to measure the eclipse of the moon were displaying a primitive backwardness that could not be tolerated. Humboldt needed men to row the boats, and transport the equipment. Sometimes they were Indians, other times they were African slaves. Sometimes they caused trouble because, according to Humboldt, they were lazy, ignorant, indolent, and always trying to take advantage of the travelers. If conflict arose, empathy had to yield to reason. Humboldt's attitude arose from his experiences as a traveler and undoubtedly helped him to survive the perils of the jungle.²⁷



Fig. 2.10. José Celestino Múti y Bosio

In the course of his travels Humboldt sought out information from numerous New World sources, with whom he conducted lively conversations. He discussed the use of nitrogen and ferric oxide with the governor of the Cumana province of Venezuela. At México's *Colegio de Minería*, Humboldt met colleagues and friends who had studied mineralogy at Freiberg with him under the guidance of A. G. Werner.²⁸ Humboldt spent two months with the famed botanist José Celestino Bruno Múti y Bosio at Bogotá in 1801. Múti had pursued the study of native flora and fauna for nearly fifty years. He discovered and described hundreds of specimens, collecting over 24,000 dried plants, 5,000 drawings of plants by his pupils, and a vast array of woods, shells, resins, minerals, and skins. Múti (1732-1808) was a Spanish physician and priest who came to the Americas in 1760, dedicating four decades of his

life to studying the New World. In this process, he investigated nature and regularly corresponded with scientists such as Linnaeus. Mútiis expounded on the principles of Copernicus and Newtonian physics, leading to a confrontation with the Catholic Church in 1774 when he was required to defend his writings before the Inquisition. Humboldt wrote that talking with Mútiis equaled a visit with the great scholars of Europe.²⁹ The favorable intellectual environment that Humboldt found in much of the Americas contributed to the success of his journey. Humboldt in turn idealized a Western Hemisphere, through his texts and maps, where Latin America and the United States were bound together by shared vision and way of life.³⁰

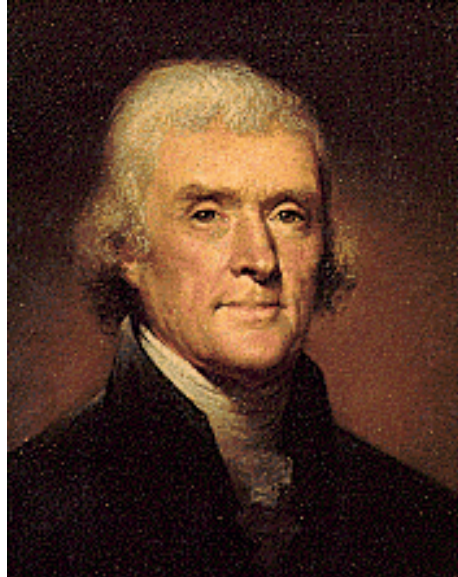


Fig. 2.11. Thomas Jefferson
Third President of the United States, 1801-1809
Painting by Rembrandt Peale

In 1804, Humboldt spent six weeks in the United States, during which he met with members of the American Philosophical Society in Philadelphia -- thus beginning an exchange of scientific information between Europe and the United States that continues to the present day. Humboldt was President Thomas Jefferson's houseguest in Washington, D.C., where he entertained Jefferson with stories of his travels. Jefferson's writings and ideas had inspired Humboldt from his boyhood. He told Jefferson, "I could not resist the moral interest to see the United States, whose executive powers have been entrusted to your enlightened spirit, and to enjoy the comforting aspect of a people who can appreciate the precious gift of freedom."³¹

Humboldt was interested in Jefferson's plans for exploring the Louisiana Territory, and looked forward to discussing with him the state of American science. Both Humboldt and Jefferson believed the advancement of science to be a basic value of the Enlightenment. Jefferson wrote, "Nature intended me for the tranquil pursuits of science by rendering them my supreme delight."³²

Jefferson (1743-1826) was concerned about the political future of Spanish America, and the prospects for democracy in the region. Humboldt's discourse with Jefferson included comparisons between the production and export volume of México

with that of the United States. Humboldt believed that the economy of a free society could increase faster than a colonial economy under mercantilism. The Lewis and Clark expedition also became a subject of mutual interest. But the primary topic of their conversation was the border region between México and the United States. Jefferson knew that Humboldt possessed documents containing information about New Spain that was to a large extent unknown to the U.S. government.³³ With the purchase of Louisiana, Jefferson needed to become better acquainted with the region and its inhabitants. Jefferson asked Humboldt the limits of Louisiana between Spain and the United States.³⁴ Jefferson was particularly interested in the disputed portion between the Red River and Rio Grande.³⁵ He asked Humboldt if the population consisted of white, red, or black people, and if any mines were located in the region.

Jefferson was amazed with the data Humboldt had collected. Humboldt loaned Jefferson a sketch of his map, *General Chart of the Kingdom of New Spain*, and provided him with a 19 page manuscript describing the population, geography, agriculture, mines, and military preparations in the northern provinces. Jefferson took keen interest in Humboldt's journey. Humboldt was a source for much information about the Spanish empire in México and California, and it is believed that Humboldt was an important influence on Jefferson and the question of land division between the United States and México.³⁶ Humboldt reported many years later that Jefferson discussed with him his ideas about the political future of America, "The project of a future division of the American continent into three great republics which were to include México and the South American states which at that time belonged to the Spanish crown."³⁷

Jefferson was an accomplished surveyor and mapmaker. In 1785 he served as chairman of the Land Ordinance Committee which enacted legislation requiring the survey of public land prior to settlement, orientation of survey lines, the township unit, and the section. Under the committee's plan, unsettled land was to be subdivided into square-mile sections. The sections were then organized into townships of thirty-six sections each. Blocks of townships were determined by north-south meridians and east-west bases. Sections were later subdivided into properties, resulting in a network of grid lines. This survey method was adopted by the committee for the U.S. Public Land Survey that started in Ohio and progressed westward. The method contrasted sharply with the non-systematic "metes and bounds" survey of the eastern seaboard of the United States.³⁸

Jefferson discussed with Humboldt his idea of determining longitude on land without the use of a chronometer. Humboldt told Jefferson, "The idea is practical but not original. It was published several years ago by (the French astronomer) Lalande (1732-1807)."³⁹ While serving as president, Jefferson conceived of the Office of Surveyor General of the United States. The Surveyor General was to be responsible for determining geographical positions necessary for the production of maps and charts. By this means the Louisiana Territory was to be divided and the surveying was to be conducted by deputies appointed by the Surveyor General. Despite Jefferson's initiative, the Surveyor General had a slow start. Political opposition in Congress delayed commencement of the first geodetic survey west of the Mississippi for fifteen years.⁴⁰



Fig. 2.12. Charles W. Peale

Charles W. Peale (1741-1825), Member of the American Philosophical Society and friend of Thomas Jefferson, kept a diary of Humboldt's journey to Washington:

The Baron spoke English very well, in the German dialect. He possesses surprising fluency of language, and it is amusing to hear him speak English, French, and Spanish, mixing them together in rapid speech. He is very communicative and possesses a surprising fund of knowledge in botany, mineralogy, astronomy, philosophy, and natural history. With a liberal education, he has been collecting information from learned men of letters from almost all quarters of the world.⁴¹



**Fig. 2.13. Humboldt's friend
Madame Récamier in her Paris salon, 1805**
Painting by Francois Gérard

Humboldt was offered a government position while in México as a guest of the Spanish monarchy.⁴² Humboldt declined, explaining to his Mexican hosts that he missed the social life of Paris. But what if Humboldt had accepted the post in the Mexican government? History suggests that relations with México and the United States might have been different. These emerging nations might have evolved on a more equal footing. At the very least, communications between the two governments would have

been considerably better.⁴³ The present-day political implications are significant. Imagine the United States without security concerns and illegal immigration problems at its southern border. Imagine a strong Mexican government supporting the United States in defense of freedom and democracy throughout the world.

Not everyone agrees with this conjecture. Historian Douglas W. Richmond finds it hard to imagine a future México fighting in defense of freedom and democracy given its authoritarian colonial legacy and future rulers such as Iturbide, Santa Anna, and Porfirio Díaz. Richmond notes that liberals, particularly federalists who would have struggled for such ideals, had failed by 1846.⁴⁴ Whether or not Humboldt's leadership would have made a difference in México will never be known. Humboldt's contribution to science was immeasurable. But his scientific agenda, impressive as it was, could have been taken up by others more qualified and more focused on their respective areas of interest. One of Humboldt's gifts was his political acumen, and it can be lamented that despite his accomplishments, Humboldt missed an opportunity to change the Americas and the world for the better by disengaging at a crucial time.

Missed opportunity does not diminish Humboldt's considerable accomplishments. Because of his untiring capacity for work, his ability to see the broader picture, and his motivation to record measurements carefully, Humboldt discovered many of the concepts we take for granted today.⁴⁵ He invented safety lamps for miners; he climbed mountains and learned about the effects of altitude on humans, plants, and climate; he learned how geomagnetic fields effect navigation; he created the most accurate relief maps of large regions; he was the first to note the relation

between the earth's magnetic intensity and the aurora borealis. Humboldt collected data in the areas of geomagnetism, mineralogy, oceanography, ethnography, physiology, and linguistics. Humboldt's travels, experiments, and knowledge transformed western science. His influence is apparent throughout the world, more so in the Americas than in his native Germany. Humboldt may have been marginalized at home because German nationalists did not care for his French leanings.⁴⁶ Or perhaps Germany's authoritarian leaders disapproved of Humboldt's liberal politics.⁴⁷ In the Americas, however, Humboldt's influence is more prevalent. There are at least eight townships named Humboldt. California has a Humboldt Bay, and three states have Humboldt counties. There is a Humboldt Range, Humboldt River, Humboldt Reservoir, Humboldt Salt Marsh and Humboldt State Park. Humboldt biographer Adolf Meyer-Abich attributes the naming of places to the "inspiration Humboldt gave American scholars during his brief visit to the U.S. in 1804."⁴⁸ Plaques commemorating Humboldt can be found throughout the Americas, even in areas where he never traveled.

Humboldt's impact on society, culture, and politics in the Americas are an important part of his journey. Humboldt initiated numerous personal links and intellectual transfers between America, Germany, and other European nations. Humboldt was "so devoted to America in heart in mind as to think of it as a second homeland."⁴⁹ Humboldt hoped one day to return to America. He called the United States "a beautiful dream, the only place on Earth where man possesses liberty and where the small evils are compensated by the great goods."⁵⁰



Fig. 2.14. Dolley Madison

Mrs. Dolley Madison (1768-1849), the Secretary of State's wife, wrote to her sister of Humboldt's visit to the United States:

We have lately had a great treat in the company of a charming Prussian Baron von Humboldt. All the ladies say they are in love with him, notwithstanding his want of personal charms. He is the most polite, modest, well-informed and interesting traveler we have ever met, and is much pleased with America. He sails in a few days for France . . . he had with him a train of philosophers who, though clever and entertaining, did not compete with the Baron.⁵¹

Humboldt's transatlantic journey left an indelible impression on Americans, who counted him as one of their own. The great respect that Humboldt had for America was not only reciprocated but strengthened during the time he spent there.⁵² German philosopher Johann Wolfgang von Goethe recognized Humboldt's contributions and noted that the Americans would very well know how to make use of them. Historian Aaron Sachs wrote, "It is quite possible that no other European had so great an impact on the intellectual culture of nineteenth-century America."⁵³

On June 30, 1804, Humboldt set sail for France. With his return to Europe, the most unique journey of its time came to a close.⁵⁴ Humboldt traveled over 6,000 miles through remote rain forests and high mountain ranges during his five years in the Americas. He collected forty-five cases of specimens including 60,000 plants and a wealth of geological, zoological, and ethnographical materials.⁵⁵ He said that his objective had been to collect ideas rather than things, and the ideas that he formulated became as important as the specimens. He meticulously documented his observations, publishing thirty-four volumes over a period of nearly four decades.⁵⁶ His texts combine analysis on a wide variety of subject matter with precise measurements, statistics, and sketch maps illustrating both natural and cultural phenomena. Humboldt was a product of the Enlightenment who used reason and scientific method in his inquiries. But at the end of his journey he wrote, "Whether in Amazonia or the high Andes, I was aware that one breath, from pole to pole, breathes one single life into rocks, plants, and animals, and into the swelling breast of man."⁵⁷

CHAPTER 3

COLLABORATIVE TRANSATLANTIC STUDY

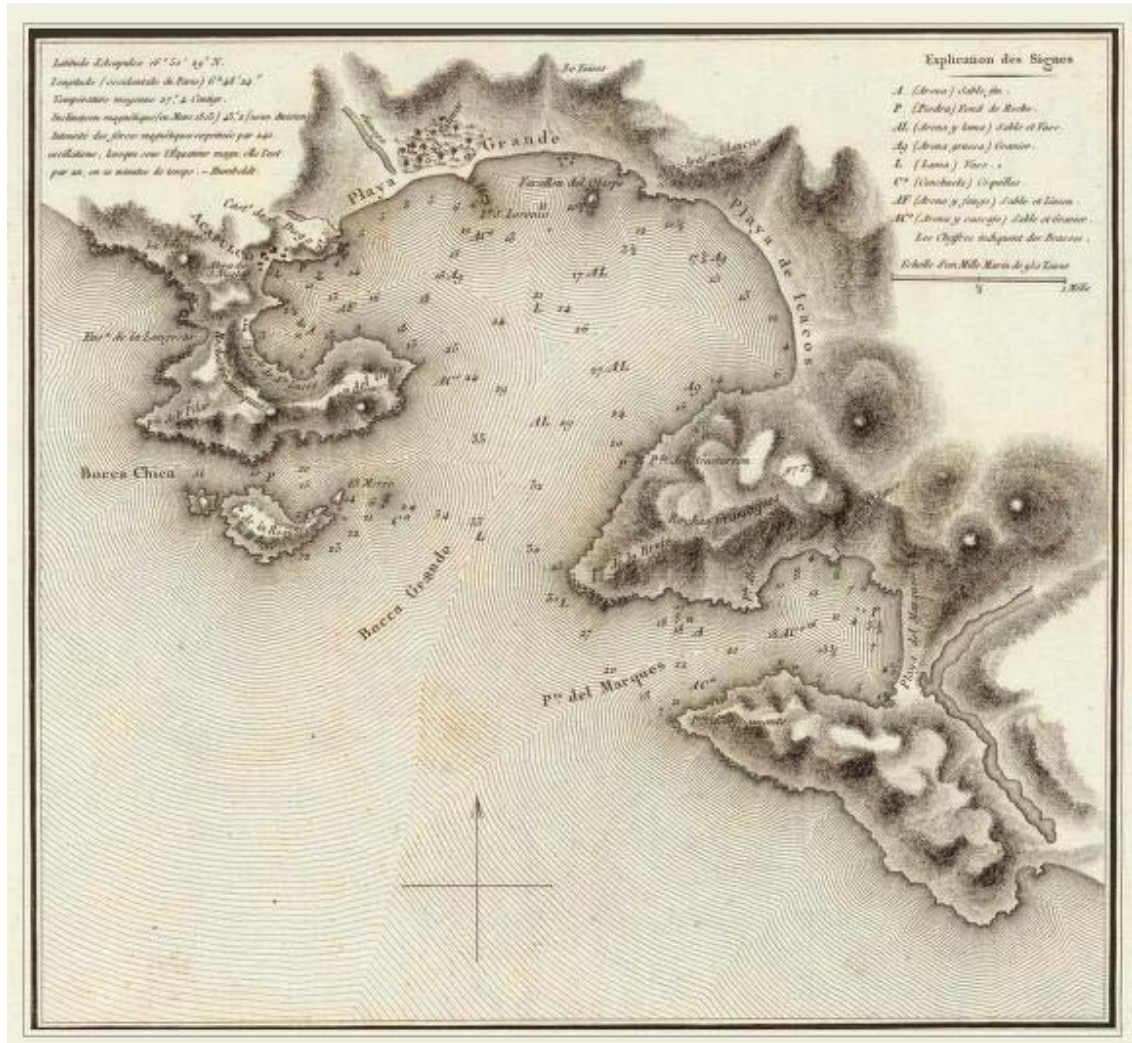


Fig. 3.1. Plan du Port d'Acapulco
Alexander von Humboldt

Humboldt arrived in New Spain on March 22, 1803, sailing into Acapulco Bay after a stormy voyage from Peru. He took astronomical observations to ascertain the true longitude and latitude of Acapulco, which had been in dispute. Humboldt consulted an unpublished report by Alejandro Malaspina (1754-1810) in preparing this map. Malaspina had charted the coasts of New Spain with "scrupulous accuracy," but the Spanish government kept the information secret.¹



Fig. 3.2. *Carte du Mexique et des pays limitrophes situés au nord, 1808*
Alexander von Humboldt and J.B. Poirson

When Humboldt arrived in New Spain, he found that the interior regions had not been adequately surveyed. Humboldt set out to conduct such a survey, utilizing the natural terrain of the country for trigometric operations that required only "trifling expense." Humboldt collaborated with Mexican scholars, using Enlightenment science and the data he found in archives and convents to chart the geography of New Spain and "dispel the darkness which for so many ages has covered one of the finest regions of the earth."²

Humboldt's role as a surveyor of Spanish America appealed to European political and economic interests. The statistical data that he obtained from his Mexican hosts and included in his texts and maps caught the attention of European readers. Humboldt was able to compare the development of New Spain to that of Europe using the plans and manuscript notes he found preserved in the Mexican archives or buried in convents. Humboldt collected additional material on excursions. He visited mines, made astronomical and barometric observations, and visited a cigar factory and a drainage system. He also worked and taught at the School of Mines. King Carlos IV

was eager to make use of Humboldt's mining experience, and asked him to report back in particular on mineralogical findings.³

Humboldt's texts and maps advanced México's image across the Atlantic as "one of the choicest countries in the world for colonization."⁴ He wrote that México was a land of contemplation, where one could "admire the landscape of nature." That image helped to promote México to colonizers and investors, making México familiar to Europeans as an undeveloped arcadia of vast proportions, replete with open land for cultivation and water for irrigation.⁵

The transatlantic response to Humboldt's work was both considerable and varied. French and German periodicals admired how Humboldt had redrawn the map of México with new, improved determinations of latitude, longitude, and altitude. British reviewers stressed the commercially strategic aspect of this new, more reliable map.⁶ It served the transformation of México into the world's most strategic area for world trade, nearly equidistant between Europe and the Far East. Harbors on the east and west coasts, and the relatively short land connections between them, would improve commercial traffic with Asia and with the west coast of North America.⁷ Humboldt instilled the idea that México was pivotal to world trade with his comprehensive description that made the previously opaque Spanish possession transparent. He expressed the belief that the relaxation of trade monopolies had produced an upturn in economic growth.⁸ Humboldt theorized it was in the free market that the economic progress of México resided. His analysis of the political economy of México stressed notions of economic and individual freedoms which he borrowed from Adam Smith (1723-1790).⁹ His writing reflected Enlightenment thought about freedom and wealth of

nations. It offered in scientific, geographical, and statistical terms a well-informed account of the geopolitical and commercial significance of México.¹⁰

A Latin American scholar, Francisco José de Caldas (1771-1816), praised Humboldt for legitimizing scientific enterprise in the New World. Caldas collaborated with José Celestino Múti in the botanical survey of Nueva Granada. His meteorological records, together with his observations on the distribution of plants and animals in relation to climate were used by Humboldt. Caldas wrote that Humboldt challenged American scholars "to confront their own observations."¹¹ Caldas credited Humboldt with providing the criticism, stimulation, and reinforcement necessary to confirm to Americans the validity of their place in the international scientific community.¹²

Mexican historian Juan A. Ortega y Medina (1913-1992), had a different view of Humboldt's work. Ortega pointed out that information on demographics and economics which Humboldt published in *Political Essay on the Kingdom of New Spain* was based on data that Mexican scholars had already researched and supplied to the European traveler. Ortega wrote, "Humboldt found a high standard of scientific knowledge and discussion upon his arrival in México. He had access to important archives and was thus able to paint a comprehensive picture of México in his own publications which in the long run overshadowed the achievements of the Mexicans. Immediately after leaving the country, Humboldt shared his knowledge with the United States government."¹³ Ortega argues that Humboldt thus paved the way for the North American expansion into Spanish America and for the economic conquest of the American Southwest.¹⁴

Humboldt had prepared a memorandum, *Tablas geográfico políticas del reyno de Nueva España* (1803) for the Viceroy of New Spain, José de Iturrigaray. When Thomas Jefferson requested information about México, Humboldt translated the memorandum into French, added a two-page summary on the Mexican border region of the Louisiana Territory and gave it to the president. The *Tablas* were first given to the Mexican Viceroy by Humboldt. The information contained therein, now known and accessible, was to be published soon thereafter for a receptive international audience. Humboldt was convinced that the sciences should be free and the exchange of information should not be limited, and it was a real exchange of information. At the end of his visit Humboldt received recent statistical data on the U.S. from Secretary of the Treasury Albert Gallatin which was published in Humboldt's *Political Essay on the Kingdom of New Spain* and in *Personal Narrative of Travels to the Equinoctial Regions of the New Continent* (1829). In his farewell letter to Secretary of State Madison, Humboldt promised that he would communicate to the U.S. government all the details he knew about the possibilities of building a trans-oceanic canal.¹⁵

John Black writes in the preface of his English translation of *Political Essay on the Kingdom of New Spain* that Humboldt was obliged to defer to his Mexican hosts and give favorable accounts of all of the Mexicans whom he mentioned. "He is profuse in his compliments to their learning, science, and their other good qualities, and nothing ever appears to shade the picture."¹⁶ But Black writes that Humboldt saw both in individuals and institutions much more that met with his disapprobation than he chose to communicate. For his part, Humboldt refers to his "esteemed and reflective" Mexican colleagues throughout *Political Essay on the Kingdom of New Spain*. He cited

Mexicans who possessed “great precision of ideas and accuracy of observation.” He attributed their relative obscurity to the effect of insulation and to “defects in the social institutions of the colonies.”¹⁷ But he found much of their work to be inaccurate and of little use in the production of his own maps and texts.

The question arises as to just how useful were Humboldt’s Mexican sources? Ortega wrote that Humboldt found a high standard of knowledge in México which he passed on to the United States government, who in turn used the information for the economic conquest of México. On the other hand, Black suggests that the Mexicans were cooperative but provided Humboldt with little useful information.¹⁸ Black's assessment raises yet another question: if the information provided by the Mexicans was of limited value, how significant was Humboldt’s sharing of that information with Thomas Jefferson and the U.S. government? Humboldt suggested that the lack of knowledge of Mexican geography in 1803 more closely reflected the policies of the Spanish government rather than the scholarship of the geographers.¹⁹ Black's assessment marginalized the role of Mexican geographers past and present who contributed to Humboldt's work. Ortega's analysis overlooked the economic benefit that Humboldt's published findings would bring to a country that was strategically located between Europe and Asia and thus pivotal to world trade. Ortega's assessment further devalued Humboldt's vital contribution to the study. Humboldt developed insights and created new knowledge with the data he found in México, and he shared his knowledge with others in the interests of progress. Humboldt never expressed any regret for allowing his map to be copied and had no problem in supplying the U.S. government with the latest geographical and statistical information on México.²⁰

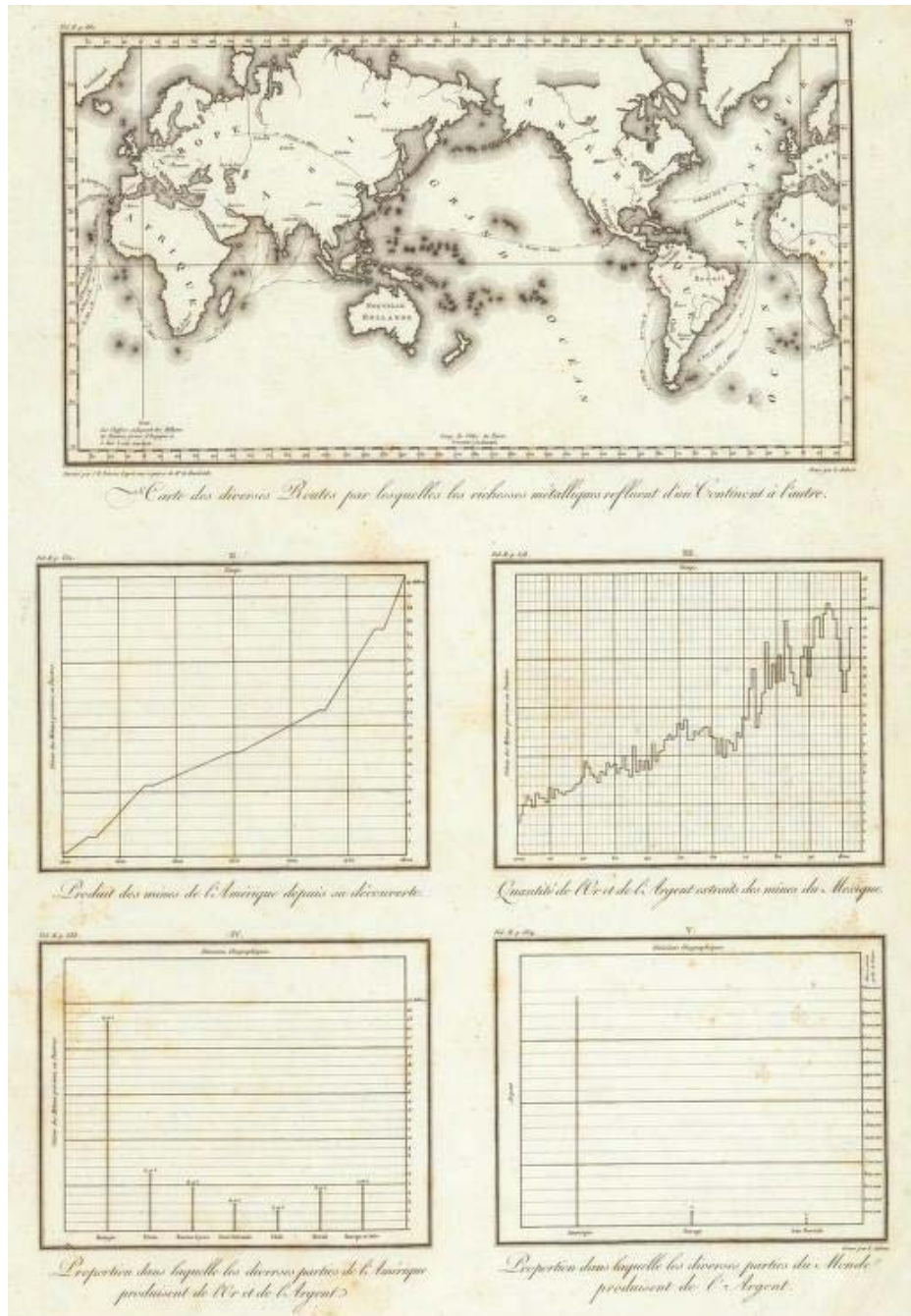


Fig. 3.3. Routes par lesquelles les richesses métalliques, 1803

Alexander von Humboldt and J.B. Poirson

Humboldt's maps included statistical as well as geographical information. He used the scientific data he collected in the interests of economic and political theories that created wealth. Depicted above is Humboldt's map of world trade routes and four charts detailing the amount and monetary worth of the gold taken from the mines of México and South America in 1802.²¹

Humboldt used the observations of Spanish scientist José Joaquín de Ferrer (1763-1818) as a benchmark for much of his own work.²⁴ Ferrer had accurately charted geographic positions throughout much of México and the United States. Humboldt also collaborated with Juan José Oteyza, a geometrician who assisted Humboldt with constructing plans and recalculating the observations of earlier scientists such as Gabriel López de Bonilla, whose unpublished manuscript of 1643 on the hydrology of México was preserved in the archives of the viceroyalty, and Diego Rodríguez (1568-1668), professor of mathematics at the Royal Pontifical University who had accurately fixed the longitude of México City.²⁵ The work of these earlier scientists laid the foundation for the mapping of New Spain throughout the eighteenth century and provided much of the context in which Humboldt constructed his map.

Historian Dennis Reinhartz calls the eighteenth century “a significant period of mapping in the social, economic, and political contexts of the development of New Spain.”²⁶ Reinhartz cites two maps from the period as being particularly noteworthy, one a military map drawn by Juan Agustín Morfi in 1770 and another map by Don Gonzalo López de Haro in 1778. The maps by Morfi and Haro were beautifully drawn and are fine examples of New World mapmaking of the time. But as Reinhartz notes, Haro’s map contains no scale, and is not accurate.²⁷ Humboldt does not mention Haro’s map in *Political Essay on the Kingdom of New Spain*, but he was critical of other cartographers of the period.²⁸

Historian Carl Irving Wheat wrote that the problem of accurate geographical positioning looms large when a cartographer seeks to construct a map. Humboldt thus

devoted a considerable portion of *Political Essay on the Kingdom of New Spain* to the errors of observation by earlier mapmakers.²⁹ Humboldt found many maps in the Mexican archives to be riddled with errors, referring to their scales of longitude and latitude as merely “accidental ornaments.”³⁰ In his best diplomacy, Humboldt pointed out that the British had accurately charted most of the world’s oceans but lacked an accurate map of the English Channel.³¹ Humboldt disputed the notion that early mapmakers were handicapped by their rudimentary equipment. He cited instances where “zealous observers procured very satisfactory results using imperfect means, including a scale made from pieces of reed.”³² Humboldt found the mapmakers, rather than their instruments, to be responsible for the faulty workmanship of their maps. Humboldt also found many of the Spanish maps, particularly those of the northern provinces, to be “meager and inadequate.”³³

The geography of the northern provinces was little known outside of the Spanish empire, since the maps and accounts of Spanish exploration remained in manuscript form and were not published. Humboldt deplored Spain's “jealous policy that long kept the world in ignorance of its possessions.”³⁴ Not until Humboldt visited México City and was given access to the Spanish archives did information become more widely available. Reinhartz writes that the Spaniards had knowledge of the geography but were secretive and refused to reveal what they knew.³⁵ This secretive nature dates back to one of the first known maps of the northern provinces, prepared in 1540 by Francisco Vázquez de Coronado (1510-1544). In a note to the viceroy, Coronado described his route from México City to present-day Albuquerque, New México, adding that he

would "say no more about it."³⁶ The Spaniards held Coronado's map so closely that nobody knew where it was kept, and to this day the map remains lost. The Spanish penchant for secrecy seemed at odds with their mostly indifferent mapping of the region.³⁷ This ambivalence was perhaps best summed-up by Humboldt when he wrote, "It is astonishing that the once-intrepid Spanish are unable to find a land route from Taos to Monterey."³⁸

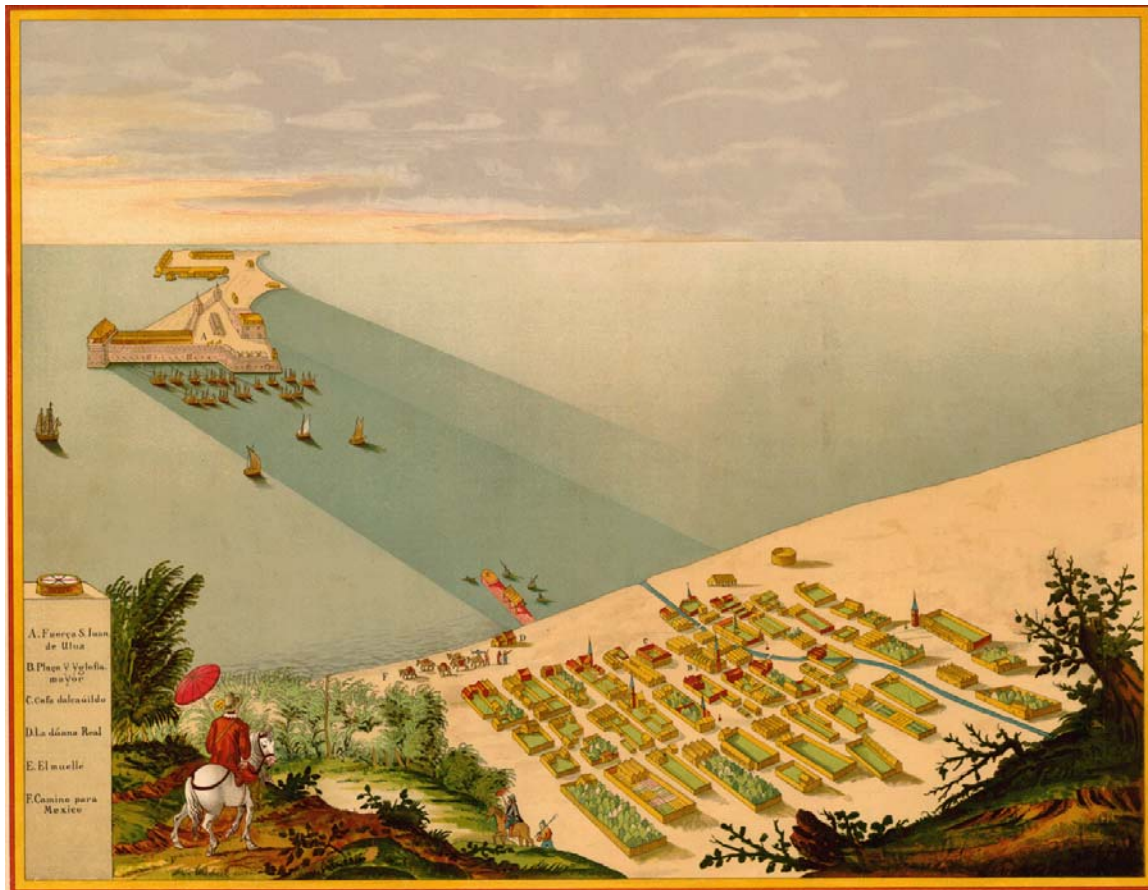


Fig. 3.5. *Puerto de la Vera Cruz Nueva con la fuerca de San Juan de Ulua en el reino de la Nueva España en el Mar del Norte, 1628*
University of Texas Austin Libraries

Early Spanish maps were beautifully drawn and are fine examples of New World mapmaking. But most contained no scale, and were not scientifically accurate.



