

**How Derivative was Humboldt? Microcosmic Nature Narratives in
Early Modern
Spanish America and the (Other) Origins of Humboldt's Ecological
Sensibilities**

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Note to the Reader:

This paper has two parts: In the first half I review some recent studies in English on sixteenth and seventeenth-century natural history and natural philosophy to demonstrate how difficult it has become for Anglo-American scholarship to bring Iberia back into narratives on the origins of “modernity.” The oversight is unfortunate for it has blinded scholars to the fact that the Iberians first created a culture of empirical, experimental, and utilitarian knowledge-gathering of massive proportions that did not get its cues from the classics or the learned but from merchants, enterprising settlers, and bureaucrats. The Portuguese and the Spanish confidently saw themselves as the first “moderns,” superseding the ancients. The English were the first to recognize this fact and they sought to imitate the new institutions of knowledge-gathering created by the Iberians. In the second half I offer an example of what is to be gained by integrating into narratives of the history of science the Iberian world. Here I offer a revisionist account of the history of the science that has awarded to Alexander von Humboldt the original creative insight in the science of plant and animal biodistribution.

I

Readers of this paper know well the frontispiece to Francis Bacon's *Instauratio Magna* (1620). The image shows a ship sailing through the columns of Hercules; it stands for the voyage of empirical and experimental discovery of nature's secrets on which Europeans embarked as soon as they left behind the authority of ancient texts [Fig 1.] Readers are also familiar with Jan van der Straet's introductory engraving to his *Nova Reperta* (ca. 1580), a collection of thirteen illustrations on key early-modern "discoveries." The engraving highlights the importance of new technologies such as the printing press, the clock, and the cannon. [Fig 2.]

Paradoxically, these two illustrations have come to be associated first with a "Protestant" and later with an "Enlightenment" narrative of modernity, which purposefully excludes the role of Catholic Iberia in the so-called "Scientific Revolution." I say paradoxically because these two illustrations either drew on Iberian motifs of discovery or sought to capture Iberian contributions to knowledge.

Take, for example, Francis Bacon's motif of sailing through the columns of Hercules to signify the triumph of the moderns over the ancients. This motif was in fact a sixteenth-century Spanish export. As José Antonio Maravall persuasively argued some forty years ago, it was in the Iberian Peninsula, and particularly Spain, that intellectuals first developed a sense that the moderns had superseded the ancients.¹ The discovery of hitherto unknown patterns of oceanic wind currents, the development of new vessels, and the mastery by sailors of new techniques to find their bearings in the open sea led in the

¹ José Antonio Maravall, *Antiguos y Modernos. Visión de la historia e idea de progreso hasta el Renacimiento*, second edition (Madrid: Alianza Editorial, 1986).

fifteenth century to a growing realization that the cosmographies inherited from the ancients were wrong. By the early sixteenth-century Iberians discovered that the Indian Ocean was not an inland sea as Ptolemy had long maintained and that an entire “new” world stood in the middle of the Atlantic. The discovery of a whole range of peoples from West and Central Africa to the Americas that had remained unknown to the ancients also became apparent. The new empires that the Portuguese and Spaniards put together, which encompassed peoples and bureaucracies on four different continents, were wonders of political engineering and military prowess that dwarfed anything Rome ever accomplished. No wonder that Charles V, when looking for motifs to capture the deeds of his new Holy Roman Empire, chose both the Golden Fleece to symbolize rightful providential rewards to chivalric valor and the columns of Hercules to signal the superiority of his age over that of the ancients.²

Consciousness of pre-eminence of the moderns over the ancients had more than one manifestation in the Iberian Peninsula. Unlike their Italian peers, local humanists were not easily dazzled by the virtues of Latin and other classical languages and

² Charles V adopted the columnar “plus ultra” device in the 1510s to signal a break with medieval readings of Hercules that emphasized cautious (military) prudence (“non plus ultra”). The columns and the motto originally meant to signify Charles V willingness to launch a crusade through North Africa by crossing Gibraltar. By the mid sixteenth century, however, the motto took on the meaning of daring trans-Atlantic imperial expansion. On this topic, see Earl Rosenthal, “Plus Ultra, Non Plus Ultra, and the Columnar Device of Emperor Charles V.” *Journal of the Warburg and Courtauld Institutes* 34 (1971): 204-28; and “The Invention of the Columnar Device of Emperor Charles V at the Court of Burgundy in Flanders in 1516.” *Journal of the Warburg and Courtauld Institutes* 36 (1973): 198-230. In *The Last Descendant of Aeneas: The Hapsburgs and the Mythic Image of the Emperor* (New Haven: Yale University Press, 1993) Marie Tanner has argued that the Golden Fleece was part of classical and medieval discourses to legitimate emperors that first began with Virgil’s *Aeneid* and *Fourth Eclogue* (to honor Augustus). The motif was Christianized under Constantine, Clovis, and Charlemagne. In medieval epics the Fleece came to stand for the recovery of Jerusalem from Islam.