Fig. 3.6. Composite of *General Chart of the Kingdom of New Spain*, 1808
Alexander von Humboldt

Humboldt was inspired to draw *General Chart of the Kingdom of New Spain* by Fausto d'Elhuyar (1755-1833), the Mexican director of mines who asked Humboldt to draw up a map for soldiers who needed to know where the mines were located so they could protect them from bandits. In 1800, Mexican mines produced much of the world's silver.³⁹ Humboldt revealed that the quantity of gold and silver sent annually from the new continent into Europe amounted to more than nine-tenths of the world's production.⁴⁰ Because of its wealth, as well as its favorable position between Europe and Asia, México was the most important colony in the Spanish empire, and mining was the backbone of its economy. Elhuyar was a mineralogy teacher sent to México by the Spanish government in 1788 to advance the state of mining in the New World. He spent 33 years as Director General of Mines, during which he established the School of Mines and investigated the amalgamation process for obtaining silver from ores. Mercury was used for amalgamating silver at the time but its supply had become limited. Elhuyar and his brother Juan José are often credited with discovering tungsten at a lab in Spain in 1783.⁴¹

Humboldt determined that mining technology in the New World had suffered as a result of the political policies of the Spanish Crown. The knowledge of European mining operations rapidly passed into México during the first colonization of the country. But from the late sixteenth century forward the American miners "learned hardly anything from the Europeans."⁴² Humboldt cited King Carlos IV, whose decree made it possible for Humboldt to conduct his research, for his "praiseworthy desire of imparting to the colonies all the advantages derived by Europe from the improvement in

machinery, the progress of chemical science, and their application to metallurgy.” He noted that German miners had been sent at the expense of the Spanish Court to México but their knowledge had not been utilized because the mines of México were the property of individuals who directed the operations and distrusted the government.⁴³

Carlos de Sigüenza y Góngora (1645-1700) was an earlier influence on Humboldt’s work. Humboldt cites Sigüenza’s contribution to New World geography throughout *Political Essay on the Kingdom of New Spain*. Sigüenza made maps of New Spain, a map of the lakes in the Valley of México, and a map of Pensacola Bay, now northwestern Florida in the United States. New Spain had a settlement there from 1559-1661.⁴⁴ Sigüenza’s map of the bay was made in 1693 at a time when the Spanish were still interested in the area. Sigüenza was sent to investigate the bay and the diary he kept and charts he made were of value to Humboldt. Sigüenza was a professor of mathematics at the University of México who intended to write a history of ancient México, but died before he could complete the work and his manuscripts were lost.

Joaquín Velázquez de León (1725-1786) accurately fixed the longitude of México City in 1778 despite using outdated lunar tables. Humboldt called Velázquez “the most remarkable geometrician produced by New Spain since Sigüenza.”⁴⁵ Velázquez taught himself mathematics and the ancient languages. From the works of Newton and Bacon he learned astronomy and philosophy. Unable to afford instruments, Velázquez constructed his own telescopes and quadrants. In 1767 he accompanied José de Gálvez to Baja California, where he made a great number of astronomical observations. Velázquez noted that previous maps of the region showed it to be marked

several degrees farther west than it actually was. In 1773 Velázquez directed the draining of the lakes in the Valley of México. He later established the School of Mines and the Tribunal of Minerals. Humboldt also noted the contributions of Velázquez's colleague Antonio León y Gama, who was "an able and well informed astronomer." León y Gama published texts on eclipses of the moon, the satellites of Jupiter, the almanac and chronology of the ancient Mexicans, and on the climate of New Spain.

Humboldt consulted maps of Veracruz drawn by Miguel Costansó (1741-1814) in the preparation of his map, *Plateau de la Ville de México jusqu'au Port de la Veracruz* (Fig. 3.6). Humboldt also took an interest in Costansó's maps of California. In 1767 Costansó sailed to Baja California on the orders of the viceroy of México. Costansó prepared sketches and plans of the Port of San Blas and made scale drawings of the area north of Cabo San Lucas. Costansó continued on to San Diego, where he reconnoitered the port and inland areas, helping the Spaniards build a camp and establish friendly terms with the Indians. Costansó sailed with Serra and Portola from San Diego to San Francisco in 1769 (they overshot the intended destination, Monterey). On the return trip he drew new maps of the port of Monterey and examined the surrounding countryside, preparing detailed accounts of his findings for the Spanish government. This expedition marked the official beginning of Spanish settlement of upper California. Humboldt used a manuscript map drawn by Costansó and Miguel Augustín Mascaró to delineate the area from Chihuahua to Texas on *General Chart of the Kingdom of New Spain*. He consulted another map drawn by Costansó for the coast of Sonora. He also used that map for the region between Acapulco and Tehuantepec.⁴⁶



Fig. 3.7. Plateau de la Ville de México jusqu'au Port de la Veracruz, 1808
 Humboldt consulted maps drawn by Miguel Costansó in preparing his map of the Mexican seaport.



Fig. 3.8. View of Plateau de la Ville de México jusqu'au Port de la Veracruz

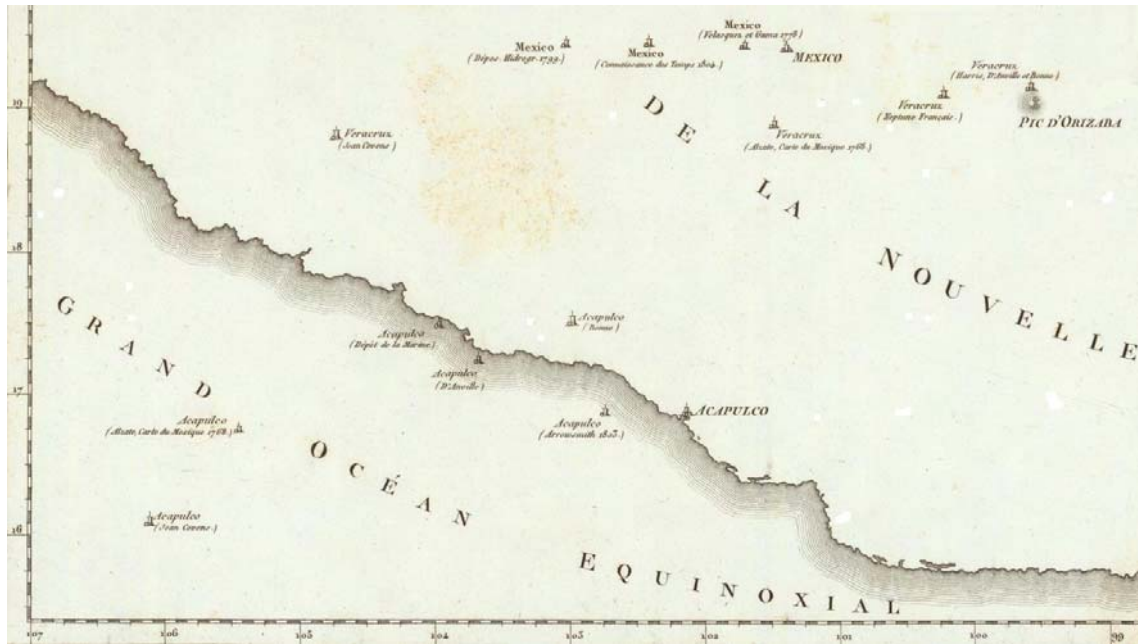


Fig. 3.9. View of *Carte de fausses positions de México, Acapulco, Veracruz et du Pic d'Orizaba, 1808*

Humboldt prepared this map showing the incorrect positions ascribed to México City, Acapulco, Veracruz and Mt. Orizaba over time, and by whom. Acapulco Bay was misplaced by miles on some maps. México City was similarly out of position.

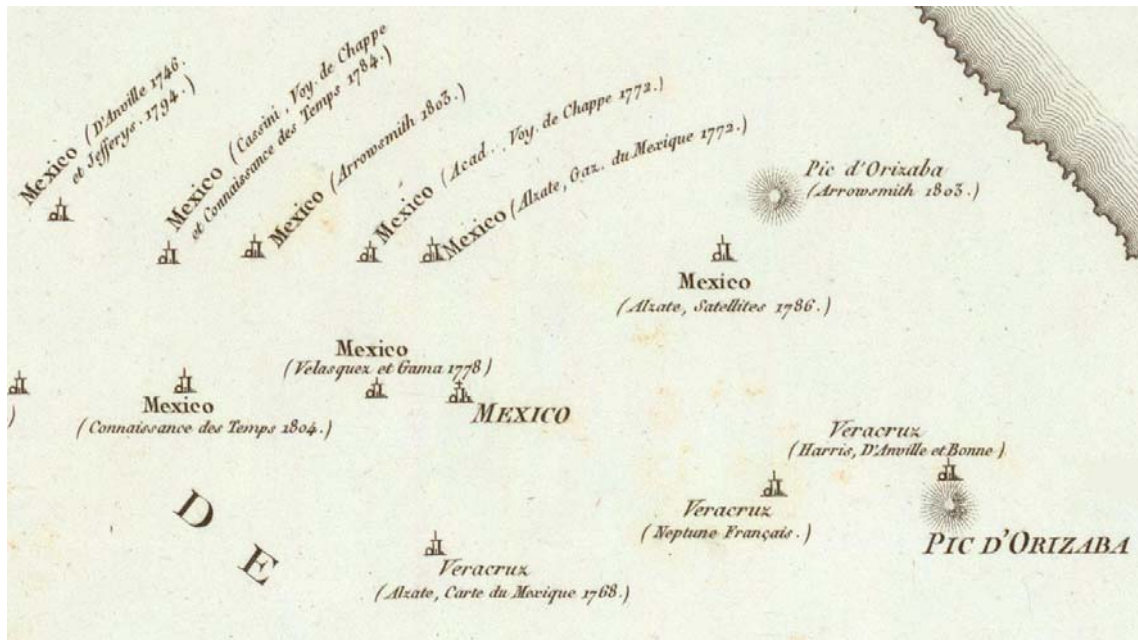


Fig. 3.10. View of *Carte de fausses positions de México, Acapulco, Veracruz et du Pic d'Orizaba*

Humboldt wrote that Arrowsmith's misplacement of Mt. Orizaba presented a "hazard to navigators."⁴⁷

José de Urrútia (1728-1800) and Nicolás la Fora (b.1730) were trained mapmakers sent by the Royal Engineers to accompany the Marqués de Rubí on an expedition along the northern frontier of New Spain in 1766-69. The purpose of the expedition was to inspect Spanish fortifications along the borderlands and to recommend measures for improving them. Urrútia and la Fora's detailed map of the region reflects the Spanish government's concern during the second half of the eighteenth century about frontier defenses, especially in response to Indian attacks and potential incursions of other Europeans into the region. The survey involved a 6,000 mile trek extending from the Gulf of California to the Red River in Louisiana. Spanish authorities established the border of the northern frontier of New Spain along the thirtieth parallel. An exception was made for New México, which jutted far to the north.⁴⁸ Since this map was never published, Americans were not aware of the extent of geographical and ethnological information known about the Spanish frontier. Rubí's expedition also yielded new information on the Indians living in the region. In 1772 King Carlos III issued a regulation based on the recommendations made by Urrútia and la Fora in their map and report. The regulation prescribed the manner of conducting relations with the Indians, the duties of the commandant inspector and other military personnel, and provided for a cordon of 15 presidios, at intervals of about 40 leagues, from Sonora to Texas. The objective was to prevent Apache raids from the north into settled areas and to bring the Indians under military control. Humboldt used Urrútia and la Fora's map to fix the location of the presidios on *General Chart of the Kingdom of New Spain*.⁴⁹



Fig. 3.11. View of José de Urrútia and Nicolás la Fora's *Mapa que comprende la frontera, de los dominios del rey en la America septentrional*, 1769, 1st of 4 sections

Santa Fé and portions of eastern New Mexico are depicted. The mapmakers seemed reluctant to identify the large river in the upper right, finally calling it *Rio de Nachitos* on the second section of their map.

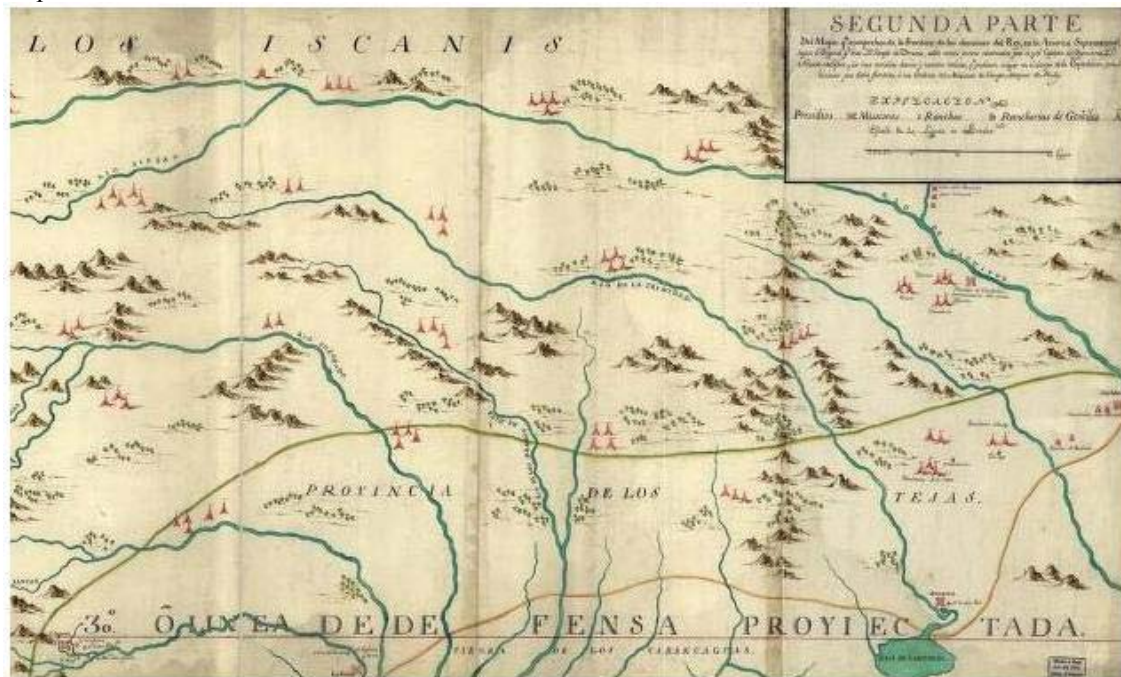


Fig. 3.12. View of *Mapa que comprende la frontera... 2nd section*

Humboldt used Urrútia and la Fora's map to fix the location of Spanish presidios along the northern frontier on his *General Chart of the Kingdom of New Spain*. Images courtesy of the Library of Congress.

Humboldt did not travel to the northern provinces of New Spain. His map of the region evolved using the cartography of Bernardo Miera y Pachéco (1713-1785). Apparently Humboldt never saw Miera's map, but only those features of the map which appeared on later maps.⁵⁰ Miera y Pachéco accompanied Francisco Atanasio Domínguez and Silvestre Velez de Escalante on their famous expedition to the upper Colorado River basin and Utah Valley in 1776-1777. As Humboldt noted, the expedition failed to link Santa Fé with the new Spanish settlements along the Pacific coast, but they obtained new knowledge of the regions north, northwest, and west of Santa Fé, penetrating into the previously unknown central Rockies. Miera's manuscript map revealed Spain's efforts to explore the interior of western North America.

The failure of the Spanish government to capitalize on the information brought back by Domínguez and Escalante is significant. It meant that Utah would not be settled by white men until over half a century later, and that it would be settled by Mormons rather than Spanish Catholics.⁵¹ Maps from the Domínguez-Escalante expedition were never published, but manuscript copies were circulated throughout New Spain.⁵² The use of Miera's map by Humboldt stemmed from the inclusion of Miera's material by Costansó and Mascaro on their maps of the northern provinces. Miera's map represented the first attempt by a European to map from first-hand experience the upper Colorado River basin. It was also the first to show the lakes and streams of the eastern portion of the Great Basin.⁵³

Miera's map contains errors which Humboldt repeated. Utah Lake and the Great Salt Lake are depicted as one lake called Lake Timpanogos. Rio de S. Buenaventura is depicted flowing into Laguna de Miera. That river is likely the Green River, which flows into the Colorado River. Where Miera's river flows into the lake bearing his name, he likely depicted the Sevier River, which flows into Sevier Lake. Miera shows another river, Rio del Tizon, flowing west from Lake Timpanogos.⁵⁴

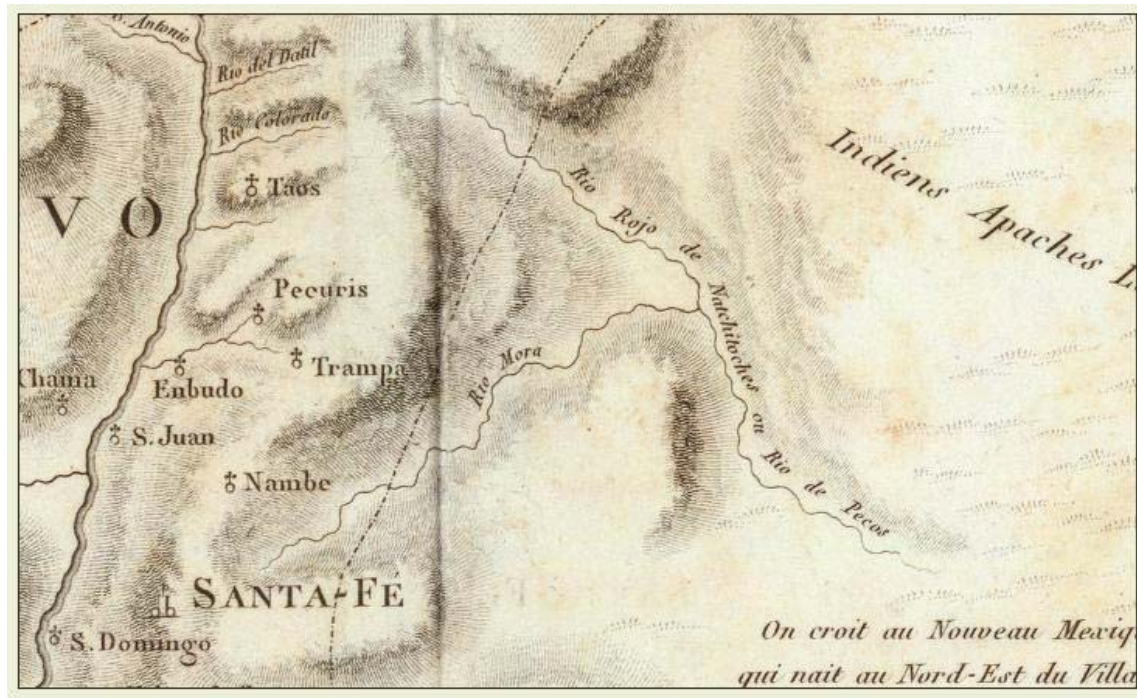


Fig. 3.13. View of *General Chart of the Kingdom of New Spain*

Humboldt represents the Canadian River as *Rio Rojo de Natchitoches* starting in the mountains east of Santa Fé. This error confused mapmakers for years and would lead Zebulon Pike to believe in 1807 that he had found the source of the Red River which separated Spanish territory from America's newly acquired Louisiana Territory.⁵⁵ Humboldt's error is a borrowing from Miera, whose manuscript shows the *origen del Rio Rojo* in that location.⁵⁶ In a land where the ruddy color of running water suggested to the Spanish the words *colorado* or *rojo*, it is not surprising that several rivers bear these names. Nor is it surprising that a river whose full course was unexplored might have a different name at its source than at its mouth. The Spanish applied the name *Rio Rojo* to the upper reaches of the Canadian River, a tributary of the Arkansas River. It made sense to suppose that it was the same *Rio Rojo* which entered the Mississippi near Natchez. In reality, that river starts in the Texas panhandle.⁵⁷

Humboldt also consulted numerous books in addition to maps. Francisco Antonio Lorenzana (1722-1804) compiled *Historia de Nueva-España*, 1770, which was one of the most lavishly illustrated works printed in the New World at the time and an important source for Latin American history. Humboldt refers to Lorenzana's book throughout *Political Essay on the Kingdom of New Spain*. It includes Cortés's letters to Emperor Carlos V, written between 1520 and 1523. Also included is an essay on the viceroys of New Spain, a section of engravings reproducing pre-Conquest Nahuatl manuscripts, an account of the Cortés and Ulloa explorations to Baja California, and two other maps. One of the maps is a copy of Domingo del Castillo's map of California from 1541, the original of which has disappeared.

Humboldt cites the Cortés letters as well as unnamed Indian historians in recounting the history of México.⁵⁸ He also credits historian Domingo Arriavitor for his very accurate mapping of Indian habitats throughout New Spain.⁵⁹ But evidently there were no early Indian maps available for Humboldt to study.⁶⁰ Historian David Buisseret writes that indigenous maps must have been very fragile, for they have not survived. No topographic maps have been preserved from the period before the Spanish conquest.⁶¹ Indigenous maps such as *Cuauhtinehan no.1* at the *Bibliothèque nationale* in Paris give no indication of orientation or scale. Concerned more with depicting historical events and social relationships, they are a very different kind of map than Europeans valued.⁶²

Humboldt was interested in indigenous culture. He may not have known -- and thus makes no mention -- of the *Relaciones geográficas*, a survey of Mexican

townships ordered by King Felipe II in 1577 that included *pinturas* drawn by indigenous mapmakers. Humboldt collected Aztec codices, and included examples of indigenous art forms throughout his thirty-four volumes of text.



Fig. 3.14. Reproduction of costumes drawn by Mexican artists at the time of Montezuma
Vue des cordelleres et monumens des peuples indigene de l’Amerique

Copied from the original artwork by a Spanish priest who accompanied Cortés on his first journey to México. Humboldt viewed the artist’s original painting in México City and was thus able to compare it with the priest’s copy. The priest’s copy is accurate in its portrayal of the costumes, but the reproduction of the Indians is not as accurate. According to Humboldt, the priest elongated the bodies to appeal to a European sensibility. Humboldt admonished future artists to be more exacting and accurate in their work.

Hernán Cortés reported in 1521 that he received a chart from the Aztec emperor Montezuma showing a large part of the Mexican coast on which were delineated estuaries, rivers, and bays. Norman J.W. Thrower writes in *Maps and Civilization*:

Cartography in Culture and Society (1999) that such charts were sometimes taken to Europe and information from them was used in compiling published maps.⁶³ But terms such as “not wholly accurate” pervade any discussion of New World cartography prior to Humboldt. David Buisseret notes that the fusion of Mexican and European cartographic styles came about as a result of transatlantic exchange, and that eventually the European style gained the upper hand.⁶⁴ The European style prevailed in part because early Mexican maps were difficult to analyze -- they had no coordinates. Maps such as the Pineda chart of 1519 and the Soto expedition map of 1544 are often cited by historians. As noted earlier, Humboldt found many of these maps to be inaccurate and of little use in preparing his map. The fact that Humboldt studied earlier maps of New Spain and improved upon them is significant. It speaks to the importance of the colonial precedent brought about by Humboldt and King Carlos IV. It is also noteworthy that Humboldt repeated some of the errors made by those earlier mapmakers.

Humboldt had low expectations of producing a good map of México. He wrote, "We ought not be surprised at the uncertainty which prevailed in the geography of México, when we consider the fetters which have arrested the progress of civilization, not only in the colonies but in Spain as well."⁶⁵ Humboldt noted that México had enjoyed a long period of peace, dating back to the early sixteenth century. Elsewhere in the world, the continual march of armies and the necessity of seeking the shortest communication contributed to better geographical information. Taking detailed measurements wherever he went, Humboldt contributed better geographical information about the New World with maps that were both scientifically accurate and aesthetically

pleasing. Historian Carl Irving Wheat concluded that Humboldt's *General Chart of the Kingdom of New Spain* "was undoubtedly the most important and most accurate published map of the American West that had yet appeared."⁶⁶

That map would figure in a considerable cartographic controversy. Humboldt complained to Thomas Jefferson that explorer Zebulon M. Pike had taken, "rather ungraciously . . . my report which he undoubtedly obtained in Washington with the copy of my map, and besides he also extracted from it all the names." Humboldt considered this to be plagiarism and an affront. He continued in his complaint to Jefferson, "I do not find my name in his book and a quick glance at Mr. Pike's map may prove from where he got it."⁶⁷

Pike, a lieutenant in the U.S. Army, had been sent by General James Wilkinson, Governor of the Louisiana Territory, to explore the headwaters of the Arkansas and Red Rivers and investigate the New México settlements. Pike likely took along a copy of Humboldt's map of México and the Southwest, but he does not mention it. Before his journey was over, Spanish soldiers captured Pike and held him prisoner before they released him. Humboldt was not complaining that Pike had used his material during the expedition of 1806-07. Humboldt was annoyed because Pike had published Humboldt's map before Humboldt himself had published it in America. Pike neither admitted nor denied Humboldt's charge of plagiarism. In response to Humboldt's accusation, Jefferson sought Humboldt's forgiveness for Pike borrowing information in his report.⁶⁸



Fig. 3.15. Zebulon M. Pike
1779-1813

Historians James C. Martin and Robert S. Martin agree that Pike copied Humboldt's map. But Pike's representation of Texas rivers is considerably better than Humboldt's.⁶⁹ Not only are the Texas rivers of the Pike maps an improvement over Humboldt, but their legends are of great interest. Pike, unlike Humboldt, based his map primarily on firsthand reconnaissance. Pike added his route through Texas via Santa Fé and Chihuahua to Humboldt's map. Martin and Martin wrote, "Pike's narrative marks the beginning of serious American interest in Texas."⁷⁰ Book collector Thomas Streeter wrote, "This famous book is noteworthy because of Pike's narrative . . . of his journey across Texas from the Rio Grande to the Sabine in June, 1807, and his description of Texas. Pike's account of the week he spent at San Antonio, where he was handsomely entertained by the Spanish officials, makes interesting reading. His description of Texas is excellent, and the depiction of the Red River region seems to be the first in English." Historian Donald Jackson added, "It is apparent that Humboldt did not see Pike's map

before he published his own map. Had he done so, he doubtless would have taken advantage of Pike's new information -- with full credit, of course -- in his map of the upper areas of the Louisiana Territory. Humboldt's depiction of that region is quite primitive."⁷¹

How did Pike acquire Humboldt's map and include it in his *Map of the Internal Provinces of New Spain*? Humboldt tells us himself that in 1804 he had loaned a manuscript copy of his map to Secretary of the Treasury Albert Gallatin in Washington. More than likely, Wilkinson issued this copy to Pike before his departure. The Pike expedition party included Dr. John H. Robinson, a surgeon and naturalist who supported Mexican independence from Spain and often found himself at odds with the official U.S. government position. Robinson published *A Map of México, Louisiana, and the Missouri Territory* in 1819. The map borrows heavily from Humboldt and includes details from the Pike expedition.

In 1810 Pike published *An Account of Expeditions to the Sources of the Mississippi and through the Western Parts of Louisiana*, including five maps, which became the principal source for the story of his explorations. His descriptions provided readers with their first glimpse of the lands beyond the Spanish border. Pike inaccurately described the Great Plains as "The Great American Desert," a name and an image which stuck for over 50 years.⁷² Pike also commented on the geography, agriculture, trade, government, religion, and culture of the northern provinces of New Spain. Pike's journal was poorly organized, lacking in details, and sometimes inaccurate. Nevertheless, it was a best-seller in its day, reading like an adventure and

written in the sort of romantic prose that inspired men to brave and heroic deeds. Pike reported the discovery of gold in Colorado.⁷³ This did not provoke a gold rush, but Pike's mention that cloth and hardware fetched high prices motivated traders to find their way to Santa Fé, despite the opposition of the Spanish government. Pike wrote that Spanish authority in Santa Fé was weak and that there was every likelihood of developing profitable trade there. Pike pointed out the importance of trade in the borderlands, starting a long exchange of economic give and take between the United States and México. Accounts of Pike's journey reached the public long before publication of the journals of Lewis and Clark, and immediate trade and settlement of the Louisiana Territory developed because of this information.⁷⁴

Expectations that Pike would produce a good map of the area traversed in his expedition were low. Jefferson knew that Pike was exploring the headwaters of the Arkansas and Red Rivers, but not on Jefferson's terms. Pike was reconnoitering. He had no training in astronomical observation or natural history, and Jefferson probably felt that Pike could not produce a map based on actual survey. The maps that Pike produced were a pleasant surprise to Jefferson. In a letter to Pike, dated February 24, 1808, Secretary of the War Department Henry Dearborn told Pike, "The information you communicated to President Jefferson . . . has been considered as highly interesting in a political, geographical, and historical view."⁷⁵ Pike was not a trained mapmaker. His drawing skills were poor, and his longitude and latitude measurements were inaccurate. As an explorer, his job was to fill in blank spaces on maps. Others who were better

trained and equipped could finish Pike's work. Antoine Nau, a trained cartographer who worked for General Wilkinson, assisted Pike in the preparation of his maps.⁷⁶

Pike's *Map of the Internal Provinces of New Spain* served as an enticement to U.S. citizens who were anxious to learn more about the wealth of New Spain and its possible inclusion into an expanding young nation.⁷⁷ Why Pike failed to cite Humboldt's contribution remains a mystery. Pike's own work provided the first detailed cartographic representation of the terrain that he explored.⁷⁸ His critics nonetheless blamed Pike for both pilfering from Humboldt and for Humboldt's misplacement of the Red River. Humboldt responded a few years later by praising Pike for his "admirable courage" and lamented that Pike was "unprovided with instruments, and was strictly watched on the road from Santa Fé to Natchitoches . . . he could do nothing towards the progress of geography."⁷⁹ Historian Carl Irving Wheat added, "Humboldt's maps made the best possible background for Pike's route from Santa Fé across Texas to Natchitoches."⁸⁰



Fig. 3.16. Map of the Internal Provinces of New Spain, 1810
Zebulon M. Pike

Pike borrows heavily from Humboldt in this map. He also borrows from Lewis and Clark. Pike's own route across Texas via Santa Fé and Chihuahua is his most important contribution. Pike was interested in the exploration of the early French trappers in connection with the western boundary of the Louisiana Purchase. On his map, Pike refers to the trading expeditions of the Mallèt Brothers in 1740 and Bruyère

in 1741-42. Bruyère was said to have buried a French coat of arms under an oak tree along the Canadian River, signifying the western boundary of the Louisiana Territory.⁸¹

Humboldt depicts the Red River starting below the mountains east of Santa Fé. Pike thought he had camped on the Red River, rather than the Rio Grande, when Spanish forces apprehended him. Considering the importance of that misunderstanding to his expedition, one might expect his published map to attempt to correct the location of the Red River. But, unbelievably, Pike copied the Red River almost exactly from Humboldt's map, the very map that deceived him! This raises the question of Pike's involvement in the preparation of his map for publication. He may have turned his manuscripts over to Antoine Nau and let him finish the map. It may well be that the responsibility for plagiarizing the Humboldt map lies with Nau, and publisher John Conrad, rather than Pike, who was absent during the final preparation and publication of the book.⁸²

Wilkinson knew that the Red River depicted on Humboldt's map was not the Red River but rather the Canadian, a tributary of the Arkansas River. Wilkinson likely got this information from travelers and passed it on to Secretary of War Dearborn in a letter dated 1805. Historian Donald Jackson argues that if Wilkinson also passed this information on to Pike, and if Pike believed it rather than the Humboldt map, then Pike was not lost -- he knew that he would not find the Red River in the mountains above Santa Fé.⁸³

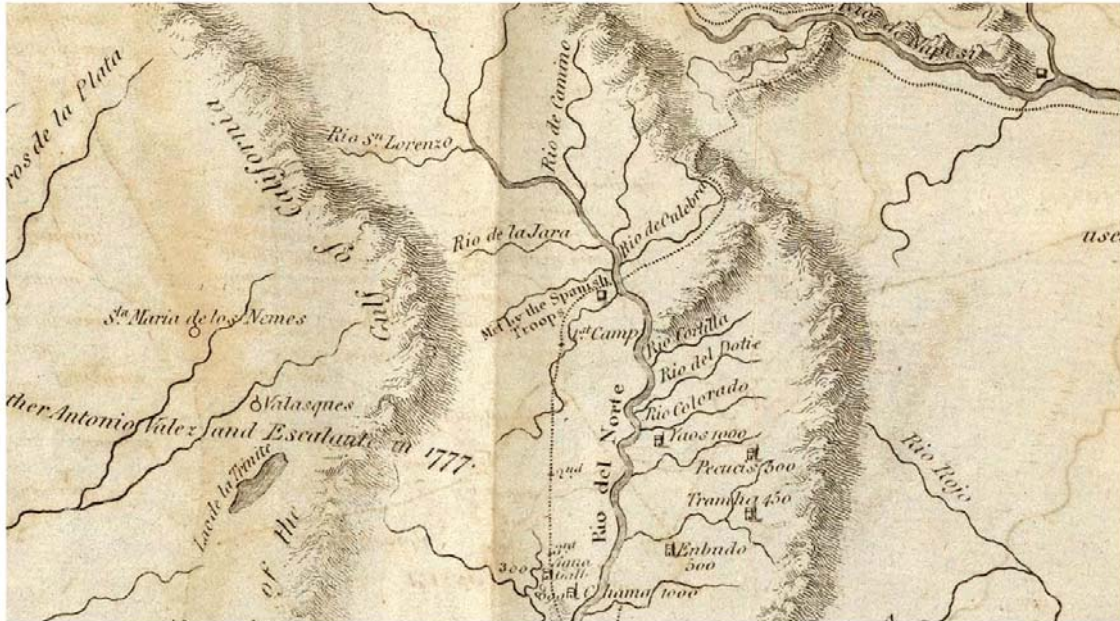


Fig. 3.17. View of Map of the Internal Provinces of New Spain

Pike was apprehended by Spanish troops on the Rio Grande north of Santa Fé. Pike explained that he thought he was camped on the Red River in the Louisiana Territory. Pike's depiction of the start of the "Rio Rojo" can be seen below the mountains to the east.



Fig. 3.18. The Spanish Escort
Painting by Frederic Remington

Pike and his men arrived in Santa Fé dressed like ordinary citizens, rather than as soldiers. Pike's appearance fueled speculation that he intended to blend in with the local population and conduct reconnaissance in Santa Fé.



Fig. 3.19. View of Map of the Internal Provinces of New Spain

Pike's representation of Texas rivers (above) is considerably better than Humboldt's (below) while his treatment of the Texas coast line is much inferior.



Fig. 3.20. View of Humboldt's General Chart of the Kingdom of New Spain

While he was in Washington, Humboldt asked General Wilkinson about the course of Texas rivers. Wilkinson gave Humboldt the same erroneous information he got in México and Humboldt used it on his map.

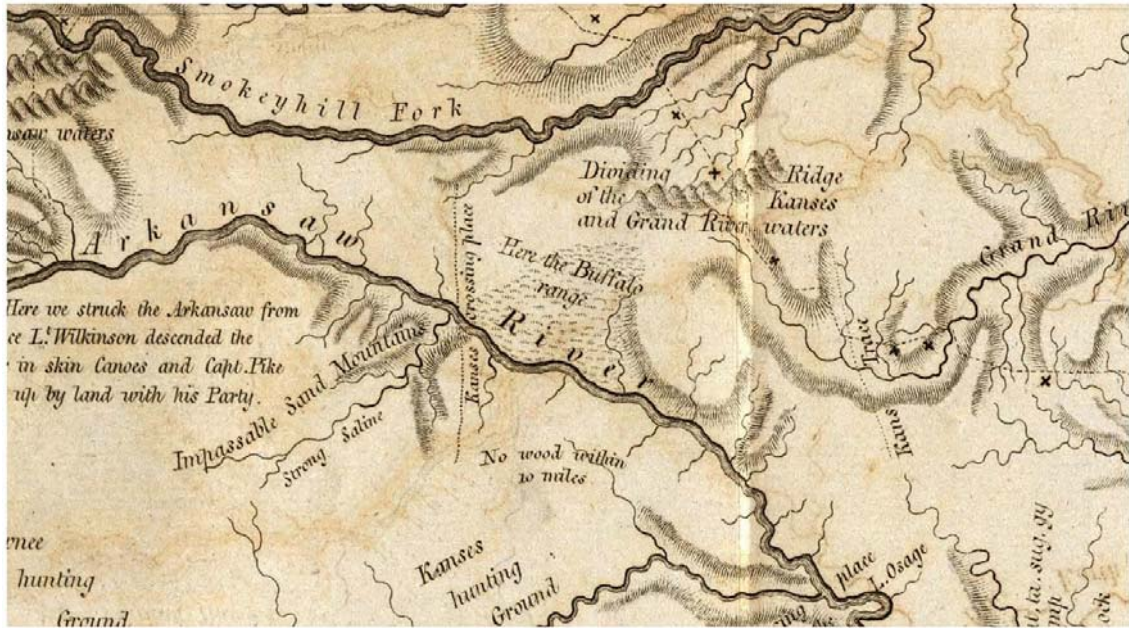


Fig. 3.21. View of First Part of the Internal Part of Louisiana, 1810
Zebulon M. Pike

Pike's map shows topography, historical information, and personal observations such as "Here the buffalo range" and "The alligators go no farther north."



Fig. 3.22. View of First Part of the Internal Part of Louisiana

This is one of five maps accompanying Pike's *An Account of Expeditions to the Sources of the Mississippi, and Through the Western Parts of Louisiana*.

CHAPTER 4

AN ENLIGHTENED VIEW OF THE NEW WORLD

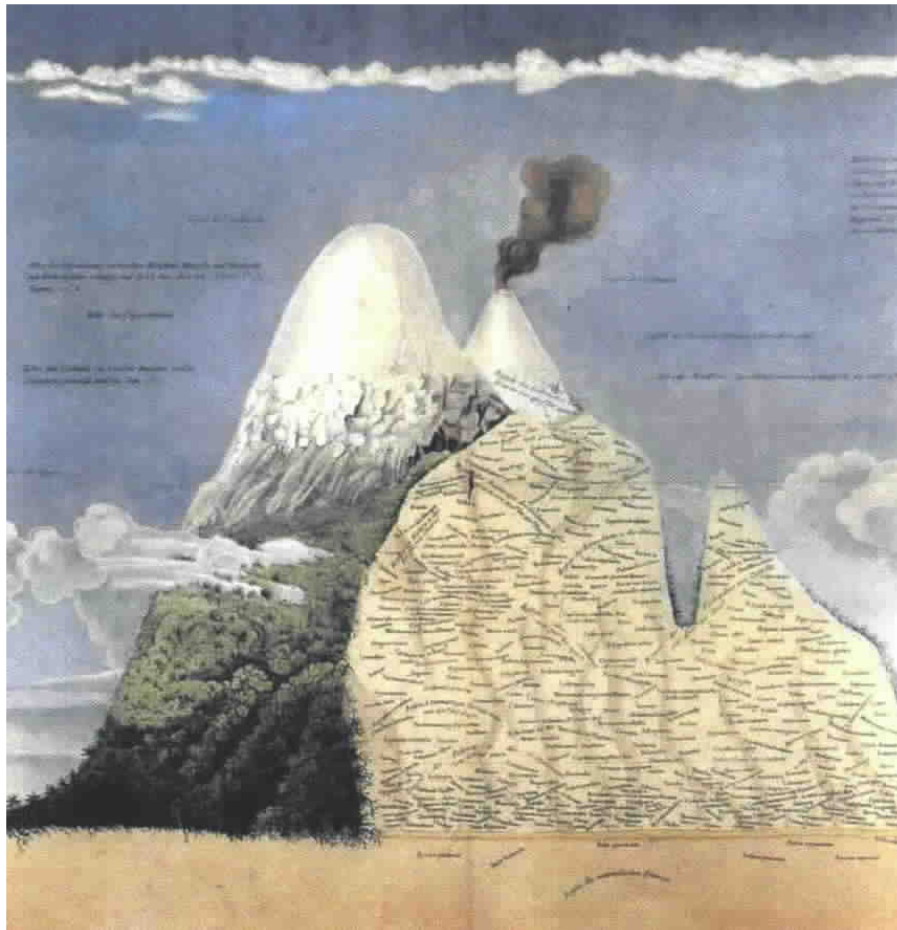


Fig. 4.1. Humboldt's picture map of the distribution of plants in Equinoctial America according to elevation above sea level
Engraving by G. Aikman in *Black's General Atlas*, Edinburgh, 1846

Humboldt advanced the calculation of mean elevation of continents, and observed that mountain chains have less impact on the mean elevation of large landmasses than the elevated plains of the typical land surfaces. Much of what motivated these detailed studies was his theorem that altitude affects climate and vegetation.

Humboldt's maps and images idealized the New World for readers on both sides of the Atlantic; incorporating modern science, with its emphasis on precise measurement and technological advancement; and the political, economic, and cultural life of the land they depicted. Humboldt's maps and images became the geographic representation of the New World, both in Europe and the Americas. The Enlightenment also stood as a metaphor for the social processes that provided the context for Humboldt's maps and shaped much of their content. It has been noted that Humboldt's maps were more than navigational charts. They were complete texts, travel chronicles in themselves. The goal of the text was not only to map the territory, but also the journey of the traveler along with it. Humboldt's maps were geographic representations of the territory they depicted. But they were also narratives in which Humboldt provided commentary and gave testimony to the adventure.¹

Humboldt's work epitomized the early nineteenth-century attempt to harness words and images together in the service of geographical description.² Visual representation served as a foundation for much of Humboldt's work and provided a better understanding of his narrative. Fixing points on a map required technical precision, while describing those points in narrative form required both literary style and visual imagery. The use of images gave identity to the geographical points on Humboldt's maps and played an important role in the presentation of his ideas. Images such as *Pic d' Orizaba* (Fig. 4.3) helped Humboldt to describe nature where narrative alone failed. The use of a pencil and sketch pad created a credible witness to what Humboldt observed in nature and described in his texts.³



Fig. 4.2. *View of Plateau de la Ville de México jusqu'au Port de la Veracruz*
Mt. Orizaba as depicted on Humboldt's map.

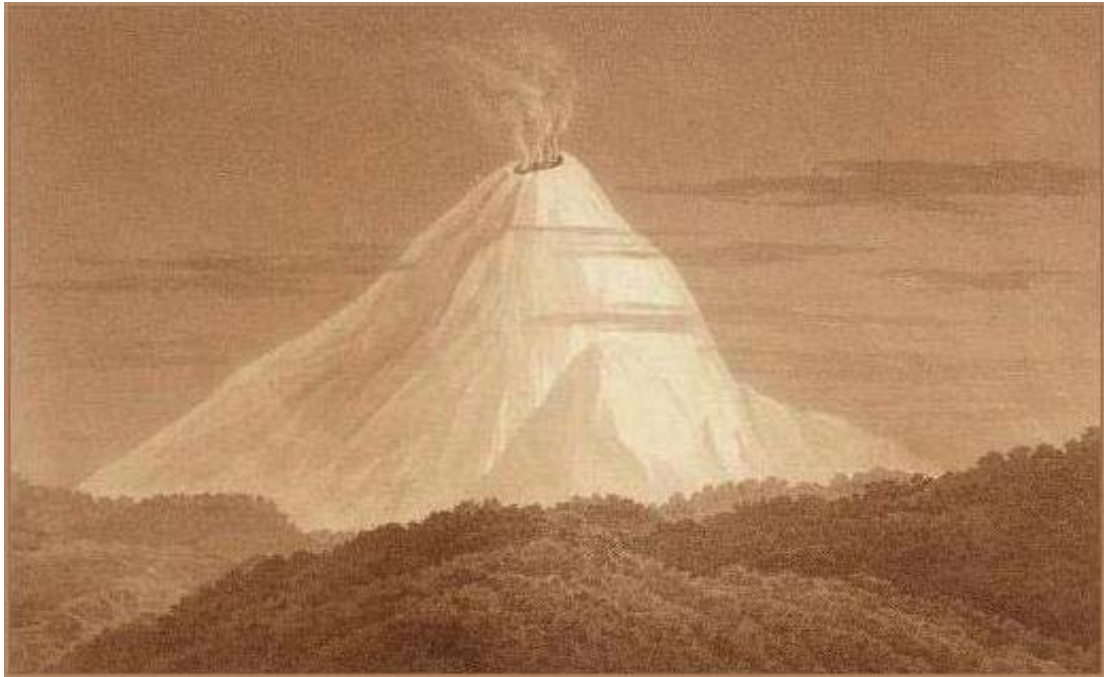


Fig. 4.3. *Pic d' Orizaba, 1808*
Sketch by Alexander von Humboldt

Visual images were not merely illustrations accompanying a narrative or an ornament for a map. They served as an authenticating tool, a corroborating witness. Images were necessary to substantiate a map.⁴

Humboldt's New Geography

Millions of Europeans migrated to the Americas in the nineteenth century. They came in order to escape from poverty, starvation, religious and political repression, or simply to find a better way of life in the New World. This massive transatlantic migration was facilitated in part by the maps that Humboldt prepared -- maps that were used for the subdivision and occupancy of land. Humboldt, in the very literal sense of the term, provided a road map for political settlement.⁵ Humboldt meticulously and carefully positioned the physical geography represented on his maps. Once he completed these exacting measurements, theoretical ways of looking at the landscape could be accomplished on a firm foundation of visual comprehension.⁶ This understanding helped determine where territorial borders would be fixed, and where transportation routes and population centers would be located, and where wealth would be accumulated. Humboldt defined the topography and drew the courses of rivers along which economic development would occur.⁷ Humboldt's maps acknowledged political and cultural realities. He compiled data on natural resources which facilitated the construction of a new post-colonial order with well-informed leaders. National entities were created, they were territorially delineated, and they were articulated in words. Humboldt's new geography allowed the re-ordering of boundaries of new nations within the liberal ideology of free trade.⁸

Humboldt drew up his maps according to the projections of Mercator, with increasing latitudes. He wrote that he favored this method because it "showed at once the true distance from one place to another, and because navigators who might use his

maps in the New World preferred it." ⁹ The scientific advancements of Humboldt's time aided his mapmaking. His use of advanced scientific equipment to determine longitude and latitude represented a major shift from the prevailing practice by New World mapmakers of drawing from other sources and collecting what was scattered in printed works and engraved maps. Humboldt's astronomic and barometric observations formed the basis of subsequent mapmaking in much of the Americas.¹⁰

In Humboldt's day it was common practice for cartographers to project rivers whose course was uncertain and position them in-between mountain ranges whose location was generally known. The same principle applied to the placement of ambiguous mountain ranges alongside rivers that had been previously charted. Humboldt characterized this practice as a "false application of the principles of hydrography," arguing that rivers do not always start below snow-capped mountains, nor do they always run in-between them. By avoiding what he described as the construction of physical maps from theoretical ideas, Humboldt's hydrographic treatments were sometimes marginalized, or as Humboldt himself noted, "far from perfect."¹¹ Humboldt adopted the "hachure" method of showing mountains in place of the older and less satisfactory method of representing mountains in profile. Hachures are fine lines used for shading maps to indicate steepness of slopes. Although thicker hachures indicate steeper slopes, hachure density remains constant throughout the map area except in areas of gentle slope. Humboldt was one of the first map makers to represent terrain with hachures. His maps of the Americas are examples of shaded hachure maps that enhance the three-dimensional effect by simulating illumination.

Humboldt acknowledged that the hachure method had defects, since, as Historian Carl Irving Wheat observed, "it forces the drawer to draw more than is possible to know of a vast geography."¹²

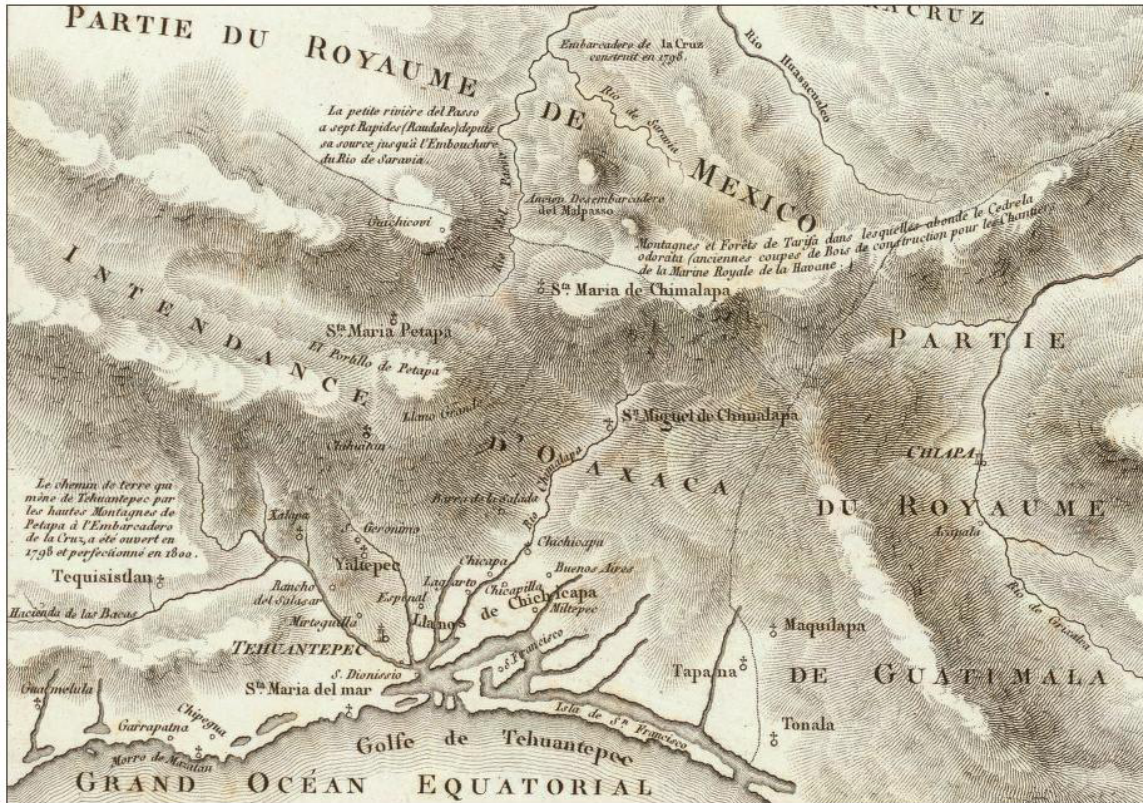


Fig. 4.4. View of Rio de Huasacualco et Rio de Chimalapa, 1808
Alexander von Humboldt and J.B. Poirson

Humboldt advanced the use of topographic maps, which indicate the height as well as spatial distribution of landforms. His use of hachures to represent elevation on this map illustrated one of the problems of building a canal through the Isthmus of Tehuantepec in México.



Fig. 4.5. View of *Carte du Mexique*

An understanding and definition of political power played a major role in the ideology of Humboldt's maps. Political power was territorial, and territoriality required knowledge. Maps with clearly delineated boundaries were needed to identify political intendencies and to better manage them. Humboldt recognized the need for geopolitical organization. The population of New Spain was scattered over a vast geographical area. Without concentrations of population, the degree of industry, commerce, military defense, and government efficiency was adversely affected.¹³

The Nature of Humboldt's Maps

Humboldt excluded areas from his maps for various reasons. One such area was California, then a backwater of the kingdom and western outpost of the Spanish territory. Humboldt wanted to include it in *General Chart of the Kingdom of New Spain*, but there was insufficient space.¹⁴ Most of Humboldt's cartographic silences represented a lack of information. Earlier charts of the New World were based on data from observations made by Spanish officers and explorers using the crude instruments

and techniques of the era. The delineations of most of these maps were impressionistic rather than precise, and their accuracy decreased as the distance from established settlements and routes increased. Humboldt entered place names only where they appeared on earlier maps which he found to be reliable. Spanish colonists, missionaries, and officials assigned the place names, which were often based on indigenous names. Humboldt cited American maps drawn up in Europe that were filled with place names whose existence were unknown in the place itself. Richard V. Francaviglia notes in *Mapping and Imagination in the Great Basin: A Cartographic History* that Humboldt chose to leave vacant space on his map rather than draw from suspicious sources.¹⁵ Modern-day cartographic historians interpret vacant space in a number of ways, including the view expressed in J.B. Harley's *The New Nature of Maps: Essays in the History of Cartography* that maps were full of erasures, that is, empty space created by Europeans anxious to appropriate native lands. Harley argued that maps occupy a crucial place in the events that had tragic consequences for the Native Americans. By trying to view the place of maps in those events and their role as they imposed on Indian affairs, Harley aimed to "add a different dimension to cartographic history."¹⁶

Harley asserts that European mapmakers renamed places in order to exclude Native Americans from maps. He claims that cartographers Anglicized place names, either by giving the place an English sound or translating it into English words. This process, according to Harley, dispossessed the Indians of their land.¹⁷ Harley wrote, "One of the ironies of the exclusion of the Indians from the map is that the Indians

undoubtedly played a significant part of the construction of the first maps by the English and their North American colonies.”¹⁸

Historians are divided on the importance of indigenous maps in the exploration of America. Harley acknowledged that indigenous maps do not answer questions of accuracy from a European perspective but instead address “historical consequences.”¹⁹ There were vast empty spaces on the maps. Harley argued that the empty spaces represented a conspiratorial silence, “empty space ready for taking by Englishmen.”²⁰

The empty space was interpreted differently in Humboldt's time. Mapmaker John Pinkerton (1758-1826) wrote, “The objective of a map is to be clear and easily consulted. It is objectionable to overload a map with the names of obscure places, often themselves erroneous.”²¹ It was a time when the term “Anglicization” invoked the disapprobation of Spaniards throughout the world but before Harley and other like-minded historians, troubled by the imperialistic behavior of their ascendants, condemned white Europeans for using maps as social constructs -- *narratives of ethnogenesis* -- in order to Anglicize the new continent and subjugate the indigenous population.²² Humboldt came to the Americas not to subjugate but rather to advance science and humanity. Maps helped accomplish his goal. Humboldt's maps served less as social constructs and more as tools used to better understand the land and bring benefit to millions of people in the process.

Humboldt traveled to the Americas at a time when travel was hazardous. If the traveler avoided blockades, pirates, and malaria he sometimes encountered hostile Indians. Humboldt chronicled his travels and thus became a historian himself. Those

who questioned Humboldt's model of natural history derided the meaning of his work.²³ These critics argued that Humboldt's science ignored social process and subjective thought, and that he imposed Western colonial concepts on people and places that could not fit into any unified pattern.²⁴ They claimed that questions of technical practice in mapmaking were confused with questions of social consequence.²⁵ Arguing that truth is more important than methodology, they found that Humboldt's explanation for leaving empty space on his map -- he did not know what was there -- ignored important ethical and moral issues. Nowhere in his text does Humboldt suggest that maps were intended or used to appropriate the land of Native Americans. Nor does he express the belief that maps served as weapons of European imperialism. Humboldt wrote that maps could not express moral ideas, the prosperity of nations, or the decay of their literature, but the geometrical configuration of maps spoke to the senses without fatiguing the mind, and whatever related to extent and quantity could be represented in geometrical figures on a map.²⁶ Humboldt rooted his maps in accurate measurement, rather than social theory. Historian Carl Irving Wheat wrote that maps, better than any other document, "illustrate the story of developing thought and understanding and vividly reflect the advance and unfolding of knowledge of the American West. Maps, historically considered, frequently afford a better understanding than do most books that undertake merely to describe the process."²⁷ Humboldt would have no doubt concurred with Wheat. He looked at the map as a source of knowledge, a tool used to inform and to enrich. He advanced the use of maps and images to support his scientific theories and to present the data that he collected. Humboldt was confident of the scientific validity of his

inquiries, and certain of the value of his findings. Long before contemporary historians interpreted the map in terms of its effect as a representation of power, Humboldt inscribed his maps with political and social context which gave them meaning.



Fig. 4.6. View of General Chart of the Kingdom of New Spain
Humboldt left much of Texas blank on his map because he did not know what was there.



Fig. 4.7. View of General Chart of the Kingdom of New Spain

Humboldt's *General Chart of the Kingdom of New Spain* extends from Natchitoches in Louisiana on the east to the Gulf of California in the west, and from present-day Wyoming (42° latitude) in the north, extending south to the Isthmus of Tehuantepec. Near the top of the map is a large lake identified as Lake Timpanogos. Next to the lake is a legend similar in wording to legends which appear on earlier maps of New Spain. “This lake, the limits of which are very imperfectly known from the journals of Father Escalante, is perhaps the Teguayo Lake, from the borders of which, according to some historians, the Aztecs removed to the River Gila.” The political implications of Humboldt’s legend are relevant today. Western scholars and Chicano activists have been searching for the ancestral home of the Aztecs for years. Native American folklore tells of a people who, acting upon a command from a spirit, left their

home near Teguayo Lake and journeyed south until they came upon an eagle devouring a serpent near the present-day location of México City, where historical records suggest they founded the city of Tenochtitlán in the 14th century. But in 1433, Aztec leaders burned the picture books that recounted the migration to the Valley of México, leaving only oral tradition and the name Aztlán, which translates as "place of the egrets," or "place of whiteness." An Aztec king sent sixty magicians north in 1440 to search for Aztlán. According to chronicler Diego Durán (c. 1537-1588), the magicians encountered a supernatural being during their journey who transformed them into birds, and they flew to Aztlán.²⁸

After the Spanish conquered the Aztecs in 1521, they began studying the Aztecs' origins. Francisco Clavijero, a Jesuit priest, in 1789 speculated that Aztlán was located north of the Colorado River. Other historians put Aztlán in the Mexican state of Michoacán, Florida, California, and Wisconsin.²⁹ Others doubt it ever existed. Historian Carl Irving Wheat wrote, "Humboldt swallowed entirely the myth of the Aztec journey from the Lake of Teguayo to the Valley of México."³⁰ Northern Arizona University archaeologist Kelley Hays-Gilpin believes that people speaking a form of Nahuatl domesticated maize in central México more than 5,000 years ago and subsequently moved north to an area of the American West that could have included Utah. Out of that multitude of cultures, some groups could have migrated south to the Valley of México.³¹ The search for Aztlán continues with a note of caution from surveyor William F. Butler, who wrote in 1872, "Geography was often drawn according to hopes

and expectations. The maps of early mapmakers were drawn and interpreted according to not only what was there, but also what they hoped was there.”³²

The Political Nature of Humboldt's Work

Historians Geoffrey J. Martin and Preston E. James wrote that Humboldt’s expedition to the Americas, 1799-1804, “Was the first journey in the history of the western world taken solely for research. Humboldt’s expedition was an entirely new concept -- the motive was purely scientific and had no political goals.”³³ Historians James C. Martin and Robert S. Martin echo those sentiments. “Unlike previous expeditions, financed by governments and of military or political nature, Humboldt underwrote the expense of his journey himself and aimed only at the geography and natural history of the places where he traveled.”³⁴

However, the notion that Humboldt’s travels were not political belies the evidence. Humboldt’s expedition was *very* political. Humboldt spent nearly a year in México. He enjoyed the auspices of the Spanish government and was privy to all of the confidential reports and records to be found in the viceroyalty, and he assembled all of these materials for a new and accurate map of New Spain. The map was prepared in draft in 1803, but Humboldt left it to be completed upon his return to Europe. On his way home, Humboldt visited with President Thomas Jefferson who made a copy of the map for the use of the United States government.³⁵

The belief that Humboldt’s journey was purely scientific and non-political is a myth that persists to the present day. There is no question as to the scientific nature of his journey. But there were few comparable expeditions up to that time serving the

goals of political power or trade interests as Humboldt's.³⁶ Humboldt came from a well-connected, politically active family. His father had served the court in Berlin. His brother Wilhelm was the Prussian Secretary of State. In his book, *Political Essay on the Kingdom of New Spain*, Humboldt analyzes the Mexican economy, health care, cultural and social diversity, racial inequality, and military defenses. As noted previously, Humboldt spent three weeks as President Thomas Jefferson's houseguest. One can assume, over the course of those three weeks, that politics entered into their conversations. Humboldt may or may not have wanted his travels to be political. But being who he was, and doing what he did, made it impossible for Humboldt *not* to be political.

Humboldt's maps and texts of New Spain were clearly political but attracted scholars and scientists for their scientific value. Not everyone, however, shared their enthusiasm. Humboldt's critics charged that his science lacked depth and understanding, that he was merely a collector of specimens who did not use what he collected.³⁷ But by publishing his work, Humboldt shared his science with others who could benefit from the information. The study of Humboldt's geopolitics has attracted much scholarly attention, but the majority of books and articles written about Humboldt's journey have focused mainly on his scientific research. While investigating why the interior of Peru was so dry, Humboldt observed the Peruvian Current off the west coast of Peru. It is a cold ocean current that runs along much of the western coast of South America. Humboldt did not discover the current. He wrote, "I may claim solely the merit of having been the first to measure its temperature and flow." But his

name was put on a map and thereafter "Humboldt Current" became accepted geographical nomenclature.³⁸ Humboldt also recorded many observations about the native peoples in South America. He was one of the first European scientists to witness native South Americans preparing curare arrow poison from a vine. He was also the first person to recognize the need to preserve the cinchona plant. Its bark contains quinine, which is used to cure malaria, and it was over-harvested at the time. Humboldt was the first person to make accurate drawings of Inca ruins in Peru. Humboldt discovered and mapped the Casiquiare Canal, the only natural canal in the world that connects two major rivers, the Orinoco River and the Rio Negro, a tributary of the Amazon. Humboldt's observations on guano deposits in Peru led chemists to develop its practical use as a fertilizer that would become Peru's most important export.³⁹ Humboldt discovered the first animal that produced electricity, *electrophorus electricus*, the electric eel.⁴⁰ But for all his contributions to natural science, his writings on the political and economic conditions of México may have brought him more attention. In *Political Essay on the Kingdom of New Spain*, Humboldt addresses what he believed to be major problems with the political organization of the Mexican state. His commitment -- his *passion* -- was the precise mapping of New Spain. But Humboldt candidly expressed his political views, lamenting that the rising wealth of the colonies benefited Spain rather than local interests, and observing that México needed fewer taxes, more trade, a middle class, and better government.⁴¹

Unintended Consequence

Economists, by way of defining capitalism, write of the transformation of society whereby the invisible hand of the market guides self-interested and competitive participants to greater efficiencies for the good of the consuming public. Adam Smith called it an “unintended consequence” of capitalism.⁴² By comparison, if the motive behind Humboldt’s journey was purely scientific and non-political, then the political settlement and organization of continents was an “unintended consequence” of his travels. Humboldt intended to study the geography and natural history of the places where he traveled. His royal investiture defined the mission to be one of scientific purpose. Humboldt’s seemingly endless capacity to absorb and assimilate new information may have allowed him to broaden his horizons, or perhaps events simply warranted Humboldt’s participation in the political discourse. If the President of the United States asked his houseguest questions about a water route to the East -- questions with far-reaching political implications -- what was Humboldt to do? He was obliged to answer such questions, especially since he, Humboldt, was considered to be *the* authority on such matters, having just completed a five-year exploration in the general region where a canal between the oceans was likely to be built.



Fig. 4.8. Simón Bolívar
1783-1830

Democratic Ideals

Humboldt's democratic ideals influenced the development of a pro-independence discourse amid changing political fortunes in Europe and the Americas. Similarly, Humboldt's maps played a role in the independence struggles of Latin America. The map which Simón Bolívar used in his campaign to conquer Nueva Granada had been made possible by Humboldt.⁴³ Bolívar asked his friend Humboldt to support the revolution. Humboldt replied, "What a splendid enterprise!" But Humboldt did not think that there was a leader capable of overthrowing the colonial powers. He told Bolívar, "The people are ready, but where is the man strong enough to carry it

through?”⁴⁴ Bolívar spoke graciously of Humboldt, saying that Humboldt “rediscovered the Americas, doing more for the New World than all of the conquistadores.”⁴⁵

Humboldt observed the Spanish colonies on the eve of their struggle for independence. He was hesitant to support revolution because he knew how difficult it would be to overcome the differences among the various social classes. On the other hand, he felt the organization of Spanish colonies into independent republics was a necessary process.

Humboldt's Analysis of the Spanish Colonial System

Political Essay on the Kingdom of New Spain includes a critical analysis of the Spanish colonial system. Humboldt wrote, "It would be difficult under colonialism to create wealth and promote industry because the concept of a colony was a failed idea in which the interests of Spain would always take precedence over local interests."⁴⁶ If the farmers, workers, and craftsmen were independent, they could develop their skills and abilities to create wealth. Humboldt understood that the colonial authorities did everything to divide the population into various social classes. The dividing line was between white and colored people. The white population was subdivided into those born in Europe and those born in the colonies, known as Creóles. The authorities mistrusted the Creóles and put the key positions into the hands of Europeans. This caused mistrust and jealousy among the whites. The non-white population consisted of Indians, free people of color, and slaves. Humboldt wrote that many of the colored people were integrated into the economic process only as forced laborers and thus had

no hope of social progress. Where climate and natural conditions allowed, some Indians lived on the edge of civilization and produced only at the subsistence level.⁴⁷

Humboldt found the Indians to be “mysteriously indifferent” to their own plight. But apart from repressive laws and the “drudgeries of the missionaries,” their situation of limitation and pressure differed fundamentally from the slavery of the black Africans in Cuba.⁴⁸ Under Spanish law there were no Indian slaves in México. Indians had previously been enslaved and set to work in the Mexican mines under horrible conditions. But by 1803, such work was voluntary. Humboldt noted with satisfaction that the Indian miners were treated well, and they were the best-paid miners in the world.⁴⁹



Fig. 4.9. Native Indian Peoples

Engraving by Louis Bouquet of an Indian couple from Michoacan, México
Atlas géographique et physique du royaume de la Nouvelle-Espagne, 1808

Humboldt saw few black Africans in México. Indians, on the other hand, “swarmed the streets of the villages.” He described the Indians as “lazy, careless wretches.” He argued that a society of Europeans and Negroes produced a race of men more active and more “assiduously industrious” than the mixture of whites with the Mexican Indian.⁵⁰

Humboldt lamented that “the better sort of Indians, among whom a certain degree of intellectual culture might be supposed, perished in great part at the commencement of the Spanish conquest.” Many of those Indians died of *matlazahuatl*, a disease peculiar to the Indian population and likened to the Black Plague by European doctors. It was estimated that as many as two million Indians died from the disease in the sixteenth century.⁵¹ Those who survived lived in a state of humiliation. Spanish priests burned books and hieroglyphical paintings, by which virtually every kind of knowledge was transmitted. The Indians, deprived of this means of instruction, were plunged into ignorance as the missionaries were sometimes unskilled in the Indian languages, and could, in Humboldt's words, “substitute few new ideas in place of the old.”⁵²

Humboldt believed that México's divided society would have to undergo reforms in order to become a free working society in which all the classes could develop their abilities. Only if they could overcome their isolation and hatred of one another could conditions improve. He wrote, “When people are divided into castes, of which each can only follow a certain species of labor, and wherever the inhabitants possess no particular property, and labor merely for the benefit of the community . . .

immense constructions will be found. But the people make almost no advances in moral cultivation, which is the result of individual liberty alone.”⁵³

A central concept in Humboldt's analysis of colonial society was that of gregariousness versus isolation. Humboldt observed that the pre-revolutionary families in North America had been less isolated from one another, and they had more of a political culture. The population had been more easily revolutionized and educated to be friendly, generous, social human beings. Humboldt witnessed the growing importance of the North American example in the Spanish colonies. He hoped that the free exchange of goods and ideas between the United States and Spanish America would enhance social progress everywhere.⁵⁴

Humboldt observed the political ideology and cultural institutions of Mexican society during the year he spent in New Spain. He was struck by the contrast between the living standards of the rural villagers and the inhabitants of México City. “México is a country of inequality. Nowhere does there exist such a fearful difference in the distribution of fortune, civilization, cultivation of the soil, and population.” The capital was comparable with the finest cities of Europe. The architecture of the public and private edifices, the elegance of the furniture, the luxury and dress of the women, the tone of society, contrasted with the nakedness, ignorance, and vulgarity of the Indians living in the villages.⁵⁵ Humboldt wrote that the Indians had been banished into the remote areas where “they lived from hand to mouth.”⁵⁶ He appealed to the Court of Madrid to prevent the council of finances of México, *la junta superior de real hacienda*, from imposing taxes on the Indians. The Indians already paid taxes to both the Spanish

government and the Catholic Church. The Indians paid parochial duty, *derechos parroquiales*, to the Church for baptism, certificate of marriage, and burial. The Church also levied a *voluntary* tithe on the parishioners of each village. Legislation enacted by Emperor Carlos V in the sixteenth century reduced the tax burden of the Indians, but they did not have the rights of other citizens.⁵⁷ Humboldt decried the concentration of economic and political power in the hands of a few, and the consequent limited opportunities.