consciously set out to develop their own vernaculars. The literatures on metallurgy, medicine, agriculture, surgery, meteorology, cosmography, cartography, navigation, and fortifications studied by Maravall are peppered with comments both on the ignorance of the ancients and on the technical superiority of the moderns. Intellectuals relished every opportunity to remind their readers about all the novelties that had completely escaped the purview of the ancients: new empirical breakthroughs in metallurgy (that allowed Spain to develop economies of scale in silver mining in the New World); new plants, diseases and cures; new forms of arranging armies and building fortifications; and new agricultural techniques.³ Luis de Camões (1524-1580) and Alonso de Ercilla (1533-1594) wrote epic poems recording the extraordinary voyages and adventures of actual Argonauts, and confidently thought they were superseding Homer. While arguing that Vasco de Gama's deeds dwarfed Ulysses's, Camões asserted without raising a single eyebrow: "May the ancient Muse be silenced, for greater heroes have now surfaced" (*Cesse tudo o que a Musa antiga canta, Que outro valor mais alto se alevanta*).⁴ It was in this environment critical of the achievements of the ancients that the Royal Cosmographer Andrés García de Céspedes published in 1606 his *Regimiento de Navegación*. The frontispiece of this treatise is identical to that later used by Bacon in the *Instauratio Magna* (Fig 3.).

³ Maravall, *Antiguos y Modernos*. 431-53, 483-549.

⁴ Luís de. Camões., *Os Lusíadas* [1572] (Lisbon: Publicações Europa-America, 1997), 20. Alonso de Ercilla y Zúñiga's *La Araucana* came out in three parts in 1577, 1578, and 1589 respectively. David Quint has written a remarkable study, *Epic and Empire. Politics and Generic Form from Virgil to Milton*. Princeton: Princeton University Press, 1993), that locates Camoes's and Ercilla's poems within the classical epic tradition of Virgil's *Aeneid* and Lucan's *Pharsalia*. Quint, however, overlooks the self-confident modernity of the sixteenth-century Iberians as a critical configuring factor of their poetry.

It is very likely that Bacon purposefully sought to imitate García de Céspedes, for throughout the sixteenth-century English authors followed the military and technical accomplishments of the Iberians with a mixture of interest and envy. The English acknowledged the technical superiority of the Portuguese and Spaniards when it came to navigation and avidly translated treatises published by royal cosmographers introducing local audiences to tables and calculations on how to locate latitude (and even longitude) in the open sea. The English sought to imitate the schools for pilots institutionalized in Seville and admired the role of Spanish mathematicians, metallurgists, cosmographers, astronomers, navigators, and hydrographers in the development of empire. As a jealous Richard Hakluyt put it in his *Principal Navigations of the English Nation* (1599), the Spaniards were far ahead of the English in the colonization of the New World largely because the former enjoyed “those bright lampes of learning (I mean the most ancient and best Philosophers, Historiographers and Geographers) to shewe them light” as well as “the loadstarre of experience (to wit, those great exploits and voyages layed up in store and recorded) whereby to shape their course.”⁵ Hakluyt presented the writings of such Spanish cosmographers as Alonso de Chaves (d. 1587), Jerónimo de Chaves (1523-1574), and Rodrigo Zamorano (b. ca. 1545) as exemplary.⁶

⁵ Richard Hakluyt, *Principal Navigations Voyages, Traffiques, and Discoveries of the English Nation*. 3 vol. (London: George Bishop, 1599). 1:*3r-v and 4v.

⁶Hakluyt most likely was referring to Alonso de Chaves’s “Quatri partitu en cosmogaphia practica, y por otro nombre, Espejo de navegantes” (unpublished Ms written in the 1530s but that circulated widely); Jerónimo de Chaves’s translation of Johannes Sacro Bosco’s *Sphera mundis, Tractado de la sphaera* (Seville, 1545); one of the multiple editions of Chaves’s *Chronographia* (1548, 1561, 1566, 1572, 1581, 1584); and Rodrigo Zamorano’s *Compendio del Arte de Navegar* (Seville, 1581), *Cronología y repertorio de la razón de los tiempos* (Seville, 1594), and *Los seis libros de geometría de Euclides* (Salamanca, 1576). Surprisingly Hakluyt does not mention Pedro de Medina’s

It is therefore not preposterous to think that Bacon might have the Spanish empire in mind when he wrote his *New Atlantis* (1624, published posthumously in 1627). A culmination of a lifetime engagement with devising new epistemologies, Bacon's *New Atlantis* describes a utopian island organized around the utilitarian, pragmatic, and experimental manipulation of natural resources. Stranded European sailors happen upon an unknown island on which the local nobility has instituted a chivalric order, the House of Salomon. After days of idle waiting on the island, the sailors finally get to meet a powerful member of the order who introduces them to the secrets of the islanders, namely, the carefully planned, massive, mechanical exploitation and reproduction of all natural resources and phenomena.⁷ The fact that the islanders and the great lord of the House speak Spanish and that island is located off the coast of Peru are not the only inklings that Bacon might have had Spanish imperial institutions of knowledge in mind when he wrote the book. As Antonio Barrera has elegantly shown, the Spaniards created throughout the sixteenth century a culture of empirical, experimental, and utilitarian knowledge-gathering of massive proportions that did not get its cues from the classics or the learned but from merchants, enterprising settlers, and bureaucrats.⁸