Humboldt wrote *Political Essay on the Kingdom of New Spain* for the benefit of “those called to watch over public prosperity.” His message was that the prosperity of the white population was connected with that of the Indians, and that there could be no lasting prosperity in México until the Indians were allowed to participate in the advantages resulting from the progress of civilization and social improvement.⁵⁸

CHAPTER 5

DECONSTRUCTING A MAP OF NEW SPAIN: JOSÉ ANTONIO de ALZATE y RAMÍREZ'S *PLANO de la NUEVA ESPAÑA*

Humboldt's *General Chart of The Kingdom of New Spain* was one of the first maps to establish the field of geography as a modern science, and was translated into several languages. It was the standard map of the Great Basin region until John C. Frémont's expedition thirty-five years later. Humboldt's depiction of Texas rivers repeated the error of previous maps in giving the rivers a southerly, rather than a southeasterly course. Humboldt compressed the western portion of the coastline while expanding the east, and in the space created between the Trinity and Sabine Rivers he created two imaginary rivers. He showed the Brazos as a minor stream and mislabeled the Lavaca as the Guadalupe, which he in turn left unnamed but placed correctly with its tributary, the San Antonio. The Pecos was shown, but placed too far west, falling far short of its actual origin in the mountains east of Santa Fé. Humboldt never visited Texas, but indicated that his depiction of the Texas rivers was based on information he received in Washington during his visit there in 1804.¹

Humboldt's map was a magnificent cartographic achievement, but his depiction of Texas rivers hardly rates as an improvement over earlier maps. Humboldt was nonetheless critical of earlier maps and mapmakers. He wrote of the "extraordinary errors" made by José Antonio de Alzate y Ramírez in his map *Plano de la Nueva España*, first published in 1770. Humboldt characterized Alzate as being

"inaccurate and impetuous," and he criticized Alzate for being unable to calculate the precise location of México City.² Humboldt wrote of Alzate, "This Mexican ecclesiastic, whom the academy of Paris named as one of their correspondents, displayed more zeal than solidity in his research. He embraced too many things at once. His acquisitions were very inferior to those of Velázquez and Gama, two of his countrymen, whose true merit has never been sufficiently known in Europe."³ Alzate had based his findings of longitude on outdated lunar tables. He likewise miscalculated the latitude of México City. Humboldt likely had Alzate in mind when he wrote, "I have traced my map of New Spain . . . not from vague suppositions or hypothetical combinations, but from a great variety of data furnished by persons who had visited Mexican mines."⁴

Was Alzate's map of New Spain, *Plano de la Nueva España*, as bad as Humboldt asserted? The map depicts the route taken by Hernán Cortés from the port of Veracruz to the Aztec capital of Tenochtitlán in 1519 and evolved from the work of Francisco Álvarez Barreiro, a military engineer with the inspection expedition of Pedro de Rivera y Villalón, 1724-28. Barreiro drew a series of six maps depicting the northern and western provinces of New Spain visited by the Rivera inspection. This expedition provided the first detailed mapping of the region from actual observations by a trained mapmaker.⁵

Plano de la Nueva España is noteworthy for its rarity as a printed Spanish map. It is the second printed map to apply the name *Texas* to a geographical region.⁶ Francisco Antonio Lorenzana's *Historia de Nueva-España*, 1770, includes a reproduction of *Plano de la Nueva España*. Alzate's map also appears in Francisco

Vindel's book, *Mapas de America en los libros españoles de siglos XVI al XVIII*, 1955. In that book, Lorenzana is listed as "senior illustrator." Hernán Cortés, whose expedition is depicted on Alzate's map, is mentioned prominently. But not a single mention is made of Alzate, who prepared the map. The omission of Alzate's name from the map in Vindel's book is curious and merits further inquiry.

Reflecting the transatlantic nature of his interests, Alzate was a correspondent of the prestigious *Academe des sciences de Paris*. He dedicated *Nuevo mapa geográfico de la America septentrional*, published two years earlier, to the members of the *Academe*, who in turn published it in Paris in 1775. Alzate became the first Mexican member of the *Academe*, for which he was very proud.⁷ But Alzate devoted most of his time promoting science and politics in New Spain. Geopolitical interpretations of Alzate's maps continue to the present day.

Texas may or may not have figured into Alzate's geopolitical aspirations. It has been noted that his maps were among the first to have the name Texas applied to them. Like Humboldt, Alzate depicted the course of Texas rivers inaccurately and incurred the wrath of Humboldt and others for his inaccuracies. Alzate was not a trained cartographer. He borrowed from earlier maps of New Spain and prepared new ones which better reflected the worldview of enlightened Mexicans.

The Enlightenment fostered a spirit of rational thinking and critical inquiry that spread from Europe to New Spain. Alzate was a leading proponent of that spirit. He had an insatiable curiosity about the world around him. He made contributions to science in the fields of medicine, astronomy, mathematics, botany, and geography. His election to the *Academe des sciences* was an unprecedented distinction for a Mexican

colonial. In addition to his map, the *Academe* published several of Alzate's papers. When the Mexican National of Academy of Science was founded in 1884, it was named the Alzate Society. Alzate was also a cleric, and the question arises as to how Alzate resolved the dichotomy that was Enlightenment science and the Catholic faith. Alzate was reviled in México for some of his journalistic views, but he seems to have largely avoided reproach from the Church for his scientific endeavors. Earlier clerics practiced science in the New World - Eusebio Kino comes to mind - so by Alzate's time such practice was not unheard of. Humboldt cites other clerics who practiced science in *Political Essay on the Kingdom of New Spain*, as well as scientific explorations sponsored by the Church.⁸ Perhaps the Church overlooked Alzate's science because, as Humboldt pointed out, "ecclesiastical discipline is difficult to maintain in México."⁹ Or perhaps the Church, like Humboldt, simply did not take Alzate's science seriously.

As a prominent scientist, Alzate was given access to official information available in México. Such information was almost certainly unavailable to the map trade at the time. Alzate based his maps on official reports and sketches of the expeditions of the early eighteenth century. Alzate depicted the interior of México reasonably well, but his maps contained little detail in Texas and the west coast and they were distorted in form. He displayed the Texas rivers with a north-south orientation, rather than their true southeasterly direction. He completely omitted the Pecos River. He depicted the Nueces River and its tributaries as a minor branch of the Rio Grande. The Medina, a small tributary of the San Antonio River, was shown as the greatest river of the area. Alzate extended the Guadalupe to flow into the Bay del

Espíritu without the waters of the San Antonio. He represented the Colorado and the Brazos rivers as one. The Trinity, also greatly exaggerated, was drawn flowing across regions where the Arkansas branches run. He also gave the Red River a north-south orientation.¹⁰

Plano de la Nueva España is an uncluttered, black and white map. The detailing is very good. It is the kind of map one might expect from a scientist, or mathematician. Alzate was both. The precisely ruled coastal lines of Alzate's map are one of the features which make it appealing. *Plano de la Nueva España* extends the Gulf Coast to the vicinity of Pensacola, while his 1768 map shows the coast only as far as the Sabine River. The map is copper engraved with text at the upper left regarding New México and Quivira. The lower left has engraved text depicting Cortés's route to Tenochtitlán on an ornate scroll with books, instruments, and charts.

The Mexican land mass relative to the Gulf of México on Alzate's map looks like a true representation, and his depiction of the gulf coast of Texas, Louisiana, and Florida is good although not as detailed. The scales of latitude and longitude on Alzate's maps are defective. Alzate asserted that the longitude of Mexico City resulted from his numerous astronomical observations. But Humboldt found Alzate's calculation to be a degree false. Humboldt noted that Alzate could have availed himself of the geodesic observations of Velázquez de León in 1773 but did not.¹¹

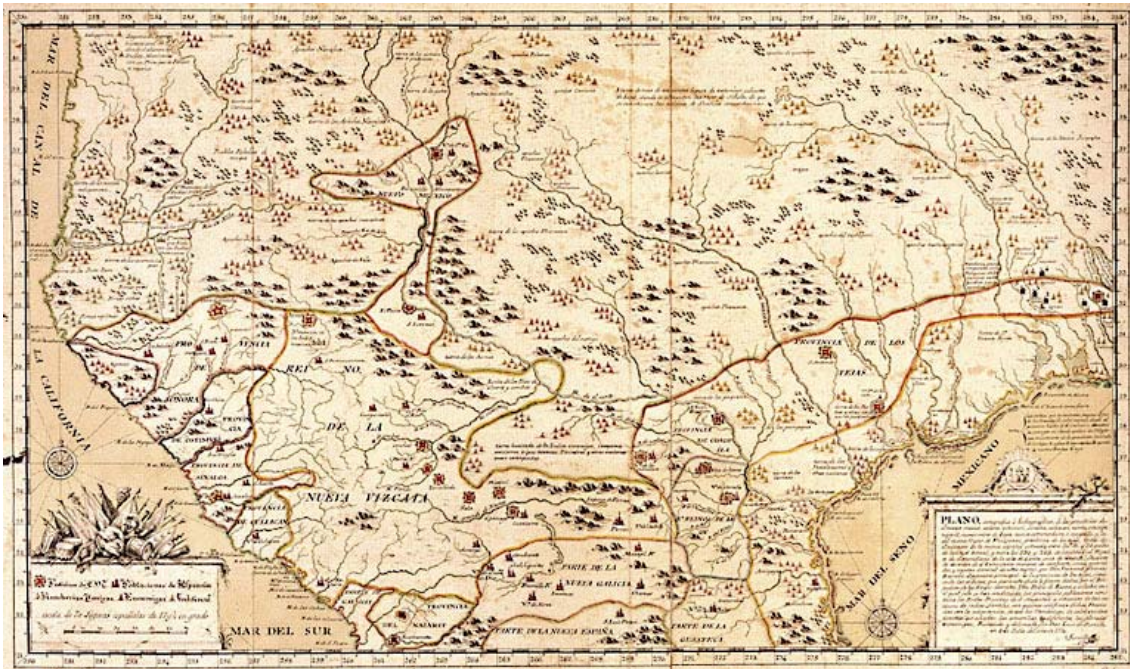


Fig. 5.1. View of *Plano corográfico y hydrográfico de las provincias de la Nueva España*, 1728
Francisco Álvarez Barreiro

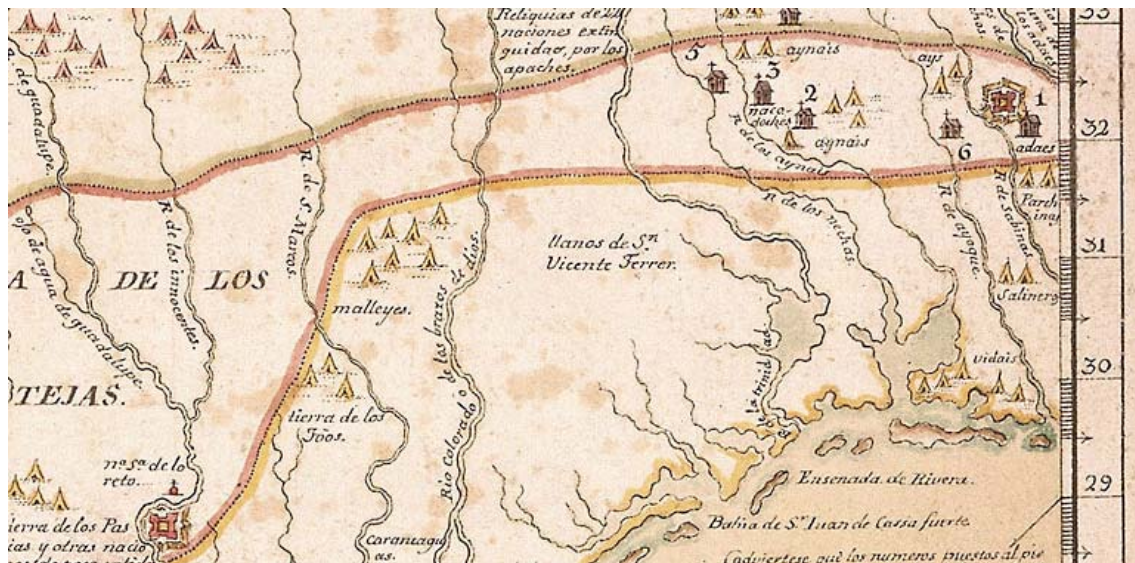


Fig. 5.2. View of *Plano corográfico y hydrográfico de las provincias de la Nueva España*

The Barreiro map gives a better representation of the northern provinces of New Spain than any other map of its time, but it contained errors that would be repeated by Alzate on his maps.¹²



Fig. 5.3. Plano de la Nueva España, 1770

José Antonio de Alzate y Ramírez

The University of Texas at Arlington Special Collections

Alzate claimed that his maps had been approved and verified by the *Academe des sciences de Paris*. But Humboldt found his measurements to be defective, noting that subsequent geographers copied Alzate's false longitude of México City onto their maps.¹⁵

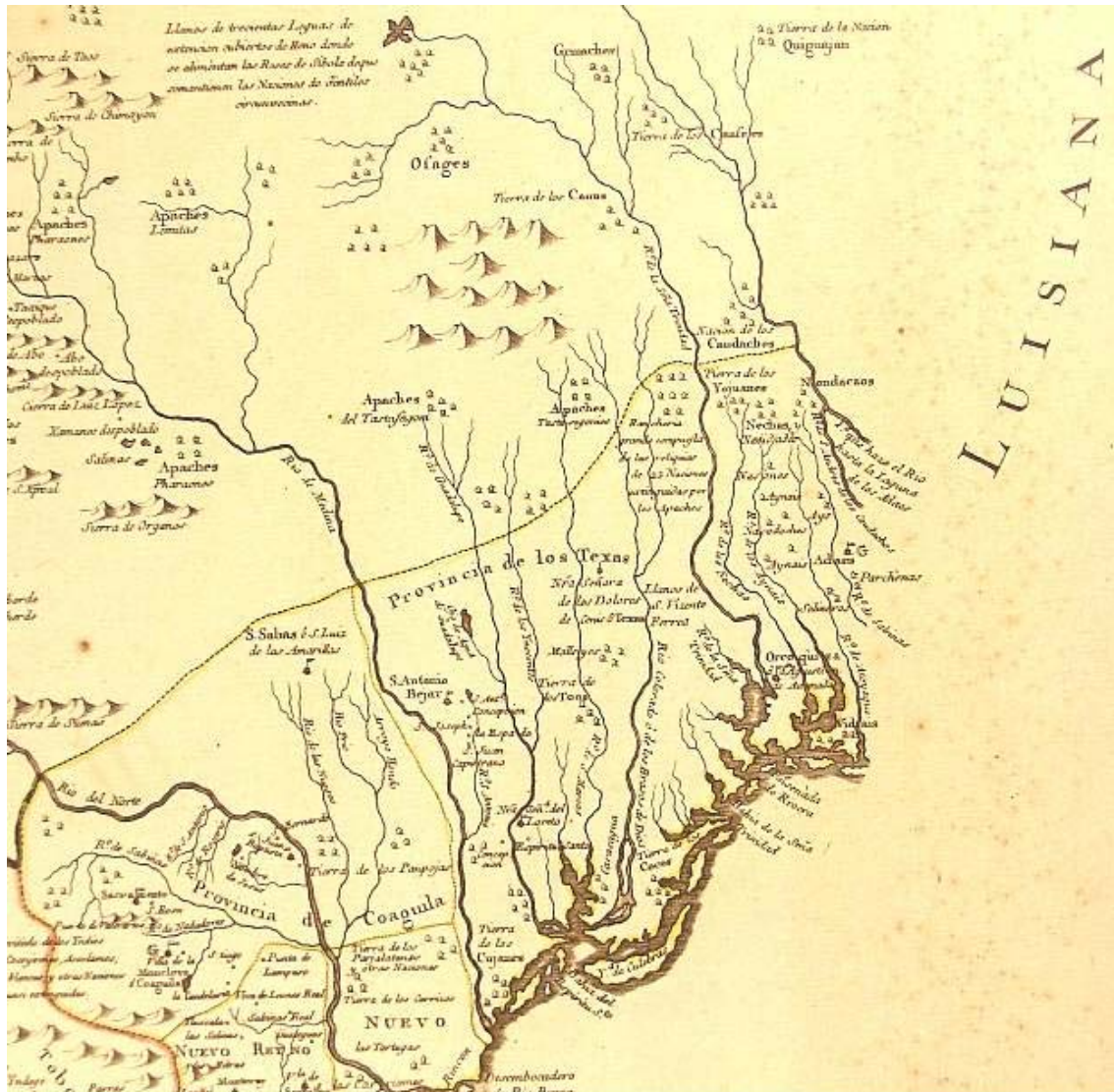


Fig. 5.4. View of *Nuevo mapa geográfico de la América septentrional*, 1768
 José Antonio de Alzate y Ramírez

Alzate's depiction of the Texas rivers includes the Trinity River flowing through a large lake that resembles Galveston Bay, and then through an extenuated neck to reach the Gulf of México. The Neches River is made to empty into a bay more nearly resembling Galveston than Sabine Lake, nearer the Trinity River than it actually is. Alzate's maps lean heavily on Barreiro's maps in certain areas and repeat some of their flaws. Humboldt pointed out that Alzate had the opportunity to correct some of the mistakes but failed to do so.

José Antonio de Villaseñor y Sánchez mapped most of the gulf coast, nearly all of México, and much of Texas during José de Escandón's expedition of 1746.¹⁴ Villaseñor's map, *Yconismo hidroterreo, ó Mapa geográfico de la América septentrional*, improved on Barreiro's map by correcting some of the Texas river courses but left much to be done.¹⁵ The viceroy appointed Villaseñor to chart New Spain, but that did not guarantee the accuracy of the map. San Antonio and Galveston Bays are practically eliminated, while Matagorda is greatly exaggerated. The Chandeleur Islands are mislabeled "Massacre," while Saint Joseph Bay and Apache are out of position.¹⁶

Barreiro, Villaseñor, and Alzate all used an old system of measuring longitude east around the globe, 360 degrees beginning at Tenerife. There is little agreement in their scales. Spanish mapmakers held to this antiquated and difficult system long after Europe's nautical chartmakers began to measure longitude both east and west. Scholars express mixed opinions of these cartographic works. W. P. Cummings describes *Nuevo mapa geográfico de la America septentrional* as "an inferior map of New Spain published under the name of José Antonio Alzate y Ramírez in 1768."¹⁷ Robert S. Weddle argues that despite their antiquated methods, the work of Barreiro, Villaseñor y Sánchez, and Alzate y Ramírez produced some of the better maps of the period. Why did Alzate ignore Villaseñor y Sánchez's map? Perhaps Alzate recognized that the 1746 map, although an improvement, was short of what was needed. The 1770 map was a depiction of Cortés's route to the Aztec capital in 1519.

Did Alzate not think the Texas rivers were important? Subsequent cartographers and historians were quick to point out the error of his ways.

Alzate's map depicts the Yucatán peninsula accurately. But when Cortés sailed from Cuba to the Mexican mainland, Yucatán was thought to be an island. Yucatán has an especially interesting cartographic history. After Juan de Grijalva had declared it to be an island in 1518, the Álvarez Pineda sketch a year later portrayed Yucatán as a peninsula. Then the Cortés expedition decided it was an island in 1520. Both the Castiglioni and the Salviati maps pictured Yucatán as an island in 1525. The following year, Juan Vespucci, Amerigo's nephew, drew it as a "fat jug linked to the mainland by a skinny neck."¹⁸ The Maiollo map of 1527 makes it an island with a highly creative touch, showing a passage called *Streito Cubitoso* through the continent to the South Sea. The same year, Nuno Garcia de Toreno expressed his uncertainty by first drawing Yucatán as a somewhat round island, and then, as an afterthought, linking it to the mainland with a narrow land bridge. The Grijalva expedition incorrectly mapped the Yucatán peninsula when the pilot of Grijalva's ship, Anton de Alaminos, incorrectly fixed the latitude of a prominent point, Bahia de Ascension, by two degrees and another point, Puerto Deseado by over two degrees. A third point, Punta de Catoche was about one-half degree off in de Alaminos's calculation. The resulting triangulation caused de Alaminos to conclude that the Yucatán Peninsula was an island.¹⁹ As no actual exploration of the interior took place for years, European map makers depicted Yucatán as an island and continued to do so until 1540 or later. Spanish mapmakers were uncertain about it. On the Barreiro map of 1528 the coastal

outlines on the south are faintly drawn and it looks like an island set off at some distance from the mainland. In 1538 Mercator's map shows Yucatán with a very narrow connection to the mainland. It was not until 1544 that Sebastian Cabot's planisphere displayed the peninsula in its true position.²⁰

In 1774, Pedro Alonso O'Crouley claimed that the maps of New World cartographers suffered from carelessness. "None of them," wrote O'Crouley, "agree on distances, directions, and latitudes and all of them omit the remote parts of the kingdom such as New México, Texas, and California." O'Crouley drew his own map of the Kingdom of New Spain, but it was lost. In the printing of O'Crouley's book, *A Description of the Kingdom of New Spain*, the editors instead used Alzate's *Nuevo mapa geográfico de la America septentrional* because it "best represents all the ideas that O'Crouley supported."²¹

Nuevo mapa geográfico de la America septentrional was printed in color, and it encompasses a larger portion of the kingdom than Alzate's second map, *Plano de la Nueva España*. Because it includes more territory, *Nuevo mapa geográfico de la America septentrional* also includes more errors than *Plano de la Nueva España*. Alzate was many things -- scientist, cleric, journalist -- but he was not a trained cartographer. So, why did he prepare these maps? Alzate borrowed from earlier maps of New Spain and prepared new ones which better reflected the worldview of México's enlightened elite. Alzate was a proponent of Mexican nationalism who used the maps to promote his goals and ambitions both at home and abroad. In his book *Mapmaker's Art*, Phillip Allen writes,

The richness, scope and variety of the maps produced during the colonization of the Americas reflect the widening horizons of European and American mapmakers. With the sciences of astronomy and mathematics in their infancy, the maps of the period evolved slowly and were largely based on information provided by sailors and explorers. The wonder is not that they were often inaccurate, sometimes wildly so, and that some of the material is fabricated, but that, given the primitive technological resources available to cartographers, and the paucity of reliable information, they invariably provide instantly recognizable images. They lack the accuracy of the modern roadmap, but have a venerable splendor of their own.²²

How Alzate fits into Allen's history is open for debate. Humboldt was probably correct when he wrote that Alzate "displayed more zeal than accuracy in his research . . . he embraced too many things at once . . . his acquisitions were very inferior."²³ But were his acquisitions inferior for their time? As Phillip Allen writes, "Given the primitive technological resources available, little wonder that the maps of early American mapmakers were inaccurate." Humboldt published his scathing criticism of *Plano de la Nueva España* over forty years after Alzate prepared it. His analysis of Alzate's work fails to account for change over time and as such amounts to a presentist view, circa 1811. Humboldt was correct to point out Alzate's errors but his scorn was excessive. Robert S. Weddle observes, "The mapmakers of New Spain were concerned with accuracy and made every effort to produce good maps."²⁴ Alzate may or may not have been concerned with accuracy -- his motives were more than purely cartographic. His maps were an expression of his geopolitical views.²⁵ But the study of Alzate's maps provided the context in which Humboldt set out to improve upon the "meager and inadequate maps" he found in México in 1803. Alzate's maps should be recognized if for no other reason than they alerted Humboldt to many of the extraordinary errors that plagued maps of New Spain.

CHAPTER 6

PASSAGEWAY THROUGH THE AMERICAS

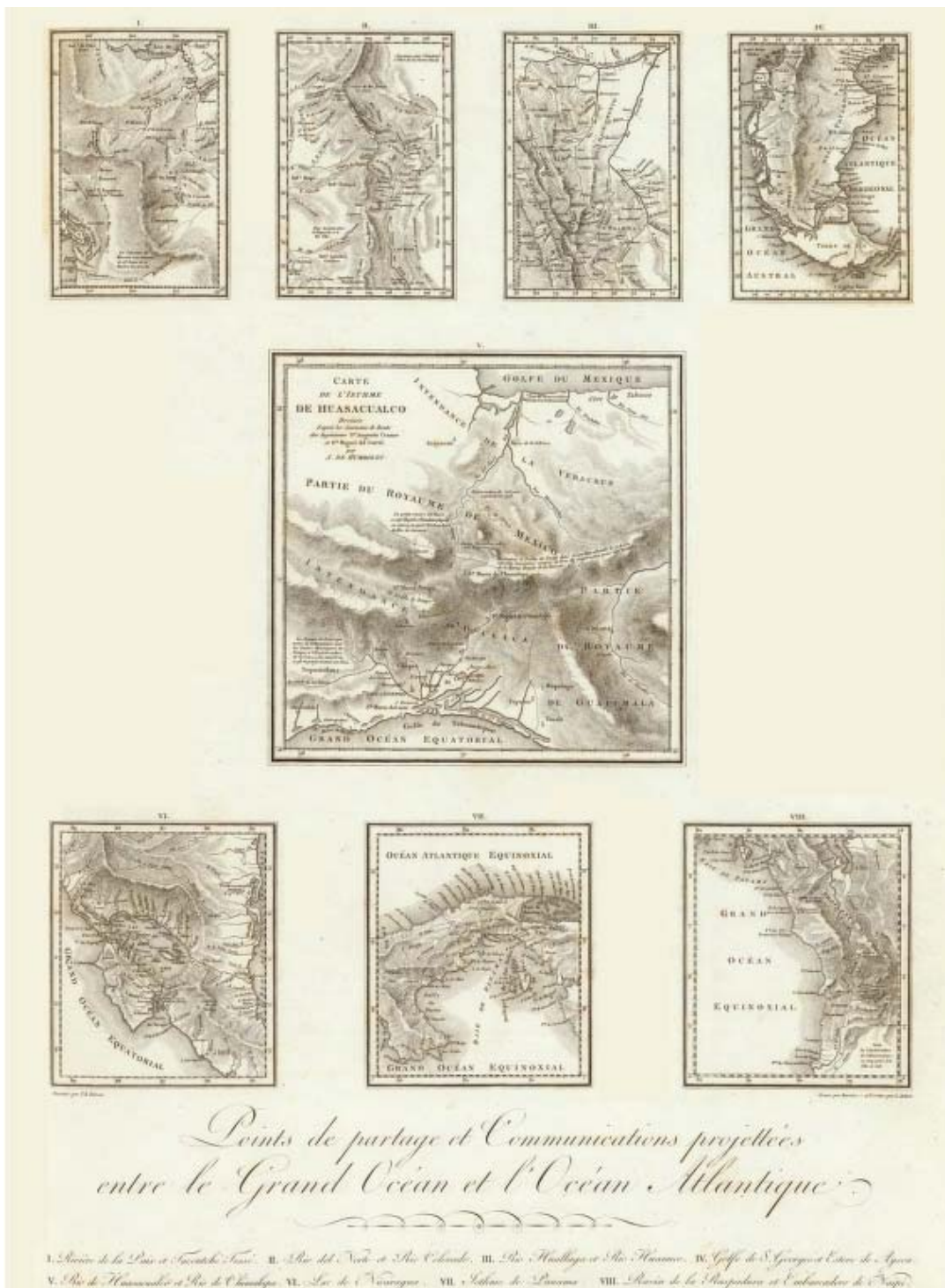
Humboldt produced the first important study of a canal connecting the oceans and influenced where the Panama Canal would eventually be built. This chapter looks at Humboldt's canal study as represented on his map *Points of Separation and Projected Communications between the South Sea and the Atlantic Ocean*, published in *Political Essay on the Kingdom of New Spain*. Humboldt envisioned a canal that would shorten navigational distances between China, Japan, and the West, thus creating vast new markets for European and American traders and helping to position the United States as a player in global affairs.¹

Humboldt studied several places for a canal, including Nicaragua and Panama. Humboldt had never been to either country, but developed his canal maps from old books and manuscripts and from the mostly inaccurate maps then available. Interest in a canal through Central America dates back to the 16th century. Plans for a water route through Panama were approved by King Carlos V of Spain in 1529 but wars in Europe put the plans on hold and the Spanish government eventually abandoned its interest in the canal.² Humboldt's study was to have more influence on the building of the canal than anything that had been written previously. Although Humboldt had not been to Nicaragua or Panama he had been almost everywhere else and no one was thought to have more firsthand knowledge of the American jungle.

The fact that his canal theories were almost wholly conjectural was generally ignored.³

How much Humboldt discussed the canal with Thomas Jefferson is not known. But his stay at the White House probably marks the start of presidential interest in the canal. It is known that Jefferson had shown prior curiosity on the subject while he was minister to France. Humboldt enthralled Jefferson with accounts of his travels, so it is difficult to imagine them *not* discussing a Central American canal.⁴ In his farewell letter to Secretary of State Madison, Humboldt promised that he would communicate to the U.S. government all the details he knew about the possibilities of building a canal.⁵

Humboldt's visit coincided with the departure of Lewis and Clark from St. Louis to seek, on Jefferson's orders, a northwest water passage to the Pacific.⁶ This marked the beginning of a federally funded reconnaissance of the American interior designed to organize space for the division and settlement of the Louisiana Territory as conceived by Thomas Jefferson.⁷ A water passage through the Americas was an important part of Jefferson's concept. The only question was where and how such a passage could be built. Humboldt projected nine water routes represented on eight maps between the two oceans. He wrote that these routes had fixed the attention of statesmen and merchants, and that it was up to them to develop the ideas he formulated in *Political Essay on the Kingdom of New Spain*. Humboldt insisted that only after examining all of the projected canal routes could governments decide which of them merited preference.⁸ Humboldt's canal maps are identified herein as they appear on his map, *Points of Separation and Projected Communications between the South Sea and the Atlantic Ocean*.



**Fig. 6.1. Points of Separation and Projected Communications
Between the South Sea and the Atlantic Ocean, 1808**
Alexander von Humboldt and J.B. Poirson

Humboldt describes each route in *Political Essay on the Kingdom of New Spain*, beginning with the northernmost, *River of Peace and Tacoutche Tesse*, utilizing a network of rivers and lakes through the Pacific Northwest. Little was known of this geography in 1800, and Humboldt had hoped that the Lewis and Clark expedition would provide more knowledge of the region. The Northwest route was considered important because of the fur trade along the Pacific coast. Scottish explorer Alexander Mackenzie (1764-1820) claimed that whoever opened and developed a water passage between the oceans would monopolize the fur trade of North America. Humboldt's map uses the route that Mackenzie followed in the summer of 1793, when the passage was free of ice and navigable. It follows the Tacoutche Tesse (known today as the Fraser River) from present-day Vancouver, B.C. north to 55° latitude opposite the Queen Charlotte Islands. Mackenzie journeyed by land twenty-one miles from the Tacoutche Tesse to the River of Peace. Humboldt projected a canal connecting the two rivers. The route continues north along the River of Peace to the Great Slave Lake and on to the North Sea at 70° latitude via the Mackenzie River. The Tacoutche Tesse was the key to Mackenzie's route. But the length of the Tacoutche Tesse was unknown and Mackenzie mistakenly thought it discharged into the Columbia River near Pt. Vancouver and then on to the Pacific Ocean.⁹ Humboldt wrote that the banks along the mouth of the Columbia at 46° latitude offered fertile land and ample timber for a "fine European colony."¹⁰ Humboldt based his observations on the manuscripts of English explorer George Vancouver (1757-1798), for whom two towns and an island in the region were named. Mackenzie may have confused Vancouver -- where the Tacoutche Tesse

discharges into the Strait of Georgia -- with Pt. Vancouver, near the mouth of the Columbia River. But a north-south water passage was impractical under any circumstances. The North Sea (now better known as the Beaufort Sea) was frozen over for much of the year. And even when navigable, it was still a long way from the fur-trading ports of Philadelphia and London. As an alternative to Mackenzie's north-south route, Humboldt proposed an east-west route along the Nelson River from Hudson's Bay to Lake Winnipeg, connecting with the Saskatchewan, Missouri, and Columbia River systems. The desire to find a Northwest Passage and control the fur trade gave cause for Humboldt and others to hope for more than these unlikely routes could offer.



Fig. 6.2. Early photograph of the upper Columbia River, date unknown
National Archives of Canada

The second route, *Rio del Norte y Rio Colorado*, ascends the Rio Grande del Norte from its mouth in the Gulf of México to a point “twelve or thirteen leagues” (40 miles) from the source of the Rio Colorado. Following an “easy carriage” across mountains, Humboldt’s route descends Rio Colorado to the Gulf of California. Humboldt positioned the source of the Rio Grande del Norte too far north on his map. He determined the source of Rio Colorado from *Mapa del Nuevo México from 29° to 42° Latitude* found in the Mexican archives.¹¹ The source of Rio Colorado at 40° latitude near Long’s Peak is over 300 miles from the source of the Rio Grande del Norte. The river described on Humboldt’s map as the “principal source of the Rio Colorado” may be the San Juan River, a tributary of the Colorado, whose headwaters near Pagosa Springs, Colorado, are approximately 40 miles from the upper reaches of the Rio Grande del Norte. From there the San Juan heads west through northern New Mexico into Utah where it discharges into the Colorado near Glen Canyon. Humboldt thought the *Rio del Norte y Rio Colorado* might be useful for internal commerce in the northern provinces of New Spain but doubted their value as a direct water passage between the oceans.¹²

Humboldt acknowledged the Domínguez-Escalante expedition of 1776 whose mapmaker, Bernardo Miera y Pacheco prepared a detailed map of the upper Colorado River basin and Utah Valley. Miera inflated the importance of the region’s rivers in his manuscript, using descriptive language such as “very large and navigable” and “great width and depth.”¹³ Maps of the region sometimes included geopolitical features intended to promote both exploration and trade. Although Humboldt’s map did not show the full course of a westward flowing river across the northern provinces, other maps suggested that such a river ran all the way to the Pacific.¹⁴

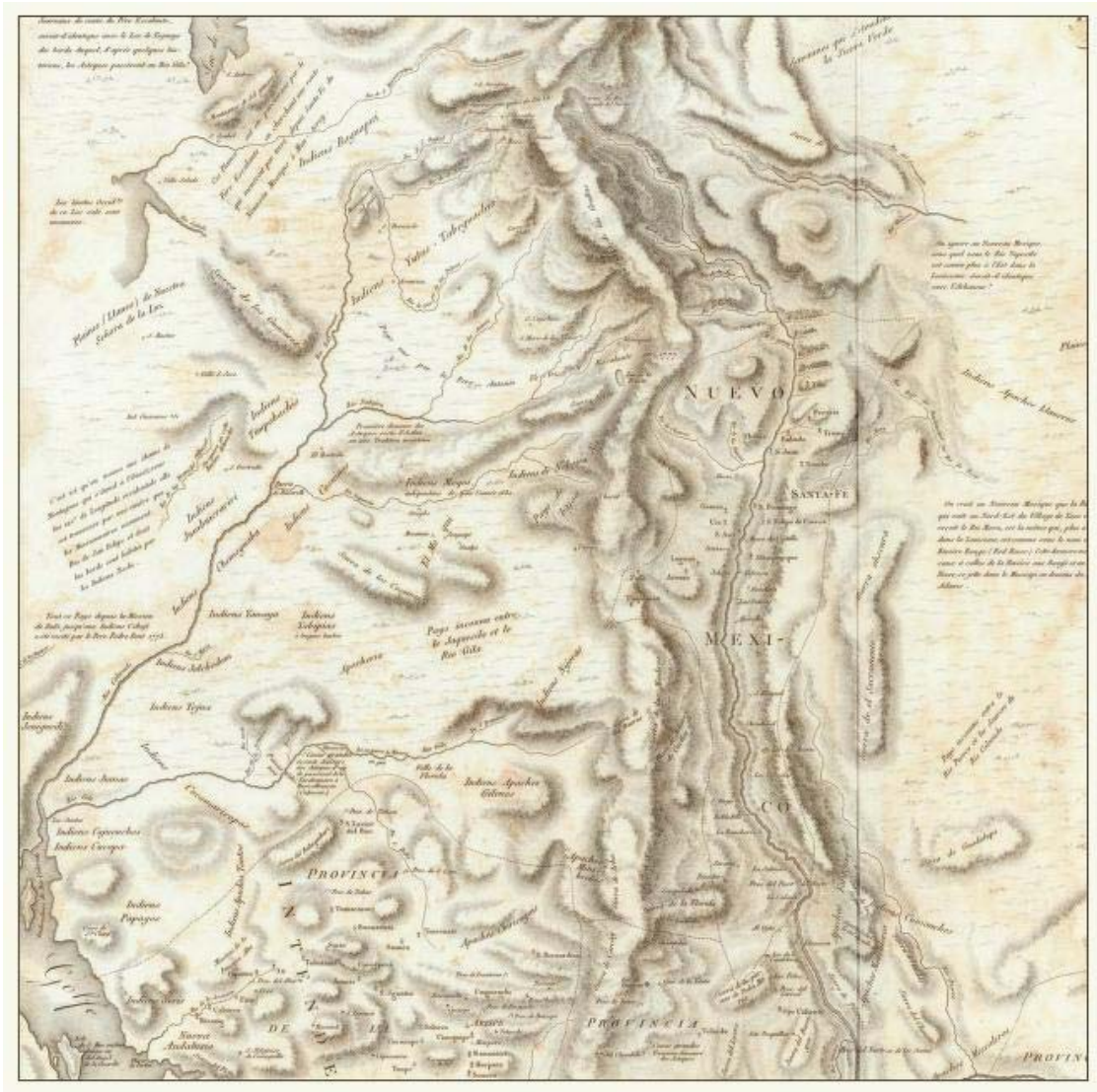


Fig. 6.9. View of General Chart of the Kingdom of New Spain

Humboldt apparently thought that the Gulf of California is much closer to the source of the Colorado River than it really is. This may explain why Humboldt believed *Rio del Norte y Rio Colorado* might serve as a useful water passage. Subsequent maps also distorted distances in the region. John Robinson's *Map of México, Louisiana, and the Missouri Territory*, 1819, shows the distance from Pike's Peak in southern Colorado to the Pacific Ocean to be 660 miles, but the distance is really 1006 miles.¹⁵ *Golfe de California* appears in the lower left on Humboldt's map. Using his calculation of "12 or 13 leagues" distance from the source of Rio del Norte to the source of Rio Colorado, one comes up with a scale of approximately 1:40. Using this calculation, the distance from the source of Rio Colorado to Golfe de California is less than 300 miles on Humboldt's map, while the actual length of the river is 1450 miles.



Fig. 6.10. Photograph of the upper Rio Grande del Norte below Taos, NM

Humboldt's map verified his concern that theory without field observation is risky.¹⁶ Having never traveled in the region, Humboldt borrowed elements from the manuscript map of Bernardo Miera y Pacheco, who exaggerated the width and depth of rivers such as the upper Rio Grande del Norte.

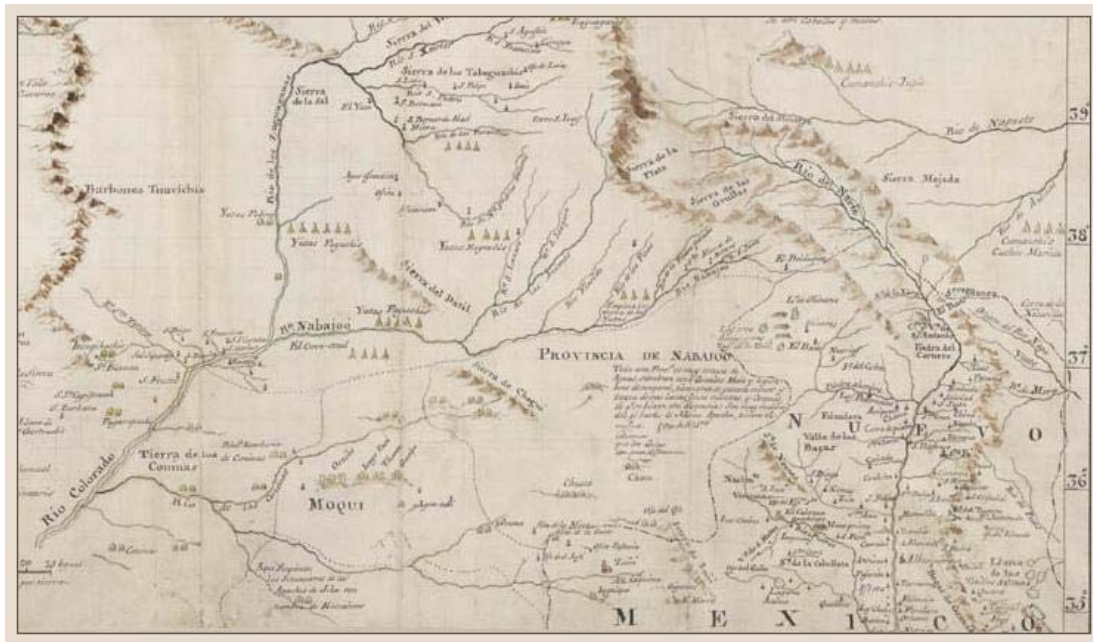


Fig. 6.11. View of Bernardo Miera y Pacheco's *Plano geográfico de los descubrimientos*, 1778

Miera positioned the upper Rio Grande del Norte better than Humboldt, but it is still too far north at 39° latitude. Miera did not know the course of Rio Colorado, so he ended it abruptly at the lower left of the map. Image courtesy of Yale University Library.

Humboldt compiled the first accurate chart of the Amazon basin during his travels through the region in 1799-1803. His third canal route, *Rio Huallaga y Rio Huanuco*, employs a network of rivers through the South American jungle. Humboldt identifies the route as no. 8 in his text. Humboldt studied the possibility of building a canal between Rio Huaura, which flows into the Pacific, and Rio Huanuco. He concluded that the terrain was too mountainous for a water passage but that a good road could be built from the Peruvian capital of Lima to the Rio Huanuco “two or three days distant.” From there Humboldt’s route follows a network of rivers to the mouth of the Amazon on the Atlantic coast of Brazil.¹⁷ Humboldt wrote that this passage would allow Peruvian goods to be transported to the coasts of Europe in five or six weeks, compared to four months around Cape Horn. He noted that it was extremely difficult for large sailing ships to travel from north to south against prevailing winds and currents along the Pacific coast of South America. He concluded that the passage from Europe to Chile and Peru around Cape Horn would be faster than via a canal through Nicaragua or Panama. He later wrote, “A canal through Nicaragua or Panama would only be advantageous for the trade along the coast of Peru when the coasting is made by steam ships.”¹⁸ The Amazon route was preferred by European traders doing commerce along the coast of Peru.¹⁹ Humboldt believed that the *Rio Huallaga y Rio Huanuco* was an important trade route, but its viability as a direct water passage between the oceans was hampered by political considerations. Spaniards were restricted from moving freely through these waters by the Portuguese government. When Humboldt traveled from the Orinoco River to the Rio Negro in Brazil, he learned that the Portuguese had issued a warrant for his arrest as a Spanish spy.



Fig. 6.12. Rio Huallaga y Rio Huanuco

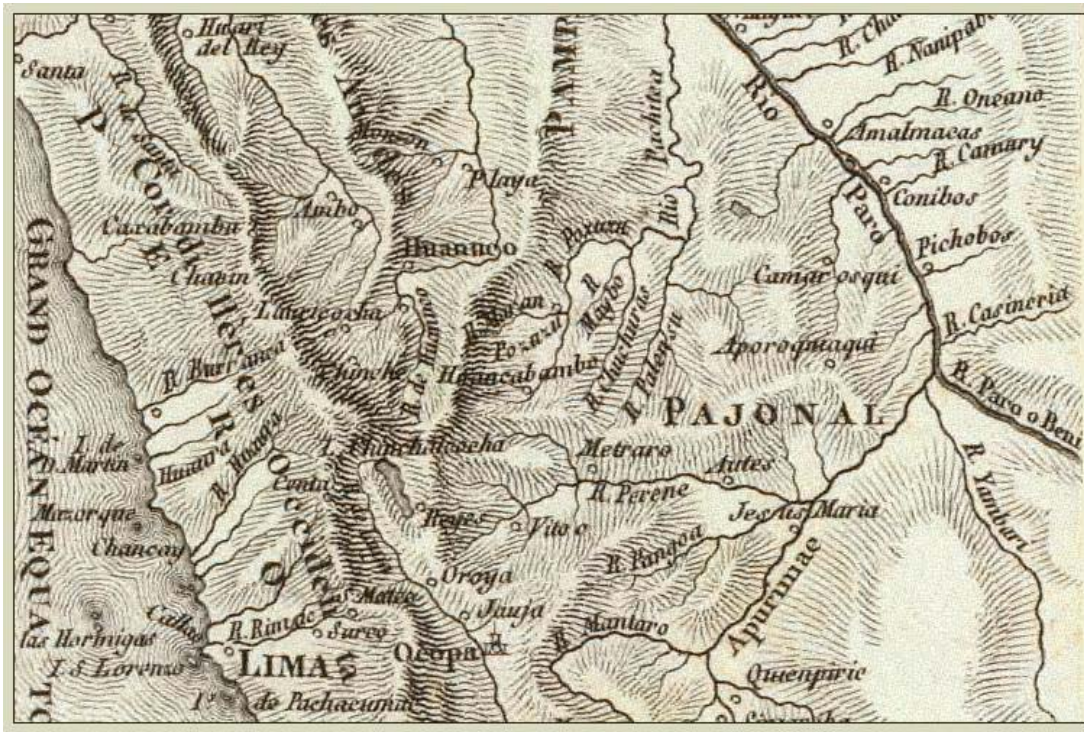


Fig. 6.13. View of Rio Huallaga y Rio Huanuco
Humboldt's map depicts the mountainous terrain near Lima, Peru.



Fig. 6.14. Humboldt near Mt. Chimborazo in the Andean highlands
Painting by Friederich G. Weitsch, 1810

Humboldt felt that the west coast of South America was too mountainous for a direct water passage but that an internal network of rivers and roads would benefit regional commerce.

The fourth route, *Golfe de St. Georges y Estero de Aysen*, also goes through South America. It is identified as no. 9 in Humboldt's text. It was thought that Golfe de St. Georges penetrated the coast of Patagonia to Estero de Aysen and on to the western coast of Chile opposite the archipelago Chayamapu. In 1746 a similar passage was said to have been found between the Bay of Julian at 50° latitude and the Pacific Ocean. A water passage through Patagonia would allow navigators to avoid the hazards of sailing around Cape Horn and shorten their route by 700 leagues. Humboldt wrote that a South American water passage occupied the attention of the court of Madrid in 1790. The viceroy of Peru equipped an expedition led by Don José de Moraleda y Montero to explore the southern coast of Chile. Humboldt saw the instructions that Moraleda received in Lima, which commended to him the greatest secrecy in case he should find a water passage between the oceans. Estero de Aysen had been explored previously by two Jesuit priests, García and Vicuña, in 1763. But when Moraleda navigated Estero de Aysen in 1793 he found that it ends nearly three-hundred miles short of Golfe de St. Georges.²⁰

A decade before Humboldt came to the Americas, Alejandro Malaspina set out from Spain with two ships on a voyage of discovery around the world. Humboldt credits the Malaspina expedition with exploring Golfe de St. Georges with "the greatest minuteness."²¹ Malaspina's voyage was both scientific and political in nature. Malaspina was arrested by Spanish prime minister Manuel Godoy (1767-1851) and imprisoned at Corunna on charges of sedition, and an account of his voyage was not published until 1885.²² But the Malaspina expedition's cartographic observations became the foundation of a great many maps.²³ Felipe Bauza y Canas drew coastal profiles and oversaw the preparation of all charts and maps of the expedition. Humboldt corresponded with Bauza concerning his drawings but not until years after publication of his own maps.²⁴

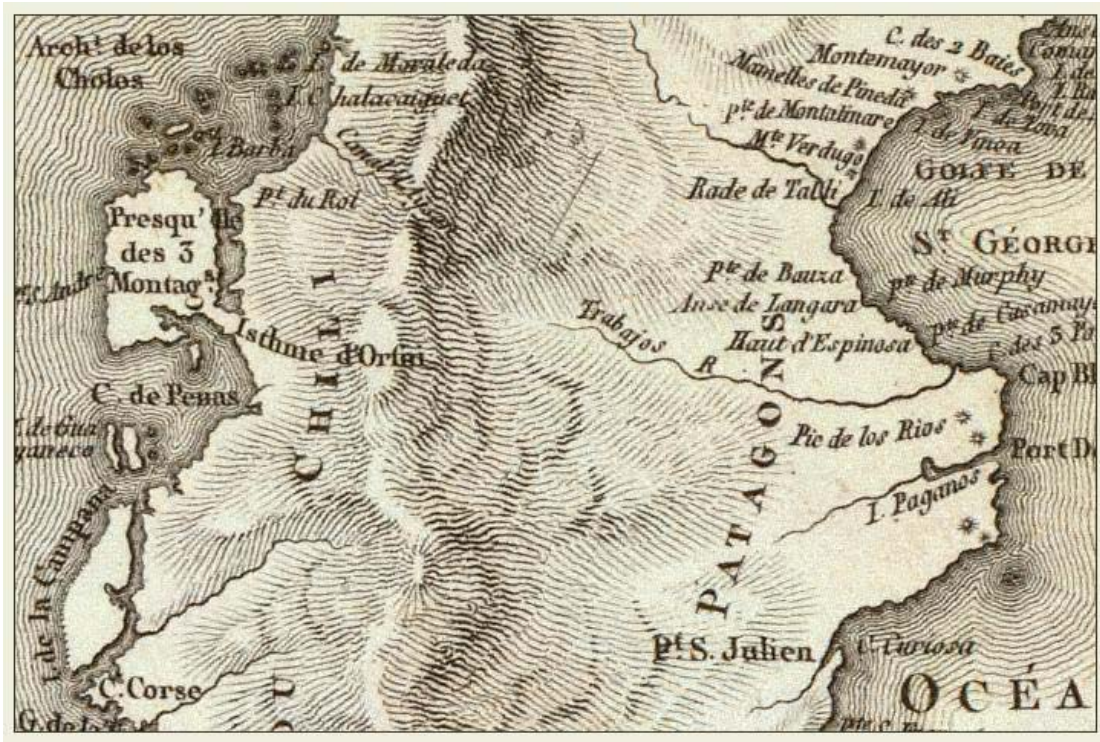


Fig. 6.16. View of Golfe de St. Georges y Estero de Aysen

Spanish explorers navigated Estero de Aysen in 1793 and found that it ends nearly three-hundred miles short of Golfe de St. Georges.



Fig. 6.17. Alejandro Malaspina

Alejandro Malaspina (1754-1810) explored the Golfe de St. Georges and charted harbors along the coast of the Americas as a way of verifying and endorsing Spain's territorial claims.²⁵ The Malaspina expedition also made hydrographic observations, recorded minerals, studied soil and volcanoes, and investigated the fauna.²⁶

The fifth route, *Rio de Huasacualco y Rio de Chimalapa*, goes through the Isthmus of Tehuantepec in México, utilizing the Rio de Chimalapa, which flows into the Pacific, and Rio de Huasacualco which discharges into the Gulf of México. Humboldt identifies it as no. 3 in his text. Hernán Cortés wrote to King Carlos V of this route in 1520.²⁷ Noting the Isthmus of Tehuantepec to be the point where the continent is narrowest, 135 miles from the Atlantic to the Pacific, Humboldt lamented that “the part of México in which the two oceans approach the nearest to each other is unfortunately not the part which contains the two ports of Acapulco and Veracruz.”²⁸ He subsequently noted, however, that much of the trade of Veracruz was conducted at the port of Huasacualco during a period of political unrest in México.²⁹ Humboldt calculated that fur trade shipping between Vancouver and Philadelphia around Cape Horn would be shortened by 9000 miles with a water passage through the Isthmus of Tehuantepec. Humboldt found that a road had been built along the route which served as a commercial communication between the two oceans. The Tehuantepec route would require the digging of a canal “six or seven leagues in length” connecting the Rio del Passo, a branch of the Rio Huasacualco, and Rio de Chimalapa. Humboldt based his study of Tehuantepec on a report conducted by Mexican engineers on behalf of the government.³⁰ The accompanying map indicated that the use of locks would not be required for a canal. Humboldt cautioned, however, that no barometric or geodesic measurements had been taken in the region. Humboldt thought that the geography of México was too broad and mountainous for a canal, and he feared the "sinuosity" of the Huasacualco and Chimalapa rivers. Humboldt felt that it was important for the Mexicans to establish a line of navigation for small craft through the isthmus, or to improve the existing road by land. He concluded that the Isthmus of Tehuantepec seemed to favor a canal project for interior navigation rather than inter-oceanic passage.³¹

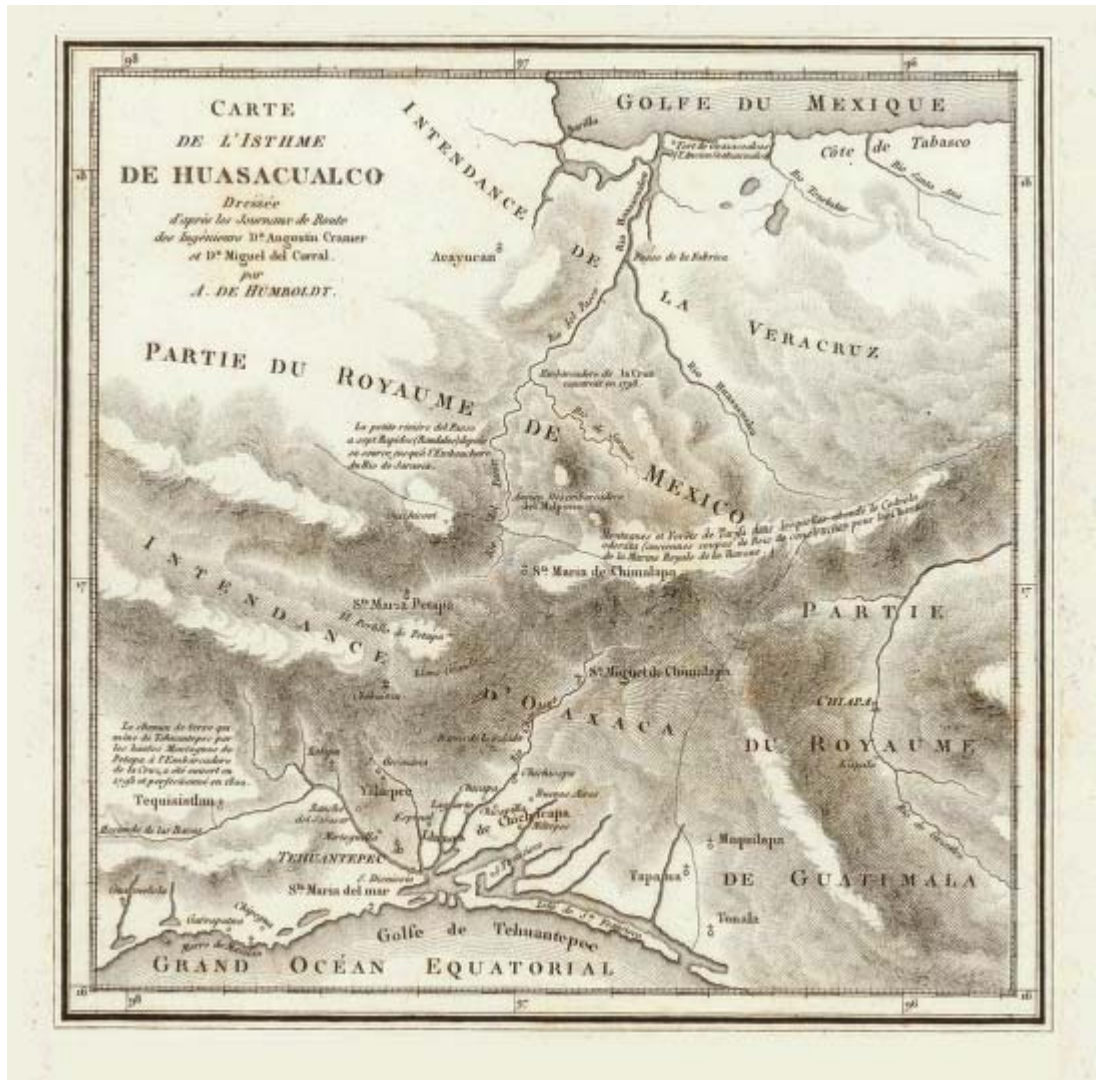


Fig. 6.18. Rio de Huasacualco y Rio de Chimalapa

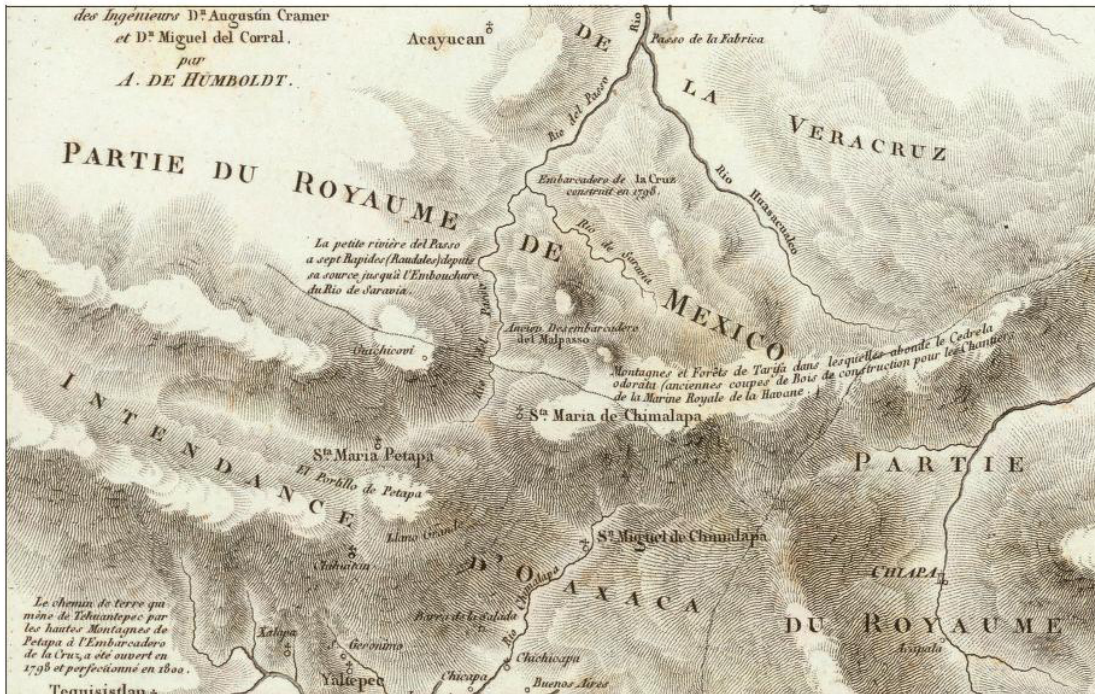


Fig. 6.19. View of Rio de Huasacualco y Rio de Chimalapa

Humboldt thought the geography of México to be too broad and mountainous for a canal, and he feared the "sinuosity" of the rivers.



Fig. 6.20. View of the Isthmus of Tehuantepec

Despite his concerns, Humboldt projected a seventeen-mile canal between the Rio del Passo, a branch of Rio de Huasacualco, and Rio de Chimalapa.

The sixth route, *Lake of Nicaragua*, identified as route no. 4 in his text, utilizes Lake Nicaragua and the San Juan River. Humboldt cites old French and English manuscripts in the archives of Madrid showing a water passage from Lake Nicaragua to the Pacific Ocean. Other maps showed the Rio Partido flowing from the lake into the Pacific. But the river does not appear on later maps, and Humboldt concluded that a canal twelve miles in length would be required between Lake Nicaragua and the Gulf of Papagayo on the Pacific coast. The Nicaragua passage was favored by English traders who conducted commerce along the Gulf of Mosquitoes in the Caribbean. When Humboldt designated Lake Nicaragua as the route posing the fewest difficulties it became known as "Humboldt's route." But Humboldt was concerned about an active volcano on the Isle of Ometap in Lake Nicaragua.³² He also noted that the west coast of Nicaragua is almost inaccessible for five months of the year due to bad weather.³³

Humboldt suggested an alternate passage from Lake Nicaragua to the Pacific Ocean via Rio Lexa through Lake León and the Rio Tosta. From an account of the voyage of William Dampier published in 1697, Humboldt supposed that there were no mountains between Lake León and the Pacific Ocean. Subsequent surveys, however, found that the Rio Tosta is dry for much of the year. The Nicaragua canal that Humboldt visualized was a lock canal, much along the lines of Thomas Telford's Caledonian Canal in Scotland, then the most ambitious project of its kind. Lake Nicaragua, besides being navigable, would, like Telford's Scottish lakes, provide a natural and limitless source of water for the canal, a vast basin at the very summit of the canal.³⁴

In the 1850s, travelers would navigate Lake Nicaragua via steamship and cross the twelve mile isthmus between Lake Nicaragua and the Pacific Ocean via stagecoach. A similar crossing at Panama was shorter and faster, but Nicaragua was five hundred miles and two days closer to the United States.³⁵

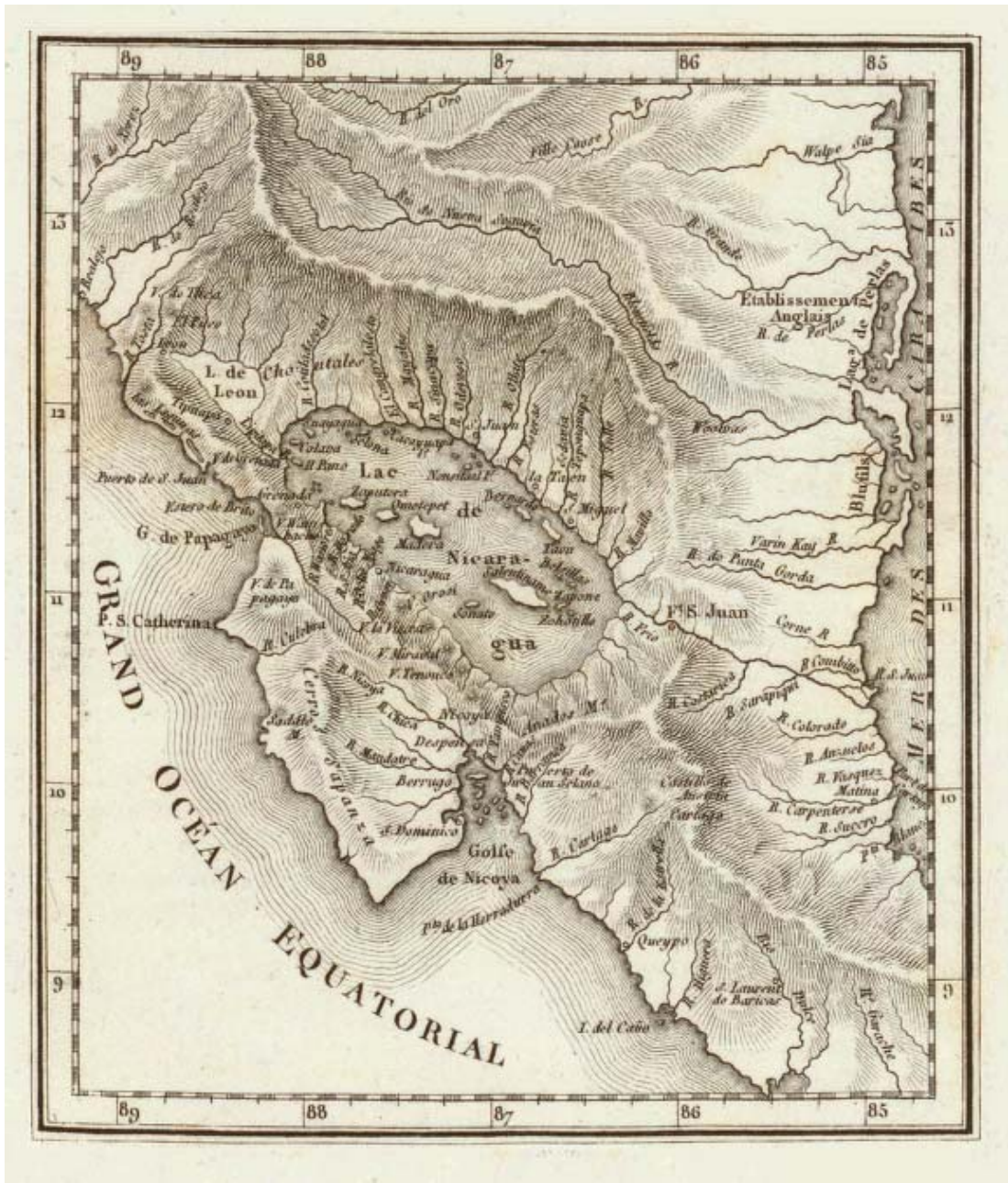


Fig. 6.21. Lake of Nicaragua

The canal would eventually be built near the seventh route, which Humboldt called the *Isthmus of Darien* and identifies as no. 5 in his text. The route is situated along the Isthmus of Panama. The Gulf of Darien, in the Caribbean Sea, is located to the east of Humboldt's route and does not appear on this map. Humboldt had planned to sail from Colombia to the northern coast of Panama in 1801. From there he intended to cross the isthmus, taking topographical measurements and charting a route for a canal. But Humboldt changed his travel plans and never went to Panama.³⁷ He eventually obtained topographical data of the isthmus but judged Panama to be the worst possible choice for a canal, primarily because of its mountains, which he thought to be three times as high as they really are. Subsequent surveys discovered a gap in the mountains twelve miles from Panama City, at a point called Culebra, where the elevation above sea level was only 275 feet. That was 200 feet less than what had been considered the lowest gap. French engineers began digging the canal along this route in 1881, and U.S. engineers completed the canal in 1914. Another consideration for building the canal in Panama was the absence of volcanoes. In Nicaragua an 1835 eruption of a volcano known as *Coseguina* lasted for two days. Geologists estimated that enough stone and ash was emitted every six minutes to fill a Nicaragua Canal.³⁸

Humboldt took barometric measurements in the course of his research which determined that there was no difference between the levels of the two oceans. The level of the Pacific was not twenty feet higher than that of the Atlantic, as had been the accepted view for centuries. Sea level was sea level, the same on both sides. The difference was in the size of the tides. The tides on the Pacific coast of Panama are considerable, eighteen to twenty feet, while on the Caribbean there is little or no tide, barely more than a foot.³⁹

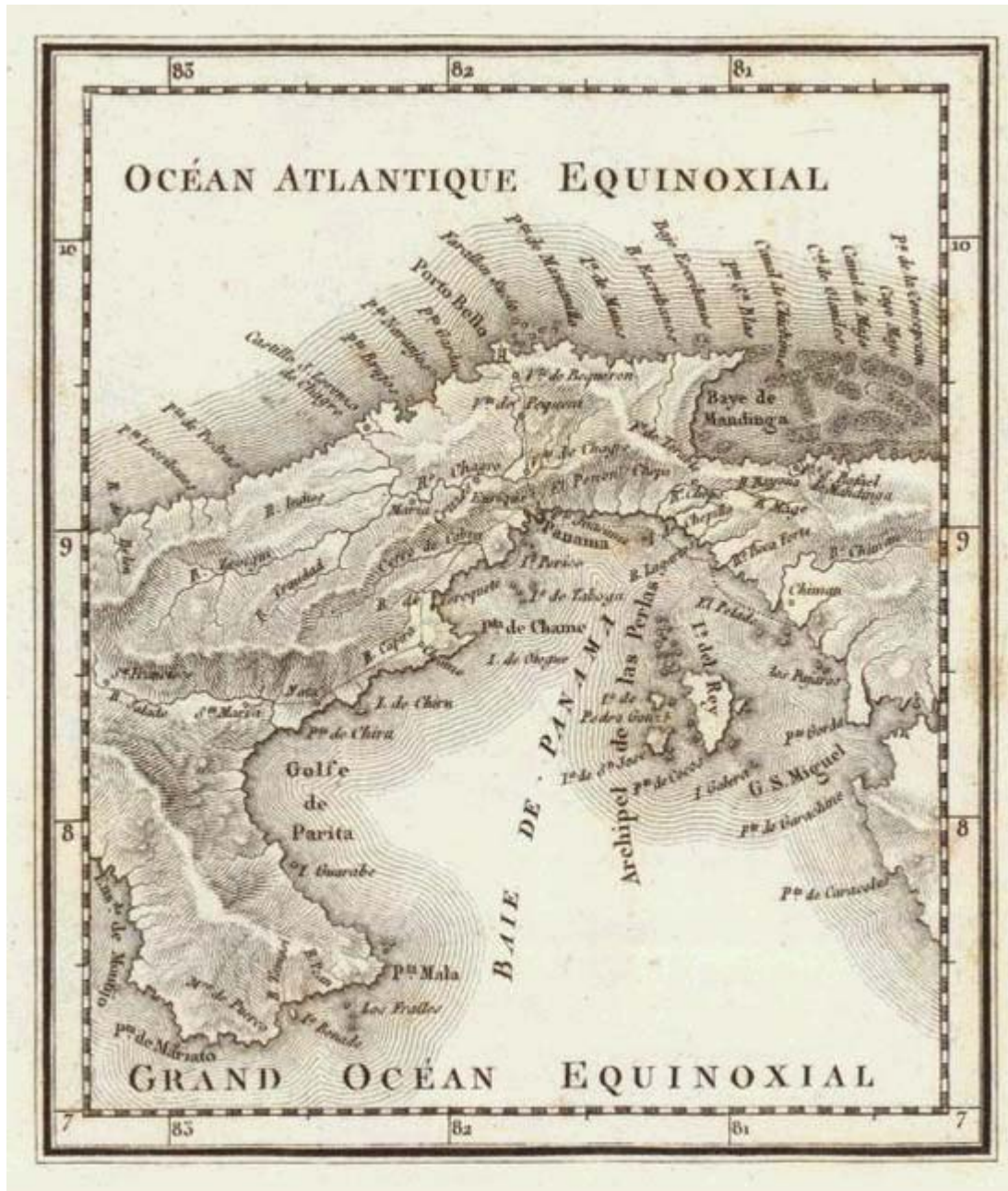


Fig. 6.24. Isthmus of Darien

Humboldt's representation of a canal route through the Isthmus of Panama. He believed the Panama route to be too mountainous and expressed his preference for a Nicaragua canal in *Political Essay on the Kingdom of New Spain*. He objected to the name "Pacific" Ocean, instead calling it the "Grand" Ocean on his map. Humboldt would learn that the Bay of Mandinga depicted in his map penetrates into the land seventeen miles less than was supposed in 1805.⁴⁰

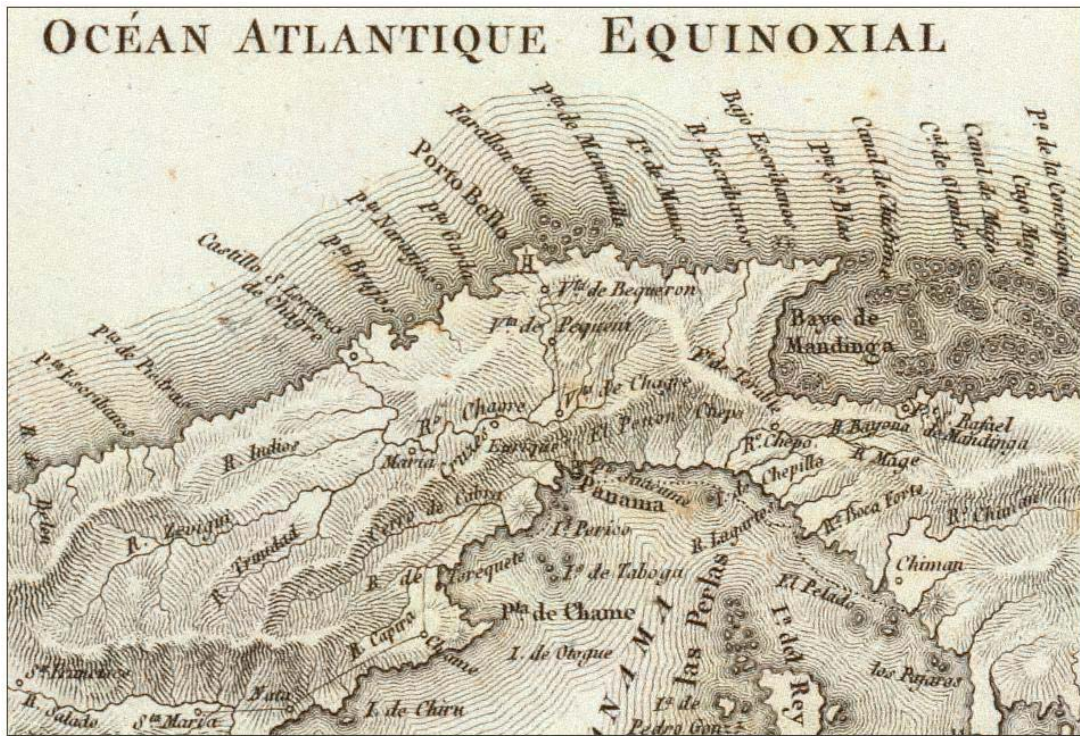


Fig. 6.25. View of Isthmus of Darien

Humboldt wrote that the terrain of Panama was better suited for a camel crossing than for a canal. He thought that the shallow depth of Panama Bay would require dredging beyond the Isle of Perico.⁴¹



Fig. 6.26. View of Isthmus of Darien showing Humboldt's projected canal route

The eighth map, *Ravin de la Raspadura y Embarcadero de Naipi*, includes two projected routes through the Isthmus of Panama, the Naipi and San Juan routes, also known as the Atrato routes, nos. 6 and 7 in Humboldt's text. A third route, from the Gulf of San Miguel to the Gulf of Darien, also appears on Humboldt's map. Because of its width, depth, and length, the Atrato River lends itself favorably to consideration as a sea-level waterway. It is more than 1,000 feet wide and 50 feet deep as far as 60 miles upstream. It rises near the Pacific coast and flows approximately 150 miles on a course nearly parallel to the coast, where it turns and flows 60 miles into the Gulf of Darien. The San Juan River, which is connected to the Atrato by the Raspadura Canal, rises only a short distance from the headwaters of the Atrato and flows southward for 150 miles into the Pacific. It is one of the largest rivers in Central America.