Settlers and merchants were always on the lookout for new natural resources to sell, constantly hyping the economic windfall that would accrue to those capable of exploiting the various new mineral, pharmaceutical, and agricultural resources found in

Arte de Navegar (Valladolid, 1545) and *Regimiento de Navegación* (Seville, 1563) that were translated and reprinted several times in England.

⁷ Francis Bacon, *The New Atlantis. A work unfinished* (London: William Lee, 1627).

⁸ Antonio. Barrera, "Local Herbs, Global Medicines. Commerce, Knowledge, and Commodities in Spanish America." In *Merchants and Marvels. Commerce, Science, and Art in Early Modern Europe*. Edited by Pamela H. Smith and Paula Findlen. (New York: Routledge, 2002). 163-181.

the Indies. They also sought to introduce new mechanical devices, demanding patents and monopolies. The crown responded eagerly but cautiously to all these claims by farming out the testing of the new products and devices to experts back home: physicians, pilots, cosmographers, apothecaries, and inventors. By the early sixteenth century the scale of claims and counterclaims was such that new institutions had to be created, including the *Casa de Contratación* in Seville, a veritable “Chamber of Knowledge.” Training pilots and assembling credible maps was one of its functions of this new institution; another was to apportion credit to contradictory reports. The crown also standardized questionnaires and launched massive campaigns of data gathering. Finally, the mechanical transformation of landscape undertaken by engineers in the pay of the Spanish empire in Potosi and the central Valley of Mexico were as extraordinary as those dreamed up by the knight of the House of Salomon, including the creation of artificial lakes and rivers to power mills to crush silver ores and the cutting of sluices through massive mountains to drain the city of Mexico.⁹ Just like Hakluyt, Bacon seemed to have been well informed of the new Spanish institutions and practices.

There is however another reason to suspect that Bacon had the Iberians in mind when he wrote the *New Atlantis*. Like the Portuguese and the Spaniards, Bacon linked knowledge to chivalry. A quick glance at the sixteenth-century Iberian treatises of cosmography admired so much by the English shows that the Iberians saw knowledge gathering as an expansion of chivalric virtues. The royal cosmographer Pedro de Medina, in the pages of his much acclaimed and widely influential *Arte de navegar* (1545), insisted that pilots were new knights whose sword and shield were the compass, the chart,

⁹ José. Sala Catalá,. *Ciencia y técnica en la metropolización de América*. (Madrid; Edición Doce Calles, 1994)

the cross-staff and the astrolabe just as their horses were ships.¹⁰ This trope lay behind the appearance of astrolabes and coats of arms in such classics of the Portuguese expansion to Africa and Asia as the *Ordenações manuelinas* (1521) (in fact the armillary sphere and the cross of Saint George are the chief elements of Portugal's coat of arms) [Fig 4] and the appearance of the motto "*a la espada y el compás, más, más y más*" ("to the sword and the compass, more, more and more [imperial territorial expansion]") adorning the frontispiece of Bernardo de Vargas Machuca's *Milicia y descripción de las Indias* (Madrid 1599) (Fig 5). Bacon's the New Atlantis with its chivalric order of the House of Salomon resembles in every respect the institutions and values created by the Iberian powers (Spain and Portugal alike) to gather of knowledge for utilitarian purposes.

Jan van der Straet's *Nova Reperta* indicates that awareness of the role of Iberians in a dawning modernity was not limited to jealous English imperial competitors. The Dutch Jan van der Straet was in fact an engraver and painter whose career developed in Italy and who went by the Latinate name of Johannes Stradanus.¹¹ Since his patrons were Roman, Florentine, and Genoese clerics and merchants, Stradanus highlighted in the opening engraving of his *Nova Reperta* the contributions to the discovery of America and to the development of the compass of Christopher Columbus, Americus Vespucci, and Flavius Amalfiti, respectively (Fig 2). Yet Stradanus's catalogue of nine remarkable new discoveries includes at least three that any of his contemporaries would have immediately granted to the Iberians: namely, the sighting of new constellations in the southern hemisphere (the Southern Cross), the introduction of new remedies (the bark of the

¹⁰ Quoted in David C. Goodman, *Power and Penury. Government, Technology and Science in Philip II's Spain*. Cambridge: Cambridge University Press, 1988), 72-3.

¹¹ Alessandra. Baroni Vannucci, *Jan Van der Straet detto Giovanni Stradano. Flandrus pictor et inventor* (Milan: Jandi Sapi, 1997).

guaiacum tree), and the discovery of new lands (America).¹² There are others in this picture that contemporaries could not have separated from a history of the Portuguese and Spanish expansions, such as the development of new cash crops (silk) and of new military technologies (the cannon).