Humboldt traced a route from Cupica via the Rio Naipi and the Rio Atrato into the Gulf of Darien. He projected a canal of "five or six marine leagues" from Cupica to the Embarcadero of Naipi over soil "quite proper for a canal."⁴² But Humboldt noted that Cupica did not appear on any Spanish maps and its precise location was unknown. He further lamented that no barometric measurements or geodesic leveling had been conducted in the region to determine the lines of elevation which the projected canal needed to traverse.⁴³ Humboldt suggested both the Napipi and San Juan routes as possible canal passages. On the strength of Humboldt's suggestion, the government of New Grenada (later Colombia) granted charters in 1851 to the prospective builders of canals along both the Napipi and San Juan river routes. Promoters called the San Juan route the Humboldt Line to lend a more authentic air to the prospectus and encourage the investment of capital. They painted glowing pictures of their plans but included few facts. Investors could not be attracted and the charters were later abandoned.⁴⁴



Fig. 6.28. View of *Ravin de la Raspadura y Embarcadere de Naipi*
 Humboldt's canal route from Cupica to the Gulf of Darien via the Rio Naipi and the Rio Atrato.



Fig. 6.29. Close-up view of *Ravin de la Raspadura y Embarcadere de Naipi*



Fig. 6.30. View of *Ravin de la Raspadura y Embarcadero de Naipi*

Humboldt's "Lost Canal"

Humboldt depicts a small canal connecting the Rio San Juan and Rio Atrato. He wrote in *Political Essay on the Kingdom of New Spain* that a monk from the village of Novita employed his parishioners to dig a canal in the *Ravin de la Raspadura*, connecting the Rio San Juan and Rio Atrato and thus allowing canoes loaded with cacao to pass 75 leagues from sea to sea when rains were abundant. This route existed since 1788 but was unknown to Europeans.⁴⁵ An American, John C. Trautwine, led an expedition in search of Humboldt's "Lost Canal" in the 1860s but came up empty. "There was no lost canal," he reported at the conclusion of a search across hundreds of miles of Atrato wilderness. "Perhaps a Spanish priest had induced his flock to make a canoe passage but it was never anything more than that."⁴⁶

In *Personal Narrative of Travels to the Equinoctial Regions of the New Continent During the Years 1799-1804* (1826), Humboldt presents new information on possible canal routes. He cites improved steamship technology in the fifteen years since publication of his first canal study. He writes of the trend toward lighter, faster cargo ships drawing less water than older ships. He reassesses the Nicaragua route, noting that the weather along the Pacific side is not as stormy as he believed it to be in 1803. He indicates five locations that appear to present the practicability of opening a direct navigation between the Atlantic and Pacific Oceans: the Isthmus of Tehuantepec, Lake Nicaragua, the Isthmus of Darien, the Isthmus of Panama, and the Canal of Rospadura between the Rio Atrato and the Rio San Juan. In his analysis of these sites, Humboldt emphasized what he believed to be most important for the political advantage and trade of nations.⁴⁷

Citing an official survey conducted by two Mexican engineers, Augustín Cramer and Miguel del Corral, Humboldt formed an idea of how a canal would be built through the Isthmus of Tehuantepec. A canal “about 16000 toises long”⁴⁸ would join the Rio Chimalapa and Rio del Passo, which is a tributary of the Rio Huasacualco. He cautioned that the Rio Chimalapa and the Rio del Passo needed to be dredged in order for large vessels to navigate their waters. Humboldt feared that the winding, shallow rivers and the width of the isthmus would present an obstacle to completing a water passage. Humboldt noted that commercial navigation required ships of great tonnage, needing a depth of 15 to 17 feet of water and uninterrupted navigation with no unloading of vessels. “It would be regretted,” he wrote, “if a

canal project was undertaken on too small a scale.”⁴⁹ Humboldt encouraged governments to survey the projected routes to determine elevation, distance, depth of the lakes, rivers to be navigated, and the amount of water needed to supply the locks. The government of New Spain conducted a canal study in 1818. Humboldt cited Davis Robinson who published work on the anchorages of México, Nicaragua, and Panama. Robinson found the depth at the mouth of the Rio Huasacualco on the Gulf of México to be adequate for the largest ships. The anchorage at the Rio San Juan on the east coast of Nicaragua was only twelve feet deep, but the river and lake were navigable for brigs and sloops.⁵⁰

Humboldt’s assessment of the Panama route remained unchanged. He felt that Panama was the least desirable place for a canal. He concluded from the observations of Antonio de Ulloa (1716-1795) that the terrain of Panama was too mountainous for a canal. The terrain between Lake Nicaragua and the Pacific Ocean, on the other hand, consisted of savannahs and plains that would present fewer problems for engineers. Humboldt cited improved technology that would allow engineers to regulate the flow of water to and from both Lake Nicaragua and Rio San Juan. Humboldt noted that the passage from Cupica via the Rio Naipi and Rio Atrato into the Gulf of Darien appeared favorable for a canal of large dimension, able to accommodate commercial vessels of great tonnage laden with cargo. Humboldt maintained his interest in the Canal of Rospadura, but conceded that it would probably be limited to small navigation and inland passage.⁵¹

Regardless of its eventual location, Humboldt argued that a canal was important because the advance of American civilization and the commerce of Asia had created great interest in the balance of commerce with Europe and the “political preponderancy of nations.”⁵² A canal between the two oceans would bring the exports of Asia more than 2000 leagues nearer to Europe and the United States. “Only then could any great changes be effected in the political state of Asia, because the Americas have served as a barrier to economic and cultural exchange between Asia and Europe.”⁵³ Humboldt hoped that a canal between the oceans would start a commercial revolution that would cure the social problems he observed in the New World. A water passage through the Americas would change world trade which would “impact the organization of society.” A canal would “liven and abridge” the communications between the western coasts of America and those of the United States and of Europe. By digging a canal the “prosperity of American industry might be increased, and very indirect influence would be exerted on the general interests of civilized nations.”⁵⁴

Humboldt addressed the political considerations of an inter-oceanic canal in *Personal Narrative*. He evaluated the military preparations needed to defend a canal along the Central American isthmus, and assessed the financial state of the former colonies following their wars for independence. Humboldt speculated how the future organization of political states would affect commerce and well-being throughout the Americas. His research served the needs of governments whose interests were served with the building of a canal. He understood the distribution of wealth to be an

essential part of civilization and infused his maps and texts with this understanding. The construction of a canal which would shorten trade routes was an important part of Humboldt's concept of the world economy. His economic analysis caught the attention of businessmen. The scientific nature of his inquiry appealed to engineers who, armed with data that Humboldt provided, came to realize that a canal could in fact be built. The prospect for the construction of a water passage through the Americas fascinated Humboldt all his life. On December 6, 1845, he wrote to Henry Wheaton, the U.S. ambassador to Prussia, "One more word about the Isthmus of Panama . . . I assure you that someday it will be done."⁵⁵

CHAPTER 7
CONCLUSION



Fig. 7.1. Humboldt's sketch of Mt. Chimborazo
Vue des cordelleres et monument des peuples indigene de l' Amerique

Humboldt's journey through the Americas signaled a new era of global exploration that would be based on science and technology. Humboldt was careful not to call himself an explorer. He was a scientific traveler who measured accurately what explorers had reported inaccurately.¹ He placed emphasis on disproving outdated theories, rather than establishing new ones. Humboldt knew that the knowledge he helped formulate would be advanced by future scientists with even better technology. But his knowledge would remain useful until it became outdated.

In 1738, Voltaire (1694-1778) declared that science was subjective, a statement of what had often happened in the past and might continue to happen in the future.² Humboldt agreed with Voltaire that much scientific knowledge was untrue, so he set out to improve knowledge using the latest scientific technology. He used instruments to measure terrain and calculate the position of places where he traveled. Humboldt was skeptical of scientific knowledge based on measurements made 20 or 30 years earlier.³ He collected specimens and made sketches for analysis by specialists in Europe. His use of scientific instruments and methods enabled him to reject past speculations. Humboldt's science of measurement could not have come into existence before the late eighteenth century because the available instruments were still too crude.

Humboldt made it clear that the traveler should look for the sublime in his travels. That was one of the reasons for traveling. But he did not consider himself a Romanticist. German philosopher Friedrich Schiller (1759-1805) gave voice to the argument against Humboldt as a Romantic. Schiller wrote that Humboldt "measured nature shamelessly and with such impudence as I cannot conceive. His are empty words and narrow concepts . . . he has no imagination. Nature should be contemplated with feeling."⁴

Like other philosophers who lived a long life, Humboldt's views changed over time. In 1850, at the age of 81, Humboldt invited his readers to "escape from the stormy waves of life and joyfully follow me into the depths of the forests, over the boundless steppes and prairies, and to the lofty summits of the Andes."⁵ But in his earlier work, Humboldt's science was more analytical. He sketched natural habitats, with their

volcanoes and exotic species, but his sketches offered a view of nature that served to construct science with a barometer and a sextant.⁶ Any Romanticist could climb a mountain. Humboldt wanted to use its height as a laboratory for observing extreme weather conditions.⁷ But Humboldt's science also included a view of nature that appealed to Europeans (Schiller excepted) because it conveyed a sense of Romanticism. For Voltaire, those Europeans had no use for science. "They are people who have no access to reason. They should be directed, rather than educated. They are unworthy of teaching."⁸ Humboldt believed all sorts of issues to be beyond the limits of science. He wrote, "Some parts of science are conjectural. Science would lose much of its attraction if we attempted to confine this conjectural part within too narrow limits. The study of nature rises above the sterile accumulation of scientific facts. The active and inquiring mind of man may therefore be permitted to escape from the present to conjecture that which cannot yet be clearly determined."⁹

To truly understand nature, Humboldt had to feel the ecstasy as well as grasp the mathematics. "Nature herself is sublimely eloquent. The stars as they sparkle in the firmament fill us with delight and ecstasy, and yet they all move in orbit marked out with mathematical precision."¹⁰

Humboldt's work appealed to European readers who knew little of exotic jungles or smoldering volcanoes. His style was a synthesis of European Enlightenment and Romanticism, a fusion of scientific precision and Romantic idealism. Humboldt's science gave humanity an enlightened view of what he discovered about nature. He

made use of Enlightenment science to better understand the natural world. Throughout his work, Humboldt idealized harmony with nature.

Crucial to Humboldt's conception of science was his belief in progress. He stressed that the perfection of science was his objective, but he was driven by a vision that called for nature's transformation by man. The opening pages of Humboldt's *Personal Narrative* foresaw future landscapes superior to the scenes of nature he went on to describe. "During my travels I saw impenetrable jungles and flooded lands . . . those who would live on the banks of the Orinoco and the Atabapo in times to come . . . may see cities enriched by commerce and fertile fields cultivated by free men."¹¹ This was an endorsement for wilderness tamed and organized, as Humboldt envisioned, by a technologically equipped humanity. It included certitude that progress was a universal aspiration implanted by God; confidence in the efficacy of rational human agency; belief that much-vaunted present-day achievements would come to be adjudged insignificant in the light of future advances; and the vital necessity of respectful recall of the past conjoined with altruistic concern for the future.¹²

Humboldt's observations attract new and growing interest today. His ideas have been cited, redefined, and applied in many fields of modern culture, including landscape painting and environmental thinking. Scholars in several fields are studying Humboldt's inter-disciplinary work, his thinking about human and natural networks, and his cross-cultural and transnational comparisons.¹³ An important part of Humboldt's appeal is his adherence to technology and science. That Humboldt's science was both a product of the Enlightenment and unmistakably Romantic speaks to the nature of both science and

philosophy at the beginning of the nineteenth century. Humboldt hoped that scientific and technological activity, properly conducted, would inevitably benefit society. Humboldt's philosophy, founded on a broad scientific base, incorporated the needs of human beings and included their economies, their prosperity, their distress, slavery, oppression, and emancipation. The scientific advancements of the Enlightenment enabled Humboldt to set out on an unprecedented journey through the Americas, and he used the scientific data he collected in the interests of progress. Historian David Lowenthal concluded that Humboldt's science and philosophy captured the essence of the modernizing Western world.¹⁴ Humboldt infused a sense of discovery and adventure in the human spirit. More than just a scientist, Humboldt lent a special, indelible character to the Americas. He shared the belief of Condorcet (1743-1794) that nature has set no bounds to society's hopes and that humanity "marches forward, liberated of all chains, escaping from the rule of chance and of the enemies of progress, secure and industrious on the paths of truth, virtue, and happiness."¹⁵

APPENDIX A
THE VIRGINIA GARRETT
CARTOGRAPHIC HISTORY LIBRARY

The Virginia Garrett Cartographic History Library at the University of Texas Arlington contains numerous rare maps and atlases, including a facsimile of the sketch map that Alexander von Humboldt shared with U.S. officials in 1804 (Fig. A.1). Humboldt loaned the sketch to Secretary of the Treasury Albert Gallatin in Washington. After leaving Washington, Humboldt wrote to Gallatin from Philadelphia on June 20, 1804, "I venture to ask you once more to remember the two geographic sketches which you studied with such care." Humboldt was sailing for Europe and wanted to take the map (in two sheets) home with him. Gallatin responded promptly, and on June 27 Humboldt acknowledged receipt of "two maps of Mexico."¹

General James Wilkinson asked Gallatin for a copy of Humboldt's sketch but Gallatin refused, saying that Humboldt had loaned the map on condition that it not be copied because he intended to publish it himself in Europe. After Wilkinson had been appointed Governor of Louisiana in 1805, Gallatin had a copy made of a portion of Humboldt's map, including the northern provinces of Mexico, and gave it to Wilkinson. It is believed that Wilkinson shared that map with Zebulon Pike, who used it for his *Map of the Internal Provinces of New Spain* (Fig. 3.16).

At the Virginia Garrett Cartographic History Library, I was able to examine Humboldt's sketch alongside the map he published in *Atlas géographique et physique du royaume de la Nouvelle-Espagne* (Fig. A.2). The sketch appears on one sheet, leading me to conclude that it is a composite of Humboldt's map, since Humboldt acknowledged in his letter to Gallatin that the sketch consisted of two sheets. The published map appears in two sheets, referred to as the upper half and the lower half in Humboldt's text. The published map contains more information than the sketch, but little if any information on the sketch appears to have been changed on the published

map. The coordinates of Humboldt's sketch agree with the published map. While viewing the sketch, in its simplified form, it becomes apparent what was important to Humboldt. He noted the route of the Domínguez-Escalante expedition, adding in his text, "It is astonishing that the once-intrepid Spanish are unable to find a land route from Taos to Monterey" (pg. 52).

"Pacific Ocean" has been penciled into the sketch, but probably not by Humboldt. He objected to the name "Pacific Ocean," instead calling it the "Grand Ocean" on his map or "South Sea" in his text. Humboldt's sketch does not show the full course of a westward flowing river across the northern provinces, but other maps suggested that such a river ran all the way to the Pacific Ocean.²

The Colorado and Rio Grande River networks are prominent on Humboldt's sketch. He projected an inter-oceanic water passage along those rivers on *Rio del Norte et Rio Colorado* (Fig. 6.6), one of eight maps depicting nine canal routes on *Points of Separation and Projected Communications Between the South Sea and the Atlantic Ocean* (Fig. 6.1). But the scales of longitude and latitude represented on *Rio del Norte et Rio Colorado* are inaccurate. A European cartographer, J.B. Poirson, assisted Humboldt with the preparation of that map.

The Virginia Garrett Cartographic History Library at the University of Texas Arlington is an invaluable resource for students of Southwestern cartographic history. The collection focuses on five centuries of exploration and mapping of the New World, with particular emphasis on Northern Mexico, Texas, New Mexico, Arizona, and California. Some of the maps from The Virginia Garrett Cartographic Collection can be viewed at <http://libraries.uta.edu/ccon/>



Fig. A.1. Humboldt's Sketch of General Chart of the Kingdom of New Spain, 1804
The Virginia Garrett Cartographic Collection - University of Texas at Arlington Libraries
It is believed that this map was traced by J.G. Bruf in 1846 from a copy of Humboldt's map.³

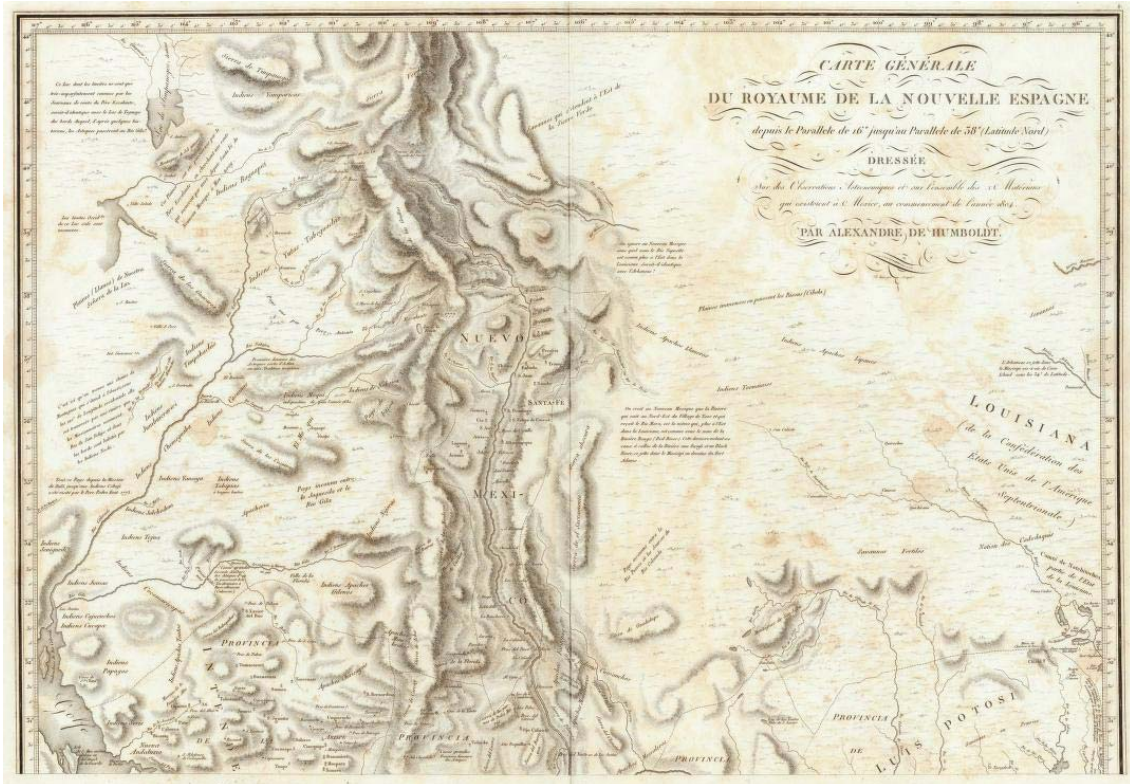


Fig. A.2. Upper half of General Chart of the Kingdom of New Spain
 Published in *Atlas géographique et physique du royaume de la Nouvelle-Espagne*
 David Rumsey Map Collection

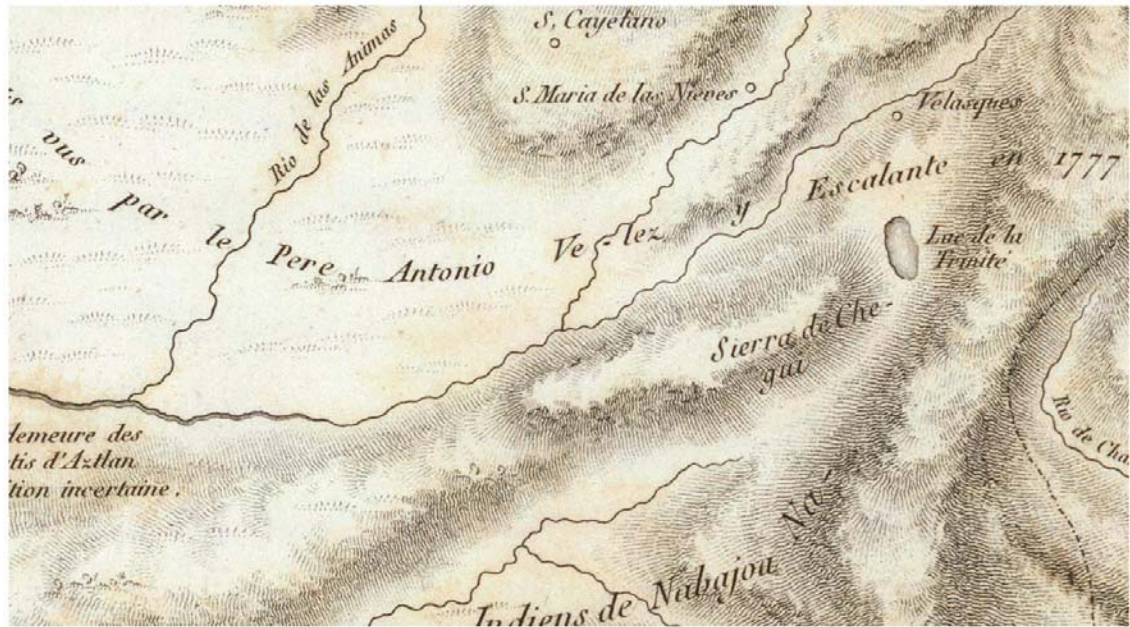


Fig. A.3. Humboldt noted the Domínguez-Escalante expedition of 1776-1777



Fig. A.4. View of Upper half of *General Chart of the Kingdom of New Spain*
 Humboldt's view depicts a portion of the Domínguez-Escalante route from Santa Fé through what is now southwest Colorado, Utah, northern Arizona and western New Mexico.



Fig. A.5. View of Upper half of *General Chart of the Kingdom of New Spain*
 Historian Donald Jackson described Humboldt's depiction of Texas and the Louisiana Territory as "quite primitive." Some of Humboldt's information dates back to the LaSalle expedition of 1684-1688.

APPENDIX B
DAVID RUMSEY MAP LIBRARY



Fig. B.1. Robert Sherwood viewing Alexander von Humboldt's *Atlas géographique et physique du royaume de la Nouvelle-Espagne* David Rumsey Library, San Francisco, Ca, June, 2007

In June, 2007, I had the opportunity to visit David Rumsey's historical map library in San Francisco, CA. The purpose of the visit was to conduct research for my doctoral dissertation, *The Cartography of Alexander von Humboldt: Images of The Enlightenment in America*.

David Rumsey's map collection focuses on rare 18th and 19th century North American and South American maps and other cartographic materials. Historic maps of the world, Europe, Asia, and Africa are also represented. The collection includes 15,800 maps online. Many of the maps and images found throughout this study are from the David Rumsey online collection.

Humboldt's *General Chart of the Kingdom of New Spain and Points of Separation and Communication Between the South Sea and the Atlantic Ocean* were published in *Atlas géographique et physique du royaume de la Nouvelle-Espagne*, 1808. A first-edition copy of the atlas can be found in David Rumsey's library. I had previously viewed Humboldt's *Atlas géographique* under glass at the DeGolyer Library at Southern Methodist University in Dallas. At the Rumsey Library I turned the pages, and examined the legends, and checked the scale -- what a great experience! One of my objectives at the Rumsey Library was to find out why Humboldt's assessment of colonial agriculture did not coincide with statistics he published in *Political Essay on the Kingdom of New Spain*. Humboldt argued that agriculture did little for the Mexican economy. But the information he found in the Mexican archives in 1803 seemed to refute his argument. Mexican wheat was considered to be of better quality than European wheat. The statistics showed that Mexican growers produced large amounts of wheat -- more than growers in Spain.¹

At the Rumsey Library I found Don Antonio de Alcedo's *Geographical and Historical Dictionary of the West Indies* (1812). Alcedo wrote that the agricultural fields of colonial México were located near silver mines for the purpose of feeding the miners. This would seem to bolster Humboldt's argument that agricultural production did little for the Mexican economy, other than to support mining.²

Henry Popple's *Atlas Map of the British Empire in America* (1796) is one of many first-edition atlases at the Rumsey Library. Popple admonished other cartographers not to clutter their maps with mis-information. Similar messages appear in Pinkerton's *Modern Atlas* (1815) and *General World Atlas* by Arrowsmith and Lewis

(1804). These views coincide with those of Humboldt, who left empty space on his maps because he did not know what was there.

Humboldt wrote that the British had accurately charted much of the world's oceans but lacked an accurate map of the English Channel. But at the Rumsey Library, I found *The West Indian Atlas* by Thomas Jeffreys which includes a detailed map of the English Channel with soundings published over twenty years (1787) before Humboldt published *Political Essay on the Kingdom of New Spain*.

Another topic of interest was Humboldt's "map of errors," *Carte de fausses positions de México, Acapulco, Veracruz et du Pic d'Orizaba*. I found this map in *Atlas géographique* at the Rumsey Library. Humboldt prepared the map showing incorrect positions ascribed to México City, Acapulco, Veracruz and Mt. Orizaba over time, and by whom. Humboldt wrote that Arrowsmith's misplacement of Mt. Orizaba presented a "hazard to navigators."

How could a mountain in the interior of México be a hazard to navigators? Humboldt was critical of other mapmakers in *Political Essay on the Kingdom of New Spain*. He tended to rant about things that annoyed him. In a letter to Thomas Jefferson, Humboldt complained that Arrowsmith had "stolen" his map, describing Arrowsmith's conduct as "reprehensible." I was ready to dismiss Humboldt's charge that Arrowsmith's map presented a "hazard to navigators" when I read Arthur Herman's *To Rule the Waves: How the British Navy Shaped the Modern World* (2004). The author writes that Mt. Orizaba is visible to navigators from many miles at sea. Perhaps Arrowsmith's map *could* have been a hazard to navigators!

The David Rumsey online collection can be found at www.davidrumsey.com

NOTES

Introduction

¹ Erwin H. Ackernecht, "Georg Forster, Alexander von Humboldt, and Ethnology," *Isis*, vol. 46, no. 2, June, 1955, 88.

² Historian Dennis Reinhartz places the Enlightenment from the time of English philosopher John Locke (1632-1704) until the reign of French military and political leader Napoléon Bonaparte (1769-1821), born in the same year as Alexander von Humboldt.

³ Norman Hampson, *The Enlightenment: An Evaluation of its Assumptions, Attitudes, and Values* (Penguin Books, 1968).

⁴ Adolf Meyer-Abich, *Alexander von Humboldt, 1769-1859* (Bonn, 1969), 70.

⁵ The science of Copernicus and the Romanticism of Goethe are discussed in the context of Humboldt's intellectual development in chapter one. Humboldt's notions of economic and individual freedoms borrowed from Adam Smith are discussed in chapter three.

⁶ David McCullough, *The Path Between the Seas: The Creation of the Panama Canal, 1870-1914* (New York: Simon & Schuster, 1977), 29.

⁷ Douglas W. Richmond, University of Texas at Arlington, note to author, 4/9/07.

⁸ David Buisseret, "Meso-American and Spanish Cartography" in *Mapping of the Entradas into the Greater Southwest*, ed. Dennis Reinhartz and Gerald D. Saxon (Norman: University of Oklahoma Press, 1998), 31.

⁹ Alexander von Humboldt, *Political Essay on the Kingdom of New Spain with Physical Section and Maps*, trans. John Black (London: Longman, Hurst, Rees, Orme, and Brown, 1811), vol. I, 210. Humboldt wrote, "Spanish laws prohibit all entry into the American possessions to every European not born in the peninsula."

¹⁰ Iris H.W. Engstrand writes in *Spanish Scientists in the New World: The Eighteenth-Century Expeditions* (University of Washington Press, 1981) that the New World research of Spanish scientists such as naturalist Martín de Sessé, 1785-1790, was not made available to the European intellectual community. She attributes this to the Spanish government's use of secrecy in order to deny Spain's enemies access to scientific and technical knowledge, and to the political crisis that affected Spain at the end of the eighteenth century. Arthur Robert Steele writes in *Flowers for the King: The Expedition of Ruiz and Pavón and the Flora of Peru* (Duke University Press, 1964) that the Spanish scientific expeditions of the eighteenth century languished in obscurity because war-torn Spain was in no position to reward its scientists with publication (ix). The expedition of Ruiz and Pavón, 1777-1788, attained only a quarter of its publication goal and only through the support of private citizens.

¹¹ Denis Cosgrove, *Apollo's Eye: A Cartographic Genealogy of the Earth in the Western Imagination* (Baltimore: The Johns Hopkins University Press, 2001), 213.

¹² *Political Essay on the Kingdom of New Spain*, vol. 1, lxxv.

¹³ Alzate's map is deconstructed in terms of its representation of the Mexican landscape in the late eighteenth century, rather than as a representation of power, social theory, or political will. Emphasis is placed on Alzate's sources of information, his method of survey, and his influence on other maps.

¹⁴ Richard V. Francaviglia, *Mapping and Imagination in the Great Basin: A Cartographic History* (Reno: University of Nevada Press, 2005), 26-37.

¹⁵ *Political Essay on the Kingdom of New Spain*, vol. 1, cxxxiv-cxlii.

¹⁶ *Political Essay on the Kingdom of New Spain*, vol. 1, xxi.

¹⁷ Angela Perez-Mejia, *A Geography of Hard Times: Narratives About Travel to South America, 1780-1849*, trans. Dick Cluster (Albany: State University of New York Press, 2002), 64.

Chapter 1

¹ Giovanni Botero, *On the Greatness of Cities: A Treatise Concerning the Magnificency and Greatness of Cities*, trans. Robert Peterson, 1606, book 3, 2.

² Martin Heidegger, *Nietzsche* (San Francisco: Harper & Row, 1982), vol. IV, 4.

³ Friedrich H. Jacobi, *Werke*, trans. Otto Pöggeler (Leipzig, 1816), vol. III, 44.

⁴ Immanuel Kant, "Answering the Question: What is the Enlightenment?" trans. Friedrich Gedike and Johann Erich Biester, originally published in 1784.

⁵ H.W. Janson and Anthony F. Janson, *History of Art*, 5th ed. revised (New York, 1997), 649.

⁶ Janson, *History of Art*, 629.

⁷ Janson, *History of Art*, 655.

⁸ Michael Dettelbach, "Alexander von Humboldt Between the Enlightenment and Romanticism," *Northeastern Naturalist*, 2001.

⁹ Denis Cosgrove, *Apollo's Eye: A Cartographic Genealogy of the Earth in the Western Imagination* (Baltimore: The Johns Hopkins University Press, 2001), 213.

¹⁰ Janson, *History of Art*, 672. *The Swing* by Jean Honore Fragonard depicts a scene of frivolity and gallantry in the erotic style popular in Paris prior to the Revolution. The painting became an immediate success, not merely for its technical excellence, but for the scandal behind it. The young nobleman is not only getting an interesting view up the lady's skirt, but she is being pushed into this position by her priest-lover, shown in the rear. This painting embodies the spirit of the Ancien Régime of the French monarchy, based on the divine right of kings, on the eve of the Revolution.

¹¹ Janson, *History of Art*, 672.

¹² *The Oath of Horatti* depicts the art, life, and morality of ancient Rome. The Roman Republic is at war, and the dispute is to be settled with mortal combat between three Roman brothers, the Horatti, and three enemy brothers, the Curatii. Jacques-Louis David shows the dramatic moment when the Horatti pledge before their father their allegiance to the state, and a readiness to die on its behalf. But the story presents a difficult moral dilemma, for one of the Horatti brothers is married to one of the sisters of the Curatii, and a Horatti sister is betrothed to one of the Curatii brothers. They will choose self-sacrifice and loyalty to the Republic over family ties and personal emotion.

¹³ Douglas Botting, *Humboldt and the Cosmos* (New York: Harper & Row, 1973), 19.

¹⁴ Jean-Jacque Rousseau, *Discourse on Political Economy and Social Contract* (Paris, 1762), vol. II, 36.

¹⁵ Humboldt crossed the Alps on foot in 1795.

¹⁶ *Old World Accounts of Mexico, 1500-1900*, exhibition at the British Library, 2005.

¹⁷ Rousseau, *Discours sur l'origine et les fondements l'inégalité parmi les hommes*, 1755, in Perez-Mejia, *A Geography of Hard Times*, 11.

¹⁸ Alexander von Humboldt, *Views of Nature: Contemplations on the Sublime Phenomena of Creation with Scientific Illustrations*, trans. E.C. Otté and Henry G. Bohn (London, 1850), 418-19.

¹⁹ Helmut de Terra, "Motives and Consequences of Alexander von Humboldt's Visit to the United States in 1804," *Proceedings of the American Philosophical Society*, vol. 104, no. 3, June, 1960, 314-316.

²⁰ G.R. Crone, "Alexander von Humboldt Centenary Studies," *The Geographical Journal*, vol. 127, no. 2, June, 1961, 226-227. The author cites a fundamental difference between their respective views of the natural world. Whereas Goethe was the philosopher "brooding over the whole," Humboldt was the practical scientist seeking to understand the elements making up the whole.

²¹ Botting, *Humboldt and the Cosmos*, 38.

²² Letter from Alexander von Humboldt to Johann Wolfgang von Goethe, Jan 1, 1810, Goethe-Schiller Archive, Marbach.

²³ Helmut de Terra, *The Life and Times of Alexander von Humboldt, 1769-1859* (New York: Alfred A. Knopf, 1955), 270.

²⁴ Paul Michael Lützel, "Goethe and Europe," *South Atlantic Review*, vol. 65, no. 2, Spring, 2000, 105-110.

²⁵ Botting, *Humboldt and the Cosmos*, 14.

²⁶ Lowenthal, "Seeds and Fruits of Humboldt's Animating Vision."

²⁷ Dorinda Outram, *Panorama of the Enlightenment* (Los Angeles: J. Paul Getty Museum, 2006), 174-179.

²⁸ Janson, *History of Art*, 658.

²⁹ Mary Louise Pratt, *Imperial Eyes: Travel Writing and Transculturation*. London : Routledge, 1992, 111.

³⁰ Botting, *Humboldt and the Cosmos*, 190-191.

³¹ Meyer-Abich, *Alexander von Humboldt*, 107.

³² Meyer-Abich, *Alexander von Humboldt*, 14.

³³ Halina Nelken, "Alexander von Humboldt: Scientific Humanist," *Harvard Magazine*, vol. 80-1, Sept.-Oct. 1977, 44.

³⁴ Helmut de Terra, *Geographical Review*, vol. 50, no. 4, October, 1960, 608.

³⁵ Botting, *Humboldt and the Cosmos*, 179.

Chapter 2

¹ Meyer-Abich, *Alexander von Humboldt*, 70.

² Werner Feisst, *Alexander von Humboldt, 1769-1859* (Wuppertal, 1978), 12.

³ *Old World Accounts of Mexico, 1500-1900*.

⁴ Frank N. Egerton, paper presented at the meeting of the History of Science Society, Washington, D.C., December 29, 1969.

⁵ Alexander Humboldt and Aimé Bonpland, *Personal Narrative of Travels to the Equinoctial Regions of the New Continent During the Years 1799-1804*, trans. Helen Maria Williams (New York: AMC Press, 1966, originally published in 1829), vol. 3, 106, 172.

⁶ Karl P. Schmidt, review of Victor W. von Hagen, *South America Called Them: Explorations of the Great Natural Scientists La Condamine, Humboldt, Darwin, and Spruce* (New York: Knopf, 1945), in *Copeia*, vol. 1945, no. 3, 179.

⁷ Alexander von Humboldt, *Cosmos: A Sketch of the Physical Description of the Universe*, trans. E.C. Otté (Baltimore: Johns Hopkins University Press, 1997, originally published in 1858), vol. 2, xix.

⁸ B. Russell, *History of Western Philosophy* (Oxford: Routledge, 2000), 529-530.

⁹ Wolf Lepenies, "Interesting Questions in the History of Philosophy," *Philosophy in History*, 157. Also in de Terra, *The Life and Times of Alexander von Humboldt*, 72.

¹⁰ Humboldt, *Cosmos*, vol. 1, 37-38.

¹¹ Alexander von Humboldt, "New Research on the Distribution of the Forms of Vegetation," *Annals of Chemistry and Physics*, vol. 16 (1821), 267, 279-280, in Michael Dettelbach, "Humboldtian Science," *Cultures of Natural History*, ed. N. Jardine, J.A. Secord, and A.C. Spary (Cambridge: Cambridge University Press, 1996), 298.

¹² Susan Faye Cannon, *Science in Culture: The Early Victorian Period* (New York: Science History Publications, 1978), 97.

¹³ Dettelbach, "Humboldtian Science," *Cultures of Natural History*, 304.

¹⁴ Evan Thomas, *John Paul Jones: Sailor, Hero, Father of the American Navy* (New York: Simon & Schuster, 2003), 20.

¹⁵ Wolf Lepenies, "Alexander von Humboldt - His Past and his Present," talk given at the Alexander von Humboldt Symposium, *Berlin News*, May 31, 1999.

¹⁶ Alexander von Humboldt, "Sur les lois l'on observe dans la distribution des formes végétales," *Dictionnaire des sciences naturelles*, ed. F. Cuvier, vol. XVIII, Strasbourg, 1820, p. 431, in Dettelbach, "Humboldtian Science," *Cultures of Natural History*, 297.

¹⁷ Lepenies, "Alexander von Humboldt - His Past and his Present."

¹⁸ Humboldt and Bonpland, *Personal Narrative*, vol. 3, 160-161.

¹⁹ Humboldt, *Cosmos*, vol. 2, 20.

²⁰ Humboldt, *Views of Nature*, x.

²¹ L. Kellner, *Alexander von Humboldt* (London: Oxford University Press, 1963), 28.

²² The Enlightenment affected Spanish policy in a way that was helpful to Humboldt. Interest in science flourished in Spain. The government paid for the training of Spanish scientists in foreign institutions such as the School of Mines at Freiberg. The government also established scientific institutions in both Spain and America and financed scientific expeditions. The general climate was favorable to Humboldt's request for permission to do scientific work in Spanish America.

²³ Perez-Mejia, *A Geography of Hard Times*, 39. Humboldt credits Spanish official Don Mariano Luis de Urquijo with helping him obtain permission to visit the Americas "for no other motive than his love of the sciences" (*Personal Narrative*, vol. 1-2, 14).

²⁴ Humboldt's Letter to Thomas Jefferson, June 12, 1809, in Helmut de Terra, "Alexander von Humboldt's Correspondence with Jefferson, Madison, and Gallatin," *Proceedings of the American Philosophical Society*, Dec. 15, 1959, 783-806.

²⁵ Norman Davies, *Europe: A History* (New York: Oxford University Press, 1996), 733. The pamphlet criticized both Napoléon and the behavior of French troops in Bavaria. The bookseller, Johannes Philipp Palm, was identified to the French by a local police agent. At his trial Palm refused to disclose the name of the author, Philippe Christian Yelin. By Napoléon's orders, Palm was shot on August 26th, 1806. A monument was erected on the site of the execution.

²⁶ Lepenies, "Alexander von Humboldt - His Past and his Present."

²⁷ *Personal Narrative*, vol. 5, 132-133.

²⁸ de Terra, *Geographical Review*.

²⁹ de Terra, *The Life and Times of Alexander von Humboldt*, 120.

³⁰ Arthur P. Whitaker, "Alexander von Humboldt and Spanish America," *Proceedings of the American Philosophical Society*, vol. 104, no. 3 (June 15, 1960), 317-322.

³¹ Ingo Schwarz, "Alexander von Humboldt's Visit to Washington and Philadelphia, His Friendship with Jefferson, and His Fascination with the United States," in *Northeastern Naturalist*, 2001.

³² Letter to DuPont de Nemours in Randolph G. Benson, *Thomas Jefferson as Social Scientist*, 1971.

³³ "Baron Alexander von Humboldt's Visit to Washington" *Records of the Columbia Historical Society*, 1963, 1-35.

³⁴ Marc Simmons, *Spanish Government in New Mexico* (Albuquerque: University of New Mexico Press, 1968), 4-5.

³⁵ Charles W. Hackett, *Picardo's Treatise on the Limits of Louisiana and Texas* (Austin, 1931-1946), in John Francis Bannon, *The Spanish Borderlands Frontier, 1513-1821* (Albuquerque: The University of New Mexico Press, 1974), 210. The western boundary of the Louisiana Purchase was very vague, and Jefferson's first view was that it included all of the western tributaries of the Mississippi River, including the Red River. By 1804, he was certain that the line extended as far west as the Rio Grande.

³⁶ *Alexander von Humboldt's Discussions*, ed. Hanno Beck (Berlin, 1959), 235.

³⁷ Kellner, *Alexander von Humboldt*, 62.

³⁸ Norman J.W. Thrower, *Maps and Civilization: Cartography in Culture and Society*, 2nd ed. (Chicago: University of Chicago Press, 1999), 136-138.

³⁹ Schwarz, "Alexander von Humboldt's Visit to Washington and Philadelphia."

⁴⁰ John Noble Wilford, *The Mapmakers*, revised ed. (New York: Vintage Books, 2000), 354.

⁴¹ Charles W. Peale, *The Selected Papers of Charles Willson Peale and His Family*, ed. Lillian B. Miller (New Haven: Yale University Press, 1983), 683.

⁴² Helferich, *Humboldt's Cosmos*, 291.

⁴³ Douglas W. Richmond asserts that Jefferson's inclusion of Texas as part of the Louisiana Purchase did not make for good relations with Mexico. Jefferson may or may not have been influenced by Humboldt's report stating that Texas was "almost deserted and useless." Humboldt arrived at that conclusion after spending a year of research in the viceroyalty's archives and in collaboration with Mexico's finest scholars.

⁴⁴ Douglas W. Richmond, note to author, 4/9/07.

⁴⁵ D. Graham Burnett, *Masters of All They Surveyed: Exploration, Geography, and a British Eldorado* (Chicago: University of Chicago Press, 2000), 93.

⁴⁶ Nicolaas A. Rupke, *Alexander von Humboldt: A Metabiography* (Frankfort, 2005), in *HiN* VIII, 12, 2006.

⁴⁷ Douglas W. Richmond, note to author, 4/9/07.

⁴⁸ Meyer-Abich, *Alexander von Humboldt*, 55-56. Another explanation might be that explorers and surveyors, needing to assign names to the places they visited, saw and used Humboldt's name which was prominently displayed on *General Chart of the Kingdom of New Spain*, the standard map of the Southwest in the early nineteenth century.

⁴⁹ Humboldt to Elisha Kent Kane, 1853, in Aaron Sachs, *The Humboldt Current: Nineteenth-Century Exploration and the Roots of American Environmentalism* (New York: Viking, 2006), 17.

⁵⁰ Botting, *Humboldt and the Cosmos* 176.

⁵¹ Herman R. Friss, "Baron Alexander von Humboldt's Visit to Washington," *Records of the Columbia Historical Society* 44, 1963, 23-24.

⁵² Aaron Sachs, "Humboldt's Legacy and the Restoration of Science," *World Watch*, Vol. 8, March 1995.

⁵³ Sachs, *The Humboldt Current*, 4.

⁵⁴ *Humboldt Exhibition at the Ewell Sale Stewart Library*.

⁵⁵ Botting, *Humboldt and the Cosmos*, 176.

⁵⁶ The production of Humboldt's work was facilitated by the invention of lithography in the late eighteenth century. Lithography is a process that uses ink and water to create images on a printing plate which permit much longer runs than the engraving method previously favored by mapmakers. The advancement of lithography allowed for the relatively inexpensive production of large quantities of printing, and may have influenced Humboldt's decision to increase publication from eleven to thirty-four volumes.

⁵⁷ Botting, *Humboldt and the Cosmos* 176.

Chapter 3

¹ *Political Essay on the Kingdom of New Spain*, vol. 1, cxxvii. Humboldt also used Malaspina's observations to fix the longitude for Monterey, California on *Carte Du Mexique*. The Malaspina expedition, 1789-1794, is discussed in chapter six.

² *Political Essay on the Kingdom of New Spain*, vol. 1, ii.

³ Ingo Schwartz. "Letter from Humboldt to José de Iturrigaray, Mexico, Jan. 3, 1804." *Briefe aus Amerika, 1799-1804*, ed. Ulrike Moheit (Berlin: Akademie Verlag, 1993), 264.

⁴ Cubas García, *The Republic of Mexico*. Trans. George E. Henderson (Mexico: 1876), 6.

⁵ Brantz Mayer, *Mexico: Aztec, Spanish, and Republican: A Historical, Geographical, Political, Statistical, and Social Account of the Country from the Period of the Invasion by the Spaniards to the Present Time* (Hartford, 1851), vol. I, 1.

⁶ Nicolaas Rupke, "A Geography of Enlightenment: The Critical Reception of Alexander von Humboldt's Mexico Work," *Geography and Enlightenment*, ed. David N. Livingstone and Charles W.J. Withers (Chicago: The University of Chicago Press, 1999), 322. French periodicals included *Annales des voyages* (1808-1814), *Le Moniteur universelle* (1790-1865), and *Revue des deux mondes* (1829-1865). German periodicals included *Allgemeine geographische Ephemeriden* (1798-1831) and *Heidelbergische Jahrbuecher der literature* (1808-1865). British reviewers included *Quarterly Review* (1809-1865) and *Edinburgh Review* (1802-1865).

⁷ Rupke, *A Geography of Enlightenment*, 331-332. Mexico in the early nineteenth century was arguably the world's most strategic area for world trade. Over the next two hundred years technological advancements would change that assessment.

⁸ *Political Essay on the Kingdom of New Spain*, vol. 4, 111, 363-369. Humboldt cites a fourteen million piastre annual trade deficit prior to relaxation of the trade monopoly with Spain. Following the relaxation of trade, Mexico's economy showed a one million piastre trade surplus.

⁹ *Political Essay on the Kingdom of New Spain*, vol. 3, 97, vol. 4, 260-282.

¹⁰ Rupke, *A Geography of Enlightenment*, 321.

¹¹ Francisco José de Caldas, *Obras Completas* (Bogotá, 1966), 300, trans. in Thomas F. Glick, "Science and Independence in Latin America (With Special Reference to New Granada)" in *Hispanic American Historical Review*, vol. 71, no. 2, 1991, 317.

¹² Glick, "Science and Independence in Latin America," 316.

¹³ Schwarz, "Alexander von Humboldt: Socio-political Views of the Americas."

¹⁴ The scientific knowledge Humboldt found in Mexico is discussed later in the chapter. Humboldt's exchange of information with U.S. officials is evaluated in the following paragraphs.

¹⁵ Ibid.

¹⁶ *Political Essay on the Kingdom of New Spain*, vol. 1, vii.

¹⁷ *Political Essay on the Kingdom of New Spain*, vol. 1, 223.

¹⁸ After reading the chapter, the reader should come away with a sense of the Mexicans' contribution to Humboldt's work. The author's findings and determinations are an essential part of the reading.

¹⁹ *Political Essay on the Kingdom of New Spain*, vol. 1, ii.

²⁰ Helferich, *Humboldt's Cosmos*, 298.

²¹ Cannon, 95.

²² *Political Essay on the Kingdom of New Spain*, vol. 1, cxix, cxxiii.

²³ *Political Essay on the Kingdom of New Spain*, vol. 1, 223.

²⁴ *Political Essay on the Kingdom of New Spain*, vol. 1, ix, xxxi-xxxii, xli-xlvii, lxii, lxxii-lxxiii, cxxvi.

²⁵ *Political Essay on the Kingdom of New Spain*, vol. 1, 223.

²⁶ Dennis Reinhartz, "Maps from the Inspections," *Cartographica*, autumn/winter, 1998, 90.

²⁷ Reinhartz, "Maps from the Inspections," 91.

²⁸ Humboldt acknowledges Haro's voyage to the Pacific Northwest, 1788, in *Political Essay*, vol. 2, 367-68.

²⁹ Wheat, *Mapping the Transmississippi West*, vol. I, 10.

³⁰ *Political Essay on the Kingdom of New Spain*, vol. 1, lxxiv.

³¹ *Political Essay on the Kingdom of New Spain*, vol. 1, xi. Humboldt may not have seen *The West Indian Atlas* by Thomas Jeffreys (London, 1787) which includes a detailed map of the English Channel with soundings.

³² *Political Essay on the Kingdom of New Spain*, vol. 1, xliv.

³³ Wheat, *Mapping the Transmississippi West*, vol. I, 132.

³⁴ *Political Essay on the Kingdom of New Spain*, vol. 1, 44-45.

³⁵ Reinhartz, "Maps from the Inspections," 97.

³⁶ Wheat, *Mapping the Transmississippi West*, vol. I, 18.

³⁷ *Political Essay of the Kingdom of New Spain*, vol. 1, i-cxxxiii. Humboldt's indictment of Spanish mapping is a recurring topic of his geographical introduction. He was "embarrassed" by the differences in measurement among eighteenth-century mapmakers, beginning with the Jesuit priest and mathematician, Eusebio Kino, who incorrectly fixed the junction of the Colorado River and the Gila River in 1701, and including the most recent work of José Antonio de Alzate y Ramírez (1737-1799), whose scientifically inaccurate maps had been considered to be the best in Mexico.

³⁸ *Political Essay on the Kingdom of New Spain*, vol. 2, 337.

³⁹ *Political Essay on the Kingdom of New Spain*, vol. 2, 293.

⁴⁰ *Political Essay on the Kingdom of New Spain*, vol. 1, cxxx.

⁴¹ *International Tungsten Industry Association Newsletter*, June 2005, 10. Tungsten is an element that has the highest melting point of any metal. In the course of their research the Elhuyar brothers isolated tungsten through reduction of the acid found in wolframite with charcoal.

⁴² *Political Essay on the Kingdom of New Spain*, vol. 3, 232.

⁴³ *Political Essay on the Kingdom of New Spain*, vol. 3, 233. The Germans were hired by the Spanish government to improve Mexican mining operations. None of their endeavors compared with Humboldt's in terms of providing European and American readers with a comprehensive, published analysis of Mexican mining. Fausto d'Elhuyar, a Spaniard who studied mineralogy at the Freiberg School in Germany before becoming director of Mexican mines, published several scientific journals after returning to Europe in 1821.

⁴⁴ Historian Douglas W. Richmond notes that Spain also controlled Pensacola during much of the eighteenth century.

⁴⁵ *Political Essay on the Kingdom of New Spain*, vol. 1, 219.

⁴⁶ *Political Essay on the Kingdom of New Spain*, vol. 1, lxxv.

⁴⁷ *Political Essay on the Kingdom of New Spain*, vol. 1, xlv.

⁴⁸ Marc Simmons, *Spanish Government in New Mexico* (Albuquerque: University of New Mexico Press, 1968), 4-5.

⁴⁹ *Political Essay on the Kingdom of New Spain*, vol. 1, lxxxiii.

⁵⁰ *The Journals of Zebulon Montgomery Pike with Letters and Related Documents*, ed. Donald Jackson (Norman: The University of Oklahoma Press, 1966), vol. 1, 455.

⁵¹ *The Domínguez-Escalante Journal: Their Expedition Through Colorado, Utah, Arizona, and New Mexico in 1776*. Trans. Angelico Chavez, ed. Ted J. Warner (Salt Lake City: University of Utah Press, 1995), xvi.

⁵² Wheat, *Mapping the Transmississippi West*, vol. I, 124.

⁵³ Wheat, *Mapping the Transmississippi West*, vol. I, 96, 135.

⁵⁴ Francaviglia, *Mapping and Imagination in the Great Basin*, 26-37.

⁵⁵ Ed Quillen, "The Adventures of Zebulon M. Pike," *Colorado Central Magazine*, March 1997, 16.

⁵⁶ Jackson, *The Journals of Zebulon Montgomery Pike*, vol. 1, 455.

⁵⁷ Jackson, *The Journals of Zebulon Montgomery Pike*, vol. 1, 456.

⁵⁸ *Political Essay on the Kingdom of New Spain*, vol. 2, 160, 169. Humboldt refers to the *Informe de Zepeda* as a source of Indian history.

⁵⁹ Fray Domingo Arriavitor, *Chronica Serafica de el Colegio de Propaganda fede de Queretaro* (Mexico: 1792), in *Political Essay on the Kingdom of New Spain*, vol. 2, 300.

⁶⁰ *Political Essay on the Kingdom of New Spain*, vol. 2, 61-62. Humboldt describes "the small remains of Mexican antiquities" to include Aztec manuscripts, or hieroglyphical pictures, painted on agave paper, stag skins, and cotton cloth.

⁶¹ Buisseret., "Meso-American and Spanish Cartography," 31.

⁶² Norman J.W. Thrower, *Maps and Civilization: Cartography in Culture and Society*, 2nd ed. (Chicago: The University of Chicago Press, 1999), 7.

⁶³ Thrower, *Maps and Civilization*, 7.

⁶⁴ Buisseret, *Mapping of the Entradas into the Greater Southwest*, xii.

⁶⁵ *Political Essay on the Kingdom of New Spain*, vol. 1, iv.

⁶⁶ Wheat, *Mapping the Transmississippi West*, vol. I, 136-137.

⁶⁷ "Alexander von Humboldt to Thomas Jefferson, Paris, 20 December, 1811," *The Journals of Zebulon M. Pike*, vol. II, 377.

⁶⁸ de Terra, "Alexander von Humboldt's Correspondence with Thomas Jefferson," 806. Pike was killed in action at the storming of York (Toronto), Canada, on April 27, 1813, when a British powder magazine exploded.

⁶⁹ *Political Essay on the Kingdom of New Spain*, vol. 1, lxxii, vol. 2, xxii. Referring to the Texas coast line, Humboldt wrote, "I have followed . . . the map of the Gulf of Mexico, *Carta*

esferica que comprehende las costas del Seno Mexicano, construida en el Deposito Hidrographico de Madrid, published by order of the King of Spain in 1799.” Humboldt made some corrections in the fixing of longitudes.

⁷⁰ James C. Martin and Robert Sidney Martin, *Maps of Texas and the Southwest, 1513-1900* (Albuquerque: University of New Mexico Press, 1984), 24.

⁷¹ Jackson, *The Journals of Zebulon Montgomery Pike*, vol. 2, 378.

⁷² Eugene W. Hollon, *The Lost Pathfinder: Zebulon Montgomery Pike* (Norman: The University of Oklahoma Press, 1949, 110-111).

⁷³ Quillen, 16.

⁷⁴ Bannon, 217.

⁷⁵ Jackson, *The Journals of Zebulon Montgomery Pike*, vol. 2, 300-301.

⁷⁶ Jackson, *The Journals of Zebulon Montgomery Pike*, vol. 2, 368-370. Vice President Aaron Burr borrowed a copy of Humboldt’s map from the Secretary of the Treasury. He then borrowed Wilkinson’s draftsman, Antoine Nau, who copied the map for Burr.

⁷⁷ Francaviglia, *Mapping and Imagination in the Great Basin*, 56.

⁷⁸ Jackson, *The Journals of Zebulon Montgomery Pike*, vol. 1, 451-452.

⁷⁹ *Personal Narrative of Travels to the Equinoctial Regions of the New Continent During the Years 1799-1804*, originally published in 1829), in Wheat, *Mapping the Transmississippi West*, vol. I, 25.

⁸⁰ Wheat, *Mapping the Transmississippi West* vol. I, 25.

⁸¹ The political motive of Pike’s map is to define a southwestern boundary to the Louisiana Purchase and to extend that boundary as far as possible. Pike seems to be well aware of the strategic, economic, and political importance of Santa Fé, judging by his detailed mapping of this area (From *Cartographic Connections*, The University of Texas at Arlington Special Collections).

⁸² Jackson, *The Journals of Zebulon Montgomery Pike*, vol. 1, 460.

⁸³ Jackson, *The Journals of Zebulon Montgomery Pike*, vol. 1, 456-57.

Chapter 4

¹ Perez-Mejia, *A Geography of Hard Times*, 64.

² David Livingstone, *Geographical Tradition*, 133.

³ D. Graham Burnett, *Masters of All They Surveyed: Exploration, Geography, and a British El Dorado* (Chicago: University of Chicago Press, 2000), 109-117.

⁴ Burnett, *Masters of All They Surveyed*, 110, 116.

⁵ Silvio A. Bedini, *Thomas Jefferson Statesman of Science* (New York: Macmillan, 1990), 322-324.

⁶ Victoria Dickenson, *Drawn From Life: Science and Art in the Portrayal of the New World* (Toronto: University of Toronto Press, 1998), 243.

⁷ Martin and Martin, *Maps of Texas and the Southwest*, 101. The authors point out that Humboldt did not draw the *exact* courses of the Texas rivers.

⁸ Perez-Mejia, *A Geography of Hard Times*, 71.

⁹ *Political Essay on the Kingdom of New Spain*, vol. 1, xvi. Humboldt's explanation may have been garbled in the English translation of his text. Historian and geographer Richard V. Francaviglia notes that Mercator's projections show *direction* from one place to another, rather than distance.

¹⁰ de Terra, *The Life and Times of Alexander von Humboldt*, 375.

¹¹ *Political Essay on the Kingdom of New Spain*, vol. 1, lxxxviii.

¹² Wheat, *Mapping the Transmississippi West*, vol. I, 134. The hachure method would be universally adopted after the publication of Humboldt's maps and remain in use for about seventy-five years. It eventually gave way to the contour method of displaying mountains and altitudes.

¹³ *Political Essay on the Kingdom of New Spain*, vol. 1, 288-289.

¹⁴ *Ibid.*

¹⁵ Francaviglia, *Mapping and Imagination in the Great Basin*, 50.

¹⁶ J.B. Harley, *The New Nature of Maps: Essays in the History of Cartography*, ed. Paul Laxton (Baltimore: Johns Hopkins University Press, 2001), 170.

¹⁷ Harley, 178-79. The author uses Brian Friel's play *Translations*, set in nineteenth-century Ireland, to show how maps were Anglicized. After acknowledging a lack of historical realism in Friel's play, Harley rhetorically wonders how it might feel to be an Indian written out of history.

¹⁸ Harley, 170.

¹⁹ Harley, 178.

²⁰ Harley, 187.

²¹ John Pinkerton, *Modern Atlas*, 1815.

²² Harley, 170-195. Also see essays by Barbara Belyea, Peter Nabokow, and G. Malcolm Lewis in *Cartographic Encounters: Perspectives on Native American Mapmaking and Map Use*, ed. G. Malcolm Lewis (Chicago: The University of Chicago Press, 1998), and almost anything written by Francis Jennings.

²³ Letter from Schiller to Körner, Aug. 6, 1797, in de Terra, *Humboldt: The Life and Times of Alexander von Humboldt*, 74.

²⁴ Pratt, *Imperial Eyes*, 140.

²⁵ Harley, 203.

²⁶ *Political Essay on the Kingdom of New Spain*, vol. I, iii.

²⁷ Wheat, *Mapping the Transmississippi West*, vol. I, 11.

²⁸ Diego Durán, *The History of the Indies of New Spain*, trans. Doris Heyden, 1994, originally published in 1581, 3-11, 12-19.

²⁹ In *The Aztec Arrangement: The Social history of pre-Spanish Mexico* (University of Oklahoma Press, 1985), author Rudolf A. M. van Zantwijk asserts that Aztlán was the northern province of the Toltecs, who are believed to have dominated much of central Mexico between the 10th and 12th centuries.

³⁰ Wheat, *Mapping the Transmississippi West*, vol. I, 134.

³¹ *The Salt Lake Tribune*, Salt Lake City, Utah, November 17, 2002, section 1, page 1.

³² Wallace E. Stegner, *Wolf Willow* (New York: Penguin, 1990), 37-38, in Rick Van Noy, *Surveying the Interior: Literary Cartographers and the Sense of Place* (Reno: University of Nevada Press, 2003), 162.

³³ Geoffrey J. Martin and Preston E. James, "All Possible Worlds: A History of Geographical Ideas," *The Association of American Geographers, the First Seventy-Five Years, 1904-1979* (Washington, D.C.: The Association, 1978), 131.

³⁴ Martin and Martin, *Maps of Texas and the Southwest*, 109. The Malaspina Expedition, 1789-1794, also conducted scientific investigations throughout the Americas. Malaspina's journey differed from Humboldt's in that it was sponsored by the Spanish government in part to establish Spanish military presence in the remote corners of the empire.

³⁵ Norman J.W. Thrower, *Maps and Civilization: Cartography in Culture and Society*, 2nd ed. (Chicago: University of Chicago Press, 1999), 130.

³⁶ One such expedition, The voyage of Alejandro Malaspina, is discussed in chapter six.

³⁷ Kellner, *Alexander von Humboldt*, 89. The author notes that Humboldt's botanical work was not well received. Robert Brown, the botanist, had doubts of the validity of his classifications. Emil Du Bois-Reymond charged that Humboldt's ambitions far exceeded his achievements.

³⁸ de Terra, *The Life and Times of Alexander von Humboldt*, 148.

³⁹ de Terra, *The Life and Times of Alexander von Humboldt*, 147. One ton of guano contains the fertilizing properties of thirty-three tons of farm manure.

⁴⁰ Mayer, 166.

⁴¹ *Political Essay on the Kingdom of New Spain*, vol. 4, 260-282.

⁴² Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations*, Vol. II, ed. J. Rogers (Oxford: Clarendon Press, 1869, originally published in 1776), 62.

⁴³ Perez-Mejia, *A Geography of Hard Times*, 39-40.

⁴⁴ Emil Ludwig, *Bolívar* (New York, 1942), 40-42.

⁴⁵ Victor Wolfgang von Hagen, *South America Called Them* (New York, 1945), 159.

Bolívar's remark has been embellished over time. A literal translation is, "Humboldt's learning has done more good for the Americas than all of the conquerors."

⁴⁶ *Political Essay on the Kingdom of New Spain*, vol. 4, 98.

⁴⁷ *Political Essay on the Kingdom of New Spain*, vol. 1, 204-210.

⁴⁸ Alexander von Humboldt, *The Island of Cuba: A Political Essay*, trans. J.S. Thrasher (Princeton, NJ: Markus Wiener, 2001), 259. Humboldt cites the Mexican Indians' excessive drinking as cause for their backwardness.

⁴⁹ Helferich, 270.

⁵⁰ *Political Essay on the Kingdom of New Spain*, vol. 1, 235.

⁵¹ *Political Essay on the Kingdom of New Spain*, vol. 1, 117-118.

⁵² *Political Essay on the Kingdom of New Spain*, vol. 1, 155-156.

⁵³ *Political Essay on the Kingdom of New Spain*, vol. 1, 162.

⁵⁴ Schwarz, "Alexander von Humboldt: Socio-political Views of the Americas,"

⁵⁵ *Political Essay on the Kingdom of New Spain*, vol. 1, 184. The indigenous peoples of New Spain were called "Indians" under Spanish law.

⁵⁶ *Political Essay on the Kingdom of New Spain*, vol. 1, 185.

⁵⁷ *Political Essay on the Kingdom of New Spain*, vol. 1, 187-188.

⁵⁸ *Political Essay on the Kingdom of New Spain*, vol. 4, 282.

Chapter 5

¹ *Political Essay on the Kingdom of New Spain*, vol. 1, lxxx.

² *Political Essay on the Kingdom of New Spain*, vol. 1, 219.

³ *Political Essay on the Kingdom of New Spain*, vol. 1, xxix. Humboldt refers to Antonio Leon y Gama, who frequently found himself at odds with Alzate y Ramirez over scientific and cultural matters.

⁴ *Political Essay on the Kingdom of New Spain*, vol. 1, xxxvii.

⁵ Melinda Luna, "Early Texas - The First Record of a Civil Engineering Project," *Texas Civil Engineer*, Summer 2003, Vol. 73, no. 2.

⁶ Martin and Martin, *Maps of Texas and the Southwest*, 20.

⁷ Peter J. Wagner, *José Antonio Alzate y Ramirez: Scientist and Publicist in Late Eighteenth-Century New Spain* (Master's Thesis, Arizona State University, 1975), 27.

⁸ *Political Essay on the Kingdom of New Spain*, vol. 1, lxix. Humboldt cites "Pedro de Laguna, lieutenant colonel in the service of his Catholic majesty."

- ⁹ *Political Essay on the Kingdom of New Spain*, vol. 1, 233.
- ¹⁰ Martin and Martin, *Maps of Texas and the Southwest*, 101.
- ¹¹ *Political Essay on the Kingdom of New Spain*, vol. 1, xcvi-xcvii.
- ¹² Robert S. Weddle, *The French Horn: Rival Explorers in the Spanish Sea, 1682-1762* (College Station: Texas A&M University Press), 332-333.
- ¹³ *Political Essay on the Kingdom of New Spain*, xcvi.
- ¹⁴ Weddle, *The French Horn*, 332-333.
- ¹⁵ Robert S. Weddle, *The Spanish Sea: The Gulf of México in North American Discovery, 1500-1685* (College Station: Texas A&M University Press, 1985), 182.
- ¹⁶ Weddle, *The French Horn*, 333.
- ¹⁷ W.P. Cumming, *The Exploration of North America, 1630-1776* (New York: Putnam 1974), 240.
- ¹⁸ Weddle, *The Spanish Sea*, 181-182.
- ¹⁹ Juan de Grijalva, *The Discovery of New Spain*, trans. Henry R. Wagner (Pasadena, California: The Cortes Society, 1942), 108.
- ²⁰ Francisco Hernández de Cordoba, *The Discovery of Yucatan*, trans. Henry R. Wagner (Whittier, California: The Cortes Society, 1942), 3.
- ²¹ Pedro Alonso O’Crouley, *Description of the Kingdom of New Spain*, trans. and ed. by Sean Galvin (John Howell, 1972), x.
- ²² Phillip Allen, *Mapmaker’s Art: Five Centuries of Charting the World* (London: Marshall Editions, Ltd, 2000), 21.
- ²³ *Political Essay on the Kingdom of New Spain*, vol. 1, xxix.
- ²⁴ Weddle, *Spanish Sea*, 28.
- ²⁵ *Political Essay on the Kingdom of New Spain*, vol. 1, 219. Humboldt acknowledged that Alzate had "excited his countrymen to the study of the physical sciences."