Stradanus's *Nova Reperta* and Bacon's *Instauratio Magna* and *New Atlantis* demonstrate the importance of Iberia to any narrative of the so-called "Scientific Revolution." Yet this term has strangely become synonymous with understanding developments in nonwestern Europe and the north Atlantic. When the first histories of the "Scientific Revolution" by A. Rupert Hall (1954), Marie Boas (1962), and Richard Westfall (1971) began to appear in Britain and the USA beginning in the 1950s, they found no room to accommodate Iberia at all. Such forgetfulness is at the core of most "western" meta-narratives of the genesis of modernity since the eighteenth century.¹³ The roots of such provincialism, to be sure, lie deep in Protestant and, later, Enlightenment ideologies. Some one hundred and fifty years after Bacon borrowed from García de Céspedes the tropes and motifs to depict the arrival of modernity, Zacharie de Pazzi de Bonneville, also known as *philosophe La Douceur*, concluded in 1771 that "there is no nation more brutish [*abrupti*], ignorant, savage, and barbarous than Spain."¹⁴ In 1777

¹² On the "discovery" of the New World as the discovery of new stars and constellations, see Jorge Cañizares-Esguerra, "New Word, New Stars: Patriotic Astrology and the Invention of Indian and Creole Bodies in Spanish America, 1600-1650." *American Historical Review* 104 (1999): 33-68.

¹³ Marie. Boas, *The Scientific Renaissance 1450-1630* (New York: Harper & Row, 1962); A. Rupert. Hall, *The Scientific Revolution, 1500-1800. The Formation of the Modern Scientific Attitude* (London: Longmans, 1954); and Richard S.. Westfall, *The Construction of Modern Science. Mechanisms and Mechanics* (New York: Wiley, 1971).

¹⁴ Zacharie de. Pazzi Bonneville, *De l'Amérique et des américains* (Berlin: Samuel Pitra, 1771), 61.

Joseph La Porte concluded in his *Le voyageur françois* (1766 –1795) that Spain was a land of superstitious folk, still practicing sciences inherited from the Moors, namely, “judicial astrology, cabala, and other Arab inanities.” Spaniards, he further argued, had boundless admiration for Aristotle, “whose senseless and tenebrous philosophy” they blindly followed.¹⁵ Finally, in 1781 the Abbé Raynal maintained in his *Histoire philosophique des deux Indes* that, “never has a nation been as enslaved to its prejudices as Spain. In no other place irrationality [*le déraison*] has proven as dogmatic, as close, and as subtle.”¹⁶ Ever since the eighteenth-century Iberians have come to represent the antithesis of modernity.

The erosion of the Iberian empires in the face of increasing Dutch and English competition and the failure of Spain and Portugal to carry out reforms to consolidate the centralizing power of the state as in France led to the relative “decline” of the Iberians in the seventeenth century. Already during the Reformation and wars of Dutch independence northwestern European printers had created an image of the Iberians as superstitious and rapacious plunderers. “Decline” not only hardened perceptions; criticism now came wrapped in the idioms of progress and the Iberians were cast as essentially non-Europeans: backward and ignorant.¹⁷ By 1721 Montesquieu could

¹⁵ Joseph de. La Porte, *Le voyageur françois*. 42 vols. (Paris: Cellot. 1768-95), 16:94.

¹⁶ Quoted in Manfred Tietz, “l’Espagne et l’*Histoire des deux Indes* de l’abbé Raynal,” in *Lectures de Raynal: L’Histoire des deux Indes en Europe et en Amérique au XVIIIe siècle*, Hans-Jurgen Lüsebrink and Manfred Tietz eds. (Oxford: Voltaire Foundation. 1991), 100.

¹⁷ J. N. Hillgarth, *The Mirror of Spain, 1500-1700. The Formation of a Myth* (Ann Arbor: University of Michigan Press, 2000). On the Spanish “Black Legend,” see Julián Juderías, *La leyenda negra: Estudios acerca del concepto de España en el extranjero*. 9th ed. (Barcelona: Araluce, 1943); Ricardo García Carcel, *La leyenda negra. Historia y opinion* (Madrid: Alianza, 1981); Charles Gibson ed., *The Black Legend. Anti-Spanish Attitudes in the Old World and New* (New York: Knopf, 1971); William S. Maltby, *The*

maintain in the pages of *Lettres Persanes*, without being challenged, that Spaniards were only good at writing chivalric romance and dogmatic scholastic treatises.¹⁸ Not surprisingly, all meta-narratives of modernity and progress that came of age in the eighteenth century have found no place for the technological and philosophical contributions of the Iberians in the early modern period.

This tendency to neglect the contributions of the Spanish sixteenth century to natural philosophy can be observed in the recent new translation into English of José de Acosta's *Natural and Moral History of the Indies* published by Duke University Press.¹⁹ For all its merit, the new edition seems more preoccupied with Acosta the historian and anthropologist than with Acosta the natural philosopher.

“And my desire is that all I have written may serve to make known which of his treasures God Our Lord divided and deposited in those realms; may the peoples there be all the more aided and favored by the people of Spain, to whose charge divine and lofty Providence has entrusted them.” With these words in the dedication to Philip II, José de Acosta summed up the spirit of his *Historia Natural y Moral de las Indias*, for the celebrated Jesuit was interested in both explaining the conquest as a preordained Providential event and identifying signs of intelligent design in the many natural wonders of the American continent. Acosta was a man of omnivorous curiosity, with an uncanny

Black Legend in England: The Development of Anti-Spanish Sentiment, 1558-1660 (Durham, NC: Duke University Press, 1971); and Benjamin Schmidt, *Innocence Abroad. The Dutch Imagination and the New World. 1570-1670* (Cambridge: Cambridge University Press, 2001).

¹⁸ Charles de Secondat, baron de Montesquieu, “Lettres Persanes,” In *The Black Legend: Anti-Spanish Attitudes in the Old-World and the New*. Edited by Charles Gibson (New York: Knopf, 1971), 115.

¹⁹ José de Acosta, *Natural and Moral History of the Indies* [1590]. Edited by Jane E. Mangan, with an introduction and commentary by Walter Mignolo. Translated by Frances López-Morillas (Durham and London: Duke University Press, 2002).

ability to find divine order in contingency, chaos, and probability. But Acosta was not simply a Christian philosopher. As the citation above makes clear, he was also a pragmatist interested in how things work and how colonial peoples thought, so as to use and manipulate the former and to convert and govern the latter.

The views of Acosta have been available to English-speaking audiences for centuries. Unlike the writings of scores of other sixteenth-century Spanish, Creole, mestizo and Amerindian authors whose treatises on the natural wonders of the Indies and the past of local indigenous peoples commanded little attention until recently, Acosta's *History* was immediately translated into several European languages, including English. In the eighteenth-century Atlantic world, when all sources produced in the early Spanish empire came to be seen as untrustworthy and useless, only Acosta's treatise was deemed worth reading. Despite Acosta's reputation, however, since 1604 the average English-speaking reader interested in the Jesuit has had to plow through Edward Grimeston's translation. Grimeston's prose in *The natvrall and morall historie of the West Indies* might have served Elizabethan audiences well, but today sounds stodgy and distant. Fortunately students can now turn to Frances López-Morillas' crisp new rendition.

This new translation forms part of a much larger editorial effort that also includes an annotated edition by Jane E. Mangan, an Andeanist, and a study by Walter D. Mignolo, a literary critic. Both the annotations and the study help put Acosta in a larger cultural and ideological context. But Mangan and Mignolo's approach to Acosta betrays a bias that is typical of most contemporary scholarship.

In 1604 Grimeston and his Tudor and Stuart audiences considered Acosta to be a great natural philosopher, not only a keen observer of things Amerindian. Yet by the late

seventeenth century Acosta began to be read only for his contributions to anthropology and ethnography. Students and scholars today do not turn to Acosta for answers on the nature of the stars and heavens in Americas but to reconstruct the lives of Amerindians peoples and the nature of colonial power. What is left out, however, are the questions that most captivated Acosta: why tides and winds in the southern and northern hemispheres have different timings and directions; why the Torrid zone of Peru instead of scorching heat enjoys temperate climate year round; why seasons of rain and drought follow exactly opposite patterns in Europe and Peru; why mercury attracts silver; and so on. Three out of every five pages in Acosta's *Historia* are devoted to accounting for the seemingly puzzling behavior of the cosmos in the Indies. Acosta sets out to prove that Nature in America, just as much as in Eurasia, is a docile servant of God, following predictable laws. For all their contributions, Mangan and Mignolo deal only tangentially with this essential facet of Acosta's world.

The disregard for Acosta as a natural philosopher and for Spanish science at large is also obvious in the otherwise marvelous book by Lorraine Daston and Katherine Park, *Wonders and the Order of Nature 1150-1750*. After passing and superficial references to Nicolás Monardes and one Ferrando de Oviedo (actually Fernández de Oviedo), Daston and Park completely overlook the Spanish literature on New World's wonders, including, say, Juan de Cárdenas's path breaking *Problemas y Secretos Maravillosos de las Indias*, published in Mexico in 1591, and the massive seventeenth-century natural history of marvels by the Jesuit Juan Eusebio Nieremberg, *Historia natvrae, maxime*

peregrinae (1635), the capstone of this tradition.²⁰ Daston and Parker show absolutely no awareness that Spanish natural histories of the Indies like Acosta's were attempts at modifying dominant narratives of marvels. A firm believer that demons were particularly powerful in the Indies, largely responsible for the idolatrous religious practices of the colonized natives, Acosta was nevertheless not willing to cede the realm of the natural and the marvelous in the New World to the devil.²¹ His *Natural History* constantly seeks to frame seeming inversion of physical laws in the Indies, puzzling natural phenomena, within a discourse of providential design and lawful regularities. By so doing, Acosta sought to steer early-modern Europeans perceptions of the New World's Nature away from the realm of the preternatural and thus the demonic.²² This is all the more remarkable because Acosta was a firm believer on the forthcoming arrival of the apocalypse, a fact that goes completely unnoticed by Mangan and Mignolo. One of Acosta's works (*De temporibus novissimis libri quatuor*, originally published in Rome in

²⁰ Lorraine Daston and Katharine Park, *Wonders and the Order of Nature 1150-1750*. New York: Zone Book. 1998), 146-49. See Juan de Cárdenas, *Primera parte de los problemas, y secretos marauillosos de las Indias*. Mexico: Pedro Ocharte, 1591) and the many works by Juan Eusebio Nieremberg, including the latter's *Historia natvrae, maxime peregrinae, libris XVI distincta. In quibus rarissima naturae arcana ... etiam cum proprietatibus medicinalibus, describuntur* (Antwerp: Moreti. 1635); *Curiosa y ocvlta philosophia primera y segunda parte de las marauillas de la naturaleza, examinadas en varias questionnes naturales* (Madrid: Imprenta Real, 1643); and *Ocvlta filosofía de la simpatía, y antipatía de las cosas. Artificio de la naturaleza, y noticia natural del mundo. Y segunda parte de la Curiosa filosofía: contiene historias notables, averiguasen muchos secretos, y problemas de la naturaleza* (Barcelona: Pedro Lacavalleria, 1645).

²¹ On Acosta and demonology, see Sabine MacCormack, *Religion in the Andes. Vision and imagination in the Early Colonial Peru* (Princeton: Princeton University Press, 1991), chs.1 and 6; and Fernando Cervantes, *The Devil In the New World. The impact of Diabolism in New Spain* (New Haven: Yale University Press, 1994), 24-31.

²² On the connections between the realm of the preternatural and the demonic in the early-modern period, see Stuart. Clark, *Thinking with Demons. The Idea of Witchcraft in Early Modern Europe* (Oxford: Oxford University Press. 1997), part II.

1590) sought to prove, among other things, that the multiplication of witchcraft, demonic possessions, prodigies, and the preternatural in early-modern Europe were all signs of the devil unleashed on the eve of the apocalypse as suggested in the Bible.²³

Examples of how the history of Renaissance Iberian natural philosophy is usually overlooked abound. Given the dominant narrative of the North Atlantic origin of modernity sketched above this is not surprising at all. It is surprising, however, that in the vibrant new field on the history of botany, natural history, and empire there is little room for considering how Portugal and Spain set long-term European patterns. Take for example the recent account on the rise of the modern botanical garden, *Nature's Government*, by Richard Drayton.²⁴ Drayton offers a dazzling, brilliant story of how botany and empire developed in tight, mutual interaction during England's eighteenth and nineteenth centuries. Although Drayton's focus is on the history of the Royal Botanic Gardens at Kew, he spends considerable time exploring the origins of the early modern botanical garden, which he traces to particular intellectual, religious, and political forces. Intellectually and religiously the culture of the botanical garden was tied to humanist efforts to catalogue the world and recover Adam's long lost grip on creation.²⁵ Politically the garden first sought to legitimate monarchs as new Solomons: learned kings deeply concerned with the secrets of nature so as to benefit the local commonwealth. Later these monarchical philosophical pretensions gave way to a culture of ornamentation, in which

²³ José de Acosta, *De Christo revelato libri novem. Simulque De Temporibus novissimis libri quator* (Lugduni: Ioannem Baptistam Buysson, 1592). Acosta's views were mainstream; see Clark, *Thinking with Demons*, part III.

²⁴ Richard Drayton, *Nature's Government. Science, Imperial Britain, and the 'Improvement' of the World* (New Haven: Yale University Press, 2000).

²⁵ On this topic, see also John Prest, *The Garden of Eden. The Botanic Garden and the Recreation of Paradise* (New Haven: Yale University Press, 1981).

all sorts of powerful patrons, not only rulers, set out to collect plants and tend gardens to dazzle while consolidating power and prestige. In these various phases, Drayton reminds us, naturalists, monarchs, and humanists found overseas the plants they needed. But this very process of primitive accumulation of botanical knowledge changed ideas about the polity, religion, and the order of nature. Eventually the botanical garden became an institution that helped generate colonialist ideologies while promoting large, global agricultural economies of scale.

This genealogy of the botanical garden (from medicine to ornamentation to plantation agriculture), however, does not pay sufficient attention to developments in sixteenth-century Portugal and Spain, for early-modern botany was as rooted in the humanist culture of the medical faculties of Padua, Leyden, and Montpellier as in the entrepreneurial, utilitarian efforts of apothecaries in gardens and hospitals in Seville, Lisbon, Goa, and New Spain. From its inception botany served the need of transnational merchant capital. Take for example the case of Carolus Clusius, whom Drayton refers as “the Copernicus who shattered the Hellenocentrism of Renaissance botany.”²⁶ The dean of early modern botany and the founder of the gardens of Vienna and Leyden, Clusius spent his life chasing after exotica to expand the classical repertoire of European botanical knowledge, limited for centuries to the few hundred of plants catalogued in the works of Theophrastus and Dioscorides. As Drayton himself correctly points out, Clusius made available in Latin the works of Portuguese and Spanish doctors and apothecaries such as Nicolas Monardes, García Orta, and Cristobal Acosta. These, however, were all works single-mindedly focused on the potential commercial value of

²⁶ Drayton, *Nature's Government*, 13.

new-found botanical staples, with little use for speculative philosophy.²⁷ Clusius inherited from these Portuguese and Spanish treatises, and from his travels through the various botanical gardens of Portugal and Spain, a keen eye for the utilitarian, commercial value of exotic commodities.²⁸ Thus Clusius's additional notes to Orta's short treatise on South East Asian aromatic and pharmaceutical plants also included references to potentially profitable exotica collected by Francis Drake in his recent circumnavigation.²⁹ Clusius's translation into Latin of Thomas Harriot's description of Virginia for Theodore de Bry is not simple rendition. It includes long lists of goods used by the local inhabitants as well

²⁷ Nicolás. Monardes, *Dos libros: El Vno Qve Trata De Todas Las Cosas que traen de nuestras Indias Occidentales, que siruen al vso de la Medicina, y el otro que trata de la Piedra Bezaar, y de la Yerua Eseuerçonera* (Seville: Heruando Diaz and Alonso Ejcriuano, 1565-1569); García de Orta, *Coloquios dos simples e drogas e coisas mediciniais da India e de algumas frutas achadas nella onde se tratam algu[m]as cousas tocantes a mediçina, practica, e outras cousas boas pera saber* (Goa: Ioannes de Endem, 1563); and Cristóbal Acosta, *Tractado de las drogas, y medicinas de las Indias Orientales : con sus plantas debuxadas al biuo por Christoual Acosta ... En el qual se verifica mucho de lo que escriuio el doctor Garcia de Orta* (Burgos: M. de Victoria, 1578).

²⁸ See for example his renditions into Latin of the works by Monardes, Orta and Cristobal Acosta: Carolus Clusius, *Aromentum et simplicium aliquot medicamentorum apud Indos nascentium historia ante biennium quidem Lusitanica lingua per dialogos conscripta*. Abridged edition of Orta's *Coloquios* (Antwerp: Christophori Plantini, 1567) and *Simpliciiis Medicamentis Ex Occidentali India Delatis*. Edition of Monardes' *Dos Libros*. Antwerp: Christophori Plantini, 1574). In *Rariorum aliquot stirpium per Hispanias obseruatarum historia, : libris duobus expressa* (Antwerp: Christophori Plantini, 1576), Clusius repeatedly cites botanical gardens he visited or friends from whose botanical gardens he obtained samples. The network was vast, including contacts with gardens in Belgium, France, Austria, Italy, and England. Among the botanical gardens in Portugal and Spain he visited are the following: monastery of "Divae Virginis" in the outskirts of Valencia (16, 444); Ferdinand Cotinho's, a gentleman in Portugal (131, 280); Johannes Plaza's, "most learned" physician in Valencia (254, 289, 444, 479); royal palace in Lisbon (299); and Pedro Alemán's (444).

²⁹ Carolus Clusius, *Aliqvot notæ in Garciae aromatum historiam : Eivsdem descriptiones nonnullarum stirpium, & aliarum exoticarum Francisco Drake equite anglo, & his obseruatæ sunt, qui eum in longa illa nauigatione, qua proximis annis vniuersum orbem circumiuit, comitati sunt: & quorundam peregrinorum fructuum quos Londini ab amicis accepit rerum, que à generoso viro* (Antwerp : Christophori Plantini, 1582).

as botanical staples with potential commercial value.³⁰

The utilitarian, pragmatic, commercial aspect of Iberian natural history found its culmination in the expedition and work of Francisco Hernández. Sent by Philip II to gather a natural history of herbals, Hernandez spent seven years in Mexico (1571-1577) experimenting in hospitals for natives, established by the Spanish clergy, and interviewing Nahua intellectuals versed in Latin. Upon return, he had assembled 11 volumes of illustrations of 3,000 different species of plants (as well as of minerals, animals, and local antiquities) and several other volumes of text. Phillip II, however, felt the work too philosophical and asked his royal physician the Neapolitan Nardo Antonio Recchi to plow through Hernández's work to come up with a list of useful pharmaceutical plants. As Recchi complied, Philip II passed away. Neither Recchi's anthology nor Hernández's massive natural history were ever made available by the crown, which at the time was seeking to shut down all publications on the Indies in an effort not to allow rival powers to gain any additional knowledge of, and footholds in, the New World. Recchi's compilation had to wait some sixty years to appear, this time with various appendices and notes by several members of the *Accademia dei Lincei*.

The history of the Academy of the Lynx and of the publication of Recchi's manuscript has recently being told by David Freedberg in *The Eye of the Lynx*, a most learned and lavishly illustrated book.³¹ In Freedberg's narrative this Roman academy to which Galileo belonged appears, again, as *the* harbinger of modernity. Mostly composed of German, Roman, and Neapolitan scholars led by Federico Cessi, the academy edited

³⁰ Carolus Clusius, *Admiranda narratio, fida tamen, de commodis et incolarvm ritibus Virginiae* (Francoforti ad Moenvm: T. de Bry, 1590).

³¹ David. Freedberg, *The Eye of the Lynx. Galileo, his Friends, and the Beginnings of Modern natural History* (Chicago: Chicago University Press, 2002).

works that sought to find the hidden order of nature. With the aid of microscopes, telescopes, and the art of dissection, academicians like Galileo and Cessi observed not only the surface appearance of plants, fossils, insects, and stars, but also their internal, intimate structure. By so doing these *novatores* set out to undermine the authority of the ancients and radically altered the way knowledge was gathered and classified. As part of this new effort, the academicians were particularly interested in curiosities and exotica and when they learned that Rechhi's nephew, one Marco Antonio Petilio, had kept the doctor's manuscripts they pounced at the opportunity. Over the course of some forty years Johannes Schreck, Johannes Faber, Fabio Colonna, Francesco Stelluti, and Federico Cessi, at different times, kept one adding notes and marginalia to the original manuscript until it finally came to light in 1651 under the title of *Rerum Medicarum Novae Hispaniae Thesaurus*.³²

A quick glance to the frontispiece (Fig. 6) demonstrates the utilitarian emphasis of the whole enterprise: scantily clad natives offer Philip IV (represented through his coat of arms) the botanical riches of Mexico. These riches (passé Drayton) are medicinal, ornamental, and agricultural, all at once. Viewers, in the meantime, are invited to cross through the doorway and step into one of the territories of the Spanish empire, which also include Castile, Leon, Granada, Portugal, Sicily, Naples, Aragon, Flanders, Jerusalem (!),

³² Francisco. Hernandez, *Rerum Medicarum Novae Hispaniae Thesaurus seu Plantarum Animalium Mineralium Mexicanorum Historia. Ex Francisci Hernandez Novi Orbis Medici Primarii relationibus in ipsa Mexicana Urbe conscriptis. A Nardo Antonio Rechho Monte Corvinate Cath. Maiest. Medico et Neap. Regni Archiatro Generali. Iussu Philippi II Hisp. Ind. Etc. Regis Collecta ac in ordinem digesta. a Ioanne Terrentio Lyceo Constantiense Germ. Pho. ac Medico Notis Illustrata. Nunc primu in Naturaliu rer Studiosor gratia lucubrationibus Lynceoru publici iuris facta. Quibus iam excussis accessere demum alia quor omnium synopsis sequenti pagina ponitur Opus duobus voluminibus divisum. Philipo IIII Regi Catholico magno Hispaniar utrisque Siciliae et Indiaru etc Monarchae dicatum* (Rome: Vitalis Mascardi, 1651).

Mexico, and Peru (see coat of arms in a frontispiece originally designed in 1628, when Portugal was still part of the Spanish empire. The serpents and eagles below the Portuguese coat of arms seem to represent Mexico and Peru). It is useful at this stage to remind the reader that Cessi and his Roman and Neapolitan allies were part of the loose Spanish monarchy.³³ The utilitarian, commercial stress of the work surfaces repeatedly in the text itself. The printer Giacomo Mastardi, for example, ends his preface to the reader, in which he outlines the complex, twisted history of the manuscript and identifies the various contributors, by insisting that “not only the herbalist, the lover of natural history, the medical doctor, the philologist, the taxonomist (*Phytosophus*), and the collector of ornamental flowers for princes and noblewomen... but also the shopkeeper (*institor*), the quack (*pharmacopola*), the apothecary (*pharmacis mercator*), and the perfumist (*odorarius*), whether in search of health, pleasure, or money, will find a wealth of objects, images, and names, to satisfy your mind, eyes, and desire.”³⁴ Johannes Schreck (a.k.a. Johannes Terrentius), charged with adding glosses and commentary to Recchi’s original manuscript, defends on pragmatic, commercial grounds Recchi’s decision to follow Theophrastus and Dioscorides. Thus in the section on Mexican trees, Terrentius argues that dividing plants into trees, bushes, and herbs is justifiable. In the case of trees because trees are the source of many riches, give us shelter from the attack of beasts,

³³ Thomas James Dandeleet, *Spanish Rome, 1500-1700* (New Haven: Yale University Press. 2001).

³⁴ “Si Herbariae, si naturali Historiae addictus: si Medicus, si Philologus, si denique Phytosophus: si Florilegus Principium, aut Heroinorum