Chapter 6

- ¹ *Political Essay on the Kingdom of New Spain*, vol. 1, 45.
- ² *Political Essay on the Kingdom of New Spain*, vol. 1, 30.
- ³ McCullough, 29.
- ⁴ McCullough, 28-30.
- ⁵ Schwartz, "Alexander von Humboldt: Socio-political Views of the Americas."
- ⁶ Wilford, *The Mapmakers*, 354.
- ⁷ Denis Cosgrove, *Apollo’s Eye: Cartographic Genealogy of the Earth in the Western Imagination* (Baltimore: Johns Hopkins University Press, 2001), 207.
- ⁸ *Political Essay on the Kingdom of New Spain*, vol. 1, 19.
- ⁹ Wheat, *Mapping the Transmississippi West*, 174. The river was named *Columbia* by Captain Robert Gray, first European to sail its waters in 1792 aboard a ship named *Columbia Rediviva*. Humboldt spelled the river *Colombia* on his map and in his text.
- ¹⁰ *Political Essay on the Kingdom of New Spain*, vol. 1, 20.
- ¹¹ *Political Essay on the Kingdom of New Spain*, vol. 1, lxxxiii.
- ¹² *Political Essay on the Kingdom of New Spain*, vol. 1, 22. If the river described as the principal source of the Rio Colorado on Humboldt’s map is really the San Juan River, then it too is out of position. There would seem to be no way to reconcile Humboldt’s error.
- ¹³ Francaviglia, *Mapping and Imagination in the Great Basin*, 37.
- ¹⁴ Francaviglia, *Mapping and Imagination in the Great Basin*, 57.
- ¹⁵ Francaviglia, *Mapping and Imagination in the Great Basin*, 72.

- ¹⁶ Francaviglia, *Mapping and Imagination in the Great Basin*, 51.
- ¹⁷ *Political Essay on the Kingdom of New Spain*, vol. 1, 41. Humboldt cites the maps of Father Skinner in *Mercurio Peruviano* (Lima, date unknown).
- ¹⁸ *Personal Narrative*, vol. 6, parts 1 & 2, 296.
- ¹⁹ *Political Essay on the Kingdom of New Spain*, vol. 1, 41.
- ²⁰ *Political Essay on the Kingdom of New Spain*, vol. 1, 43. Humboldt cites "two very interesting manuscripts" by Moraleda in the archives of the viceroyalty of Lima.
- ²¹ *Political Essay on the Kingdom of New Spain*, vol. 2, 363. Humboldt wrote that Malaspina "will ever hold an honorable place on the list of intelligent and intrepid navigators to whom we owe an exact knowledge of the coast of the new continent."
- ²² Robin Inglis, "The Malaspina Expedition," *Botanical Electronic News*, no. 286, May 2002.
- ²³ Richard V. Francaviglia, review of *The Malaspina Expedition 1789-1794: The Journal of the Voyage by Alejandro Malaspina, Volume I, Cadiz to Panama*. eds. Andrew David, Felipe Fernandez-Armesto, Carlos Novi, Glyndwr Williams (London: The Hakluyt Society, series III, vol. 8), 2002. Also see the new introduction by Donald Cutter.
- ²⁴ Thomas Vaughn, *Voyages of Enlightenment: Malaspina on the Northwest Coast, 1791-1792* (Oregon Historical Society, 1977), 6.
- ²⁵ Francaviglia, review of *The Malaspina Expedition 1789-1794*.
- ²⁶ *Ibid.*
- ²⁷ *Political Essay on the Kingdom of New Spain*, vol. 4, 17.
- ²⁸ *Political Essay on the Kingdom of New Spain*, vol. 1, 17.
- ²⁹ *Personal Narrative*, vol. 6. Humboldt is likely referring to the Mexican War of Independence, 1810-1821, but he does not say.
- ³⁰ *Political Essay on the Kingdom of New Spain*, vol. 1, x. The engineers, de Cevallos and Herrera, using "superb English instruments," determined the width of the isthmus and fixed the positions of both the port of Tehuantepec and the bar of San Francisco at the mouth of the Rio Chimalapa.
- ³¹ *Political Essay on the Kingdom of New Spain*, vol. 1, 17.
- ³² *Personal Narrative*, vol. 6, 270.
- ³³ *Political Essay on the Kingdom of New Spain*, vol. 1, 83. Humboldt later reassessed the weather along Nicaragua's west coast.
- ³⁴ *Personal Narrative*, vol. 6, 282.
- ³⁵ McCullough, 38.
- ³⁶ McCullough, 283.
- ³⁷ Helferich, *Humboldt's Cosmos*, 208.
- ³⁸ McCullough, 283.
- ³⁹ *Political Essay on the Kingdom of New Spain*, vol. 1, 32.
- ⁴⁰ *Personal Narrative*, vol. 6, 256. Also in *Political Essay*, vol. 1, 82.
- ⁴¹ *Political Essay on the Kingdom of New Spain*, vol. 1, 38.
- ⁴² *Political Essay on the Kingdom of New Spain*, vol. 1, 39.
- ⁴³ *Personal Narrative*, vol. 6, 240.
- ⁴⁴ McCullough, 39.
- ⁴⁵ *Political Essay on the Kingdom of New Spain*, vol. 1, 40.
- ⁴⁶ McCullough, 39.
- ⁴⁷ *Personal Narrative*, vol. 6, 241.

⁴⁸ A distance of slightly under seventeen miles. The toise is a French unit of measurement which was widely used in the 19th century and equals 6.395 feet.

⁴⁹ *Personal Narrative*, vol. 6, 248.

⁵⁰ *Personal Narrative*, vol. 6, 244, 289.

⁵¹ *Personal Narrative*, vol. 6, 242.

⁵² *Political Essay on the Kingdom of New Spain*, vol. 1, 18.

⁵³ *Political Essay on the Kingdom of New Spain*, vol. 1, 45.

⁵⁴ *Personal Narrative*, vol. 6, 246-47.

⁵⁵ de Terra, "Alexander von Humboldt's Correspondence with Jefferson, Madison, and Gallatin," 797.

Chapter 7

¹ Cannon, 75.

² Hampson, 77.

³ Cannon, 97.

⁴ Wertz, "Humboldt's Classical Education Curriculum."

⁵ *Views of Nature*, x.

⁶ Cannon, 85.

⁷ Cannon, 78.

⁸ Hampson, 160.

⁹ *Views of Nature*, x.

¹⁰ Helferich, 26.

¹¹ *Personal Narrative*, vol. 1, ii.

¹² David Lowenthal, "Seeds and Fruits of Humboldt's Animating Vision," *The Alexander von Humboldt Annual Lecture Series*, 2004.

¹³ Andreas W. Daum, "Alexander von Humboldt and North America," *German Historical Institute Bulletin*, no. 35, Fall 2004, 201.

¹⁴ Lowenthal, "Seeds and Fruits of Humboldt's Animating Vision."

¹⁵ Lepenies, "Alexander von Humboldt - His Past and his Present."

Appendix A

¹ "Gallatin Papers," in Jackson, *The Journals of Zebulon Montgomery Pike*, vol. 2, 370.

² Francaviglia, *Mapping and Imagination in the Great Basin*, 57.

³ John R. Hébert and Anthony P. Mullen, *The Luso-Hispanic World in Maps: A Selective Guide to Manuscript Maps to 1900 in the Collections of the Library of Congress*, 2001.

Appendix B

¹ *Political Essay on the Kingdom of New Spain*, vol. 2, 482.

² *Political Essay on the Kingdom of New Spain*, vol. 4, 13.

SELECTED BIBLIOGRAPHY

Primary Sources

Beristáin y Souza, José Mariano. *Biblioteca hispano-americana septentrional*, 1816-1821. 3 vols. México, 1883.

Mackenzie, Alexander. *Voyages through the Continent of North America in the Years 1789 and 1793*. London, 1801. David Rumsey Library.

Pike, Zebulon M. *Account of Expeditions to the Sources of the Mississippi and Through the Western Parts of Louisiana*. Philadelphia: C. & A. Conrad & Co., 1810. The Virginia Garrett Cartographic Collection, University of Texas Arlington Libraries.

_____. *Exploratory Travels Through the Western Territories of North America*. London: Longman, Hurst, Rees, Orme, and Brown, 1811. The Virginia Garrett Cartographic Collection, University of Texas Arlington Libraries.

Pitman, Robert Birks. *On the Practicability of Joining the Atlantic and Pacific Oceans by Means of a Ship Canal Across the Isthmus of America*. London, 1825.

Sigüenza y Góngora, Carlos de. *Obras históricas*. México: Editorial Porrúa, 1960.

Primary Sources Translated

Botero, Giovanni. *On the Greatness of Cities: A Treatise Concerning the Magnificency and Greatness of Cities*. 3 vols. Trans. Robert Peterson, 1606.

Cordoba, Francisco Hernández. *The Discovery of Yucatán*. Trans. Henry R. Wagner. Whittier, California: The Córtes Society, 1942.

Costansó, Miguel. *Diario histórico de los viajes . . . de la California al norte*. Trans. William Reveley. London, 1790. The Virginia Garrett Cartographic Collection, University of Texas Arlington Libraries.

Durán, Diego. *The History of the Indies of New Spain*. Trans. Doris Heyden, 1994, originally published in 1581.

Grijalva, Juan. *The Discovery of New Spain*. Trans. R. Wagner. Pasadena, California: The Córtes Society, 1942.

Humboldt, Alexander. *Cosmos: Sketch of a Physical Description of the Universe*. Trans. Edward Sabine. London, 1847.

_____. *The Island of Cuba: A Political Essay*. Trans. J.S. Thrasher. Princeton: Markus Wiener, 2001.

_____. *Political Essay on the Kingdom of New Spain with Physical Section and Maps*. 4 vols. Trans. John Black. London: Longman, Hurst, Rees, Orme, and Brown, 1811. The Virginia Garrett Cartographic Collection, University of Texas Arlington Libraries.

_____. *Views of Nature: Or Contemplation on the Sublime Phenomena of Creation; with Scientific Illustrations*. Trans. E.C. Otté and Henry G. Bohn. London: Henry G. Bohn, 1850.

Humboldt Alexander and Aimé Bonpland. *Personal Narrative of Travels to the Equinoctial Regions of the New Continent During the Years 1799-1804*. 7 vols. Trans. Helen Maria Williams. New York: AMC Press, 1966, originally published in 1829.

Jacobi, Friedrich H. *Werke*. Trans. Otto Pöggeler. Leipzig, 1816.

Kant, Immanuel. *Critique of Judgment*. Trans. Werner S. Pluhar. Indianapolis: Hackett Publishing, 1987, originally published in 1790.

_____. "Answering the Question: What is the Enlightenment?" Trans. Friedrich Gedike and Johann Erich Biester. *Berlinische Monatsschrift*, December, 1784.

_____. *Observations on the Feeling of the Beautiful and the Sublime*. Trans. John T. Goldthwait. University of California Press, 1961.

O’Crouley, Pedro Alonso. *Description of the Kingdom of New Spain*. Trans. and ed. Sean Galvin John Howell, 1972, originally published in 1774.

Secondary Sources

- Allen, Phillip. *Mapmaker's Art: Five Centuries of Charting the World*. London: Marshall Editions, Ltd., 2000.
- Almaráz, Felix D. *Tragic Cavalier: Governor Manuel Salcedo of Texas, 1803-1813*. Austin: The University of Texas Press, 1970.
- Bannon, John Francis. *The Spanish Borderlands Frontier, 1513-1821*. Albuquerque: The University of New México Press, 1974.
- Bedini, Silvio A. *Thomas Jefferson Statesman of Science*. New York: Macmillan Co., 1990.
- Billingham, Ray A. *Westward Expansion: A History of the American Frontier*. 2nd ed. New York: MacMillan, 1964.
- Bodley, Temple. *George Rogers Clark: His Life and Public Services*. Boston: Houghton Mifflin, 1926.
- Botting, Douglas. *Humboldt and the Cosmos*. New York: Harper & Row, 1973.
- Brock, W.H. *Science for All: Studies in the History of Victorian Science and Education*. Great Britain, 1996.
- Bryson, N. *Word and Image: French Painting in the Ancien Régime*. Cambridge University Press, 1981.
- Buisseret, David. *From Sea Charts to Satellite Images: Interpreting North American History Through Maps*. Chicago: The University of Chicago Press, 1990.
- _____. *The Mapmaker's Quest: Depicting New Worlds in Renaissance Europe*. Oxford: Oxford University Press, 2003.
- Burnett, D. Graham. *Masters of All They Surveyed: Exploration, Geography, and a British Eldorado*. Chicago: The University of Chicago Press, 2000.
- Camp, L. Sprague and Ley, Willy. *de la Atlantida a El Dorado*. Barcelona, 1960.
- Cannon, Susan Faye. *Science in Culture: The Early Victorian Period*. New York: Science History Publications, 1978.

- Cartographic Encounters: Perspectives on Native American Mapmaking and Map Use.* Ed. G. Malcolm Lewis. Chicago: The University of Chicago Press, 1998.
- Chipman, Donald. *Spanish Texas, 1519-1821.* Austin: The University of Texas Press, 1992.
- Clavijero F. J. *Historia antigua de México.* México, 1853.
- Cline, Gloria Griffen. *Exploring the Great Basin.* Norman: The University of Oklahoma Press, 1963.
- Collected Writings of Rousseau.* Ed. Roger Masters and Christopher Kelly. Hanover: University Press of New England, 1990-1997.
- Cosgrove, Denis. *Apollo's Eye: A Cartographic Genealogy of the Earth in the Western Imagination.* Baltimore: The Johns Hopkins University Press, 2001.
- Coues, Elliott. *The Expeditions of Zebulon Montgomery Pike.* Minneapolis: Ross & Haines, 1965, originally published in 1895.
- Craib, Raymond. *Cartographic México: A History of State Fixations and Fugitive Landscapes.* Durham: Duke University Press, 2004.
- Cumming, W.P., Hillier, S.E., Quinn, D.B., Williams, G. *The Exploration of North America, 1630-1776.* New York: G.P. Putnam, 1974.
- Crosby, Alfred W. *The Measure of Reality: Quantification and Western Society, 1250-1600.* Cambridge: Cambridge University Press, 1997.
- Cutter, Charles. *The Legal Culture of Northern New Spain, 1700-1810.* Albuquerque: The University of New México Press, 1995.
- Davies, Norman. *Europe: A History.* New York: Oxford University Press, 1996.
- de Terra, Helmut. *Humboldt: The Life and Times of Alexander von Humboldt, 1769-1859.* New York: Alfred A. Knopf, 1955.
- Dickenson, Victoria. *Drawn From Life: Science and Art in the Portrayal of the New World.* Toronto: The University of Toronto Press, 1998.
- Dolan, Edward F. Jr. *Green Universe: The Story of Alexander von Humboldt.* New York: Dodd, Mead, & Co., 1959.

- Empire's Nature: Mark Catesby's New World Vision*. Ed. Amy R.W. Myers and Margaret Beck Pritchard. Chapel Hill: The University of North Carolina Press, 1998.
- Engstrand, Iris H.W. *Spanish Scientists in the New World: The Eighteenth Century Expeditions*. Seattle, 1981.
- Exploration and Mapping of the American West: Selected Essays*. Ed. Donna P. Koeppe. Chicago: Speculum Orbis Press, 1986.
- Foucault, Michael. *The Order of Things: An Archaeology of the Human Sciences*. New York: Vintage Books, 1973.
- Francaviglia, Richard V. *Mapping and Imagination in the Great Basin: A Cartographic History*. Reno: The University of Nevada Press, 2005.
- Fuentes, Carlos. *The Broken Mirror: Reflections on Spain and the New World*. New York: Houghton Mifflin, 1992.
- García, Cubas. *The Republic of México*. Trans. George E. Henderson. México, 1876.
- Geography and Enlightenment*. Ed. David N. Livingstone and Charles W.J. Withers. Chicago: The University of Chicago Press, 2001.
- Geography and Revolution*. Ed. David N. Livingstone and Charles W.J. Withers. Chicago: The University of Chicago Press, 2005.
- Hampson, Norman. *The Enlightenment: An Evaluation of Its Assumptions, Attitudes, and Values*. London: Penguin Books, 1990.
- Harley, J. B. and Paul Laxton. *The New Nature of Maps: Essays in the History of Cartography*. Baltimore: The Johns Hopkins University Press, 2000.
- Harrison, H. *Kentucky's Road to Statehood*. Lexington: The University Press of Kentucky, 1992.
- Heidegger, Martin. *Nietzsche*. 4 vols. San Francisco: Harper & Row, 1982.
- Helferich, Gerard. *Humboldt's Cosmos: Alexander von Humboldt and the Latin American Journey That Changed the Way We See the World*. New York: Gotham Books, 2004.

- Herman, Arthur. *To Rule the Waves: How the British Navy Shaped the Modern World*. New York: Harper, 2004.
- Herr, Richard. *The Eighteenth Century Revolution in Spain*, 1958.
- Hollon, W. Eugene. *The Lost Pathfinder: Zebulon Montgomery Pike*. Norman: The University of Oklahoma Press, 1949.
- Hyslop, Stephen G. *Bound for Santa Fé: The Road to New México and the American Conquest, 1806-1848*. Norman: The University of Oklahoma Press, 2002.
- Imaginary Kingdom: Texas as Seen by the Rivera and Rubi Military Expeditions, 1727 and 1767*. Ed. J. Jackson. Austin: Texas State Historical Association, 1995.
- Jackson, Donald. *The Journals of Zebulon Montgomery Pike with Letters and Related Documents*. Two volumes. Norman: The University of Oklahoma Press, 1966.
- Jacobs, James Ripley. *Tarnished Warrior: Major-General James Wilkinson*. New York: Macmillan, 1938.
- Janson, H.W. and Anthony F. Janson, *History of Art*, 5th ed. revised. New York: Harry N. Abrams, 1997.
- Keehler, William. *Turmoil in New Mexico*. Albuquerque: The University of New Mexico Press, 1952.
- Kellner, L. *Alexander von Humboldt*. London: Oxford University Press, 1963.
- Kuehn, Manfred. *Kant: A Biography*. Cambridge University Press, 2001.
- Kugelen, Helga von. "America as Allegory: The Frontispiece to the Travel Journals of Humboldt and Bonpland." In Carl-Justi Vereinigung. *Herencias Indigenas*. English trans. Frankfurt: *Iberoamericana*, 2002.
- Livingstone, David N. *The Geographical Tradition: Episodes in the History of a Contested Enterprise*. Oxford, UK: Blackwell, 1992.
- Mappings*. Ed. Denis Cosgrove. London: Reaktion Books, 1999.
- Martin, James C. and Robert Sidney Martin. *Maps of Texas and the Southwest, 1513-1900*. Albuquerque: The University of New México Press, 1984.

- Mayer, Brantz. *Mexico: Aztec, Spanish, and Republican. A Historical, Geographical, Political, Statistical, and Social Account of the Country from the Period of the Invasion by the Spaniards to the Present Time*. Two volumes. Hartford, 1851.
- Mayer, William. *Early Travellers in Mexico, 1534-1816*. México, D.F., 1961.
- Meyer-Abich, Adolf. *Alexander von Humboldt, 1769-1969*. Bonn, 1969.
- McCullough, David. *The Path Between the Seas: The Creation of the Panama Canal, 1870-1914*. New York: Simon & Schuster, 1977.
- Mollhausen, Baldwin. *Diary of a Journey from the Mississippi to the Coasts of the Pacific*. 2 vols. Translated by Mrs. Percy Sinnett. London, 1858. David Rumsey Library.
- Pagden, Anthony. *European Encounters with the New World*. New Haven: Yale University Press, 1994.
- Peale, Charles W. *The Selected Papers of Charles Willson Peale and His Family*. Ed. Lillian B. Miller. New Haven: Yale University Press, 1983.
- Perez-Mejia, Angela. *A Geography of Hard Times: Narratives About Travel to South America, 1780-1849*. Trans. Dick Cluster. Albany: State University of New York Press, 2002.
- Pratt, Mary Louise. *Imperial Eyes: Travel Writing and Transculturation*. London : Routledge, 1992.
- Rand McNally World Atlas*. New York, 1970.
- Richmond, Douglas W. *The Mexican Nation: Historical Continuity & Modern Change*. New Jersey: Prentice Hall, 2002.
- Rupke, Nicolaas. "Geography of Enlightenment: The Critical Reception of Alexander von Humboldt's Mexico Work." *Geography and Enlightenment*. Ed. David N. Livingstone and Charles W.J. Withers. Chicago: The University of Chicago Press, 1999.
- Sachs, Aaron. *The Humboldt Current: Nineteenth-Century Exploration and the Roots of American Environmentalism*. New York: Viking, 2006.

- Schwarz, Ingo. "Letter from Humboldt to José de Iturrigaray, México, Jan. 3, 1804." *Briefe aus Amerika, 1799-1804*. Ed. Ulrike Moheit. Berlin: Akademie Verlag, 1993.
- Simmons, Mark. *Spanish Government in New Mexico*. Albuquerque: The University of New México Press, 1968.
- Smith, Adam *An Inquiry into the Nature and Causes of the Wealth of Nations*, 2 vols. Ed. J. Rogers. Oxford: Clarendon Press, 1869, originally published in 1776.
- Steele, Arthur Robert. *Flowers for the King: The Expedition of Ruiz and Pavon and the Flora of Peru*. Durham, 1977.
- Stegner, Wallace E. *Wolf Willow*. New York: Penguin, 1990.
- Terrell, John Upton. *Zebulon Pike: The Life and Times of an Adventurer*. New York: Weybright and Talley, 1968.
- The Domínguez-Escalante Journal: Their Expedition Through Colorado, Utah, Arizona, and New México in 1776*. Trans. Angelico Chavez. Ed. Ted J. Warner. Salt Lake City: The University of Utah Press, 1995.
- The Malaspina Expedition 1789-1794: The Journal of the Voyage by Alejandro Malaspina*, Volume I, Cadiz to Panama. Volume II, Panama to the Philippines. Ed. Andrew David, Felipe Fernandez-Armesto, Carlos Novi, G. Williams. London: The Hakluyt Society, in association with the Museo Naval, Madrid, 2003.
- The Southwestern Expedition of Zebulon M. Pike*. Ed. Milo Milton Quaipe. Chicago: R.R. Donnelley & Sons, 1925. The Virginia Garrett Cartographic Collection, University of Texas Arlington Libraries.
- Thrower, Norman J.W. "Mapping the United States-Mexican Borderlands: An Overview," *Exploration and Mapping of the American West*, No. 1. Ed. Donna P. Koepp. Chicago: Speculum Orbis Press, 1986.
- _____. *Maps and Civilization: Cartography in Culture and Society*, 2nd ed. Chicago: The University of Chicago Press, 1999.
- Van Noy, Rick. *Surveying the Interior: Literary Cartographers and the Sense of Place*. Reno: The University of Nevada Press, 2003.

- Vaughn, Thomas. *Voyages of Enlightenment: Malaspina on the Northwest Coast, 1791-1792*. Oregon Historical Society, 1977.
- Vindel, Francisco. *Mapas de América en los libros españoles de los siglos XVI al XVIII*. Madrid: Gongora, 1955.
- Wagner, Peter J. *José Antonio Alzate y Ramirez: Scientist and Publicist in Late Eighteenth-Century New Spain*. Master's Thesis. Arizona State University, 1975.
- Weber, David J. *Northern New México on the Eve of the United States Invasion*. New York: Arno Press, 1976.
- Weddle, Robert S. *The French Horn: Rival Explorers in the Spanish Sea, 1682-1762*. College Station: Texas A&M University Press, 1991.
- Weddle, Robert S. *The Spanish Sea: The Gulf of México in North American Discovery, 1500-1685*. College Station: Texas A&M University Press, 1985.
- Wheat, Carl Irving. *Mapping the Transmississippi West, 1540-1861*. Vol. II. San Francisco: Institute of Historical Cartography, 1957-1963. The Virginia Garrett Cartographic Collection, University of Texas Arlington Libraries.
- Wilford, John Noble *The Mapmakers*, Revised Edition. New York: Vintage Books, 2000.
- Wilkinson, James. *Memoirs of My Own Times*. Philadelphia: Abraham Small, 1816.
- Williams, Jerry and Robert Lewis. *Early Images of the Americas*. Tucson: University of Arizona Press, 1994.
- Williams, Patrick and Laura Chrisman. *Colonial Discourse and Post-Colonial Theory*. New York: Columbia University Press, 1994.
- Wood, Denis. *The Power of Maps*. New York: Guilford Press, 1992.

Articles

- Ackerknecht, Erwin H. "Georg Forster, Alexander von Humboldt, and Ethnology," *Isis*, vol. 46, no. 2, June, 1955.

- Carrera, Magali M. "Locating Race in Late Colonial México," in *Art Journal*. Fall, 1998.
- Clark, Fiona. "la Gazeta de Literatura de México, 1788-1795: Relating Science and Society through Periodical Literature in Late Eighteenth-Century México." *Atlantic Perspectives*. Harvard University Press, 2002.
- Crampton, C. Gregory. "Humboldt's Utah, 1811," *Utah Historical Quarterly* 26, 1958.
- Crampton, C. Gregory, and Gloria G. Griffen. "The San Buenaventura, Mythical River of the West," *Pacific Historical Review* 25, 1956.
- Daum, Andreas W. "Alexander von Humboldt and North America," *German Historical Institute Bulletin*, Issue 35. Washington, D.C., fall 2004.
- de Terra, Helmut. "Alexander von Humboldt's Correspondence with Thomas Jefferson." *Proceedings of the American Philosophical Society* 103, 1959.
- _____. *Geographical Review*, vol. 50, no. 4, October, 1960.
- _____. "Motives and Consequences of Alexander von Humboldt's Visit to the United States in 1804," *Proceedings of the American Philosophical Society*, vol. 104, no. 3, June, 1960.
- Ette, Ottmar. "The Scientist as *Weltbürger*: Alexander von Humboldt and the Beginning of Cosmopolitics." *International Review for Humboldtian Studies*, vol. II, 2001.
- Francaviglia, Richard V. Review of *The Malaspina Expedition 1789-1794: The Journal of the Voyage by Alejandro Malaspina, Volume I, Cadiz to Panama*. Ed. Andrew David, Felipe Fernandez-Armesto, Carlos Novi, Glyndwr Williams. *Terrae Incognita*, vol. 35, 2003.
- Friis, Hermann R. "Baron Alexander von Humboldt's Visit to Washington." *Records of the Columbia Historical Society* 44, 1963.
- Inglis, Robin "The Malaspina Expedition," *Botanical Electronic News*, no. 286, May 2002.
- Lepenius, Wolf. "Alexander von Humboldt – His Past and his Present," talk given at the Alexander von Humboldt Symposium, *Berlin News*, May 31, 1999.
- Lowenthal, David. "Seeds and Fruits of Humboldt's Animating Vision," Talk given at The Alexander von Humboldt Annual Lecture Series, 2004.

Lubrich, Oliver. "In the Realm of Ambivalence: Alexander von Humboldt's Discourse on Cuba." *German Studies Review*. Vol. 26 no. 1, February, 2003.

Luna, Melinda. "Early Texas--The First Record of a Civil Engineering Project." *Texas Civil Engineer*. Vol. 73, no. 2, summer 2003.

Martin, Geoffrey J. and Preston E. James. "All Possible Worlds: A History of Geographical Ideas." *The Association of American Geographers, the First Seventy-five Years, 1904-1979*. Washington, D.C., 1978.

Nelken, Halina. "Alexander von Humboldt: Scientific Humanist." *Harvard Magazine*, vol. 80-1, Sept.-Oct. 1977.

"Pike, Zebulon Montgomery." *Handbook of Texas Online*, <http://www.utexas.edu>, 2005.

Quillen, Ed. "The Adventures of Zebulon M. Pike," *Colorado Central Magazine*, March 1997.

Reinhartz, Dennis. "Ambition and Enterprise: Zebulon Pike's Maps Relating to the Exploration of the Southern Louisiana Purchase." *Journal of the International Map Collectors Society*, no. 103, winter, 2005.

_____. "Maps from the Inspections." *Cartographica*, autumn/winter 1998.

_____. "The Arid Lands of the Greater Southwest on the Maps of Zebulon Pike and Stephen Long." *Forum of the Association for Arid Land Studies*, vol. XXII, 2006.

Richmond, Douglas W. "Climax of Conflicts with Native Americans in New México: Spanish and Mexican Antecedents to U.S. Treaty Making During the U.S.-Mexican War, 1846-1848." *New Mexico Historical Review*, winter, 2005.

Sachs, Aaron. "The Humboldt Current: Avant-Guard Exploration and Environmental Thought in 19th Century America." *Terrae Incognitae*, vol. 37, 2005.

Salt Lake Tribune, Salt Lake City, Utah, section 1, page 1, November 17, 2002.

Savage, James E. "Spaniards, Scoundrels, and Statesmen: General James Wilkinson and the Spanish Conspiracy, 1787-1790." *The Hanover Historical Review* 6, 1998.

Schwarz, Ingo. "Alexander von Humboldt: Socio-political Views of the Americas."
University of Kansas Digital Library, <http://www.ku.edu>, 2005.

_____. "Alexander von Humboldt's Visit to Washington and Philadelphia, His
Friendship with Jefferson, and His Fascination with the United States."
Northeast Naturalist, 2001.

Cartobibliography

Arrowsmith, Aaron, and Alexander von Humboldt. *México and Adjacent Provinces*.
London, 1810. David Rumsey Library.

Arrowsmith and Lewis. *General World Atlas*. Philadelphia, 1804. David Rumsey
Library.

Alzate y Ramirez, José Antonio de. *Plano de la Nueva España en que se señalan los
viajes que hizo el Capitán Hernán Cortés año de 1769*. México: J.A. de Hogal,
1770. The Virginia Garrett Cartographic Collection, University of Texas
Arlington Libraries.

_____. *Nuevo mapa geográfico de la América
septentrional*. Austin: Texas State Historical Association, 1981. The Virginia
Garrett Cartographic Collection, University of Texas Arlington Libraries.

Atlas para el viaje de las goletas Sutil y Mexicana, 1802. David Rumsey Library.

Bonne, Rigobert. *Carte du Mexique*. Paris, 1771. David Rumsey Library.

Bowen, Emmanuel. *Complete System of Geography*. 2 vols. London, 1747. David
Rumsey Library.

Buchon, J.A. *Atlas des deux Amériques*. Paris, 1825. David Rumsey Library.

Cary, John. *New Map of North America*. London, 1806. David Rumsey Library.

Champion, J.N. *Amérique*. 1819. David Rumsey Library.

Cubas, Antonio García. *Atlas pintoresco y histórico de los Estados Unidos mexicanos*.
México, 1885. David Rumsey Library.

de L'isle, Gullaume. *Atlas nouveau*. Amsterdam, 1742. David Rumsey Library.

Humboldt, Alexander. *Atlas géographique et physique du royaume de la Nouvelle-Espagne*. Paris, 1811. David Rumsey Library.

_____. *Amérique*. Paris, 1816. David Rumsey Library.

_____. *Carte du Mexique et des pays limitrophes situés au nord et à l'est*. Paris: F. Schoell, 1811. The Virginia Garrett Cartographic Collection, University of Texas Arlington Libraries.

_____. *General Chart of the Kingdom of New Spain between parallels of 16 degrees and 38 degrees north from materials in Mexico at commencement of year 1804*. The Virginia Garrett Cartographic Collection, University of Texas Arlington Libraries.

_____. *Sketch of the Vice Royalty: Exhibiting the Several Provinces and its Approximation to the Internal Provinces of Spain*. New York: Francis P. Harper, 1895. The Virginia Garrett Cartographic Collection, University of Texas Arlington Libraries.

_____. *Vue des cordillères et monuments des peuples indigènes de l'Amérique*. Paris: F. Schoell, 1810. The Virginia Garrett Cartographic Collection, University of Texas Arlington Libraries.

_____. *Points of Separation and Projected Communications Between the South Sea and Atlantic Ocean*. London: 1811.

_____. *Map of the Isthmus of Huasacualco*. London: 1811.

Jeffreys, Thomas. *The West Indies Atlas*. London, 1775-1788. David Rumsey Library.

Kitchin, Thomas. *General Atlas*. London, 1791. David Rumsey Library.

Mascaro, Manuel Agustín and Miguel Costansó. *Mapa geográfica de una gran parte de la América septentrional comprendida, entre las 19° y 41° de latitudes, norte y los 251° y 289° de longitudes oriental*, 1779. From the Karpinski Collection, Library of Congress. University of Texas at Arlington Special Collections.

Miera y Pacheco, Bernardo de. *Plano geográfico, de la tierra descubierta . . . del Nuevo México*. Manuscript maps, 1776-1778. The Virginia Garrett Cartographic Collection, University of Texas Arlington Libraries.

- _____. *Plano geográfico, de los descubrimientos hechos por Bernardo Miera y Pacheco, Francisco Atanasio Domínguez, y Silvestre Veles, 1778.* Yale University Library.
- Pike, Zebulon Montgomery. *First Part of Captn. Pike's Chart of the Internal Part of Louisiana.* New York: Francis P. Harper, 1895. The Virginia Garrett Cartographic Collection, University of Texas Arlington Libraries.
- Pinkerton, John. *Modern Atlas.* London, 1815. David Rumsey Library.
- Pinkerton and Herbert. *Spanish Dominions in North America.* London, 1811. David Rumsey Library.
- _____. *Map of the Internal Provinces of New Spain.* Philadelphia, 1810. The Virginia Garrett Cartographic Collection, University of Texas Arlington Libraries.
- Popple, Henry. *Atlas Map of the British Empire in America.* London, 1796. David Rumsey Library.
- Sigüenza y Góngora, Carlos de. *Nueva demarcación de la bahía de Santa Maria de Galve . . . el año de 1693.* From the Karpinski Collection, Library of Congress. The University of Texas at Arlington Special Collections.
- _____. *Camino que el año de 1689 hizo el Gobernado Alonso de León des de Coahuila . . . cerca del lago de San Bernardo el lugar donde dauian poblado los franceses, 1689.* From the Karpinski Collection, Library of Congress. The University of Texas at Arlington Special Collections.
- Tanner, H.S. *Tanner's American Atlas.* 1823. David Rumsey Library.
- Vandermaelen, P.H. *Atlas Universel Géographie.* Brussels, 1827. David Rumsey Library.

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Robert Sherwood earned his Bachelor of Arts degree in History at San Diego State University in 2001, and earned his Master's degree in History at San Diego State University in 2002, writing a thesis titled *How the Catholic Church Avoided the Black Legend: An Analysis of Anti-Spanish Literature in the Sixteenth and Seventeenth Centuries*. While studying in the Transatlantic History Ph.D. program at the University of Texas Arlington, he received the Virginia Garrett Cartographic History Award (2006), and the George Wolfskill Graduate Division Award for the E.C. Barksdale Essay Competition (2007). He also received Honorable Mention for the Washington Map Society's Dr. Walter W. Ristow Prize (2005). He was recognized as a University Scholar at the President's Convocation for Academic Excellence in 2007, and earned his Ph.D. in Transatlantic History in 2008. He is a member of the History honor society, Phi Alpha Theta, Omicron Kappa Chapter. He will make a presentation on the cartography of Alexander von Humboldt at the sixth biennial Virginia Garrett Lectures on the History of Cartography in October, 2008, and will debate noted cartographic historian Dennis Reinhartz in a program entitled *Cartographic Plagiarism? A Comparison of the Maps of Humboldt and Pike* at the spring 2009 meeting of the Texas State Historical Association and the Texas Map Society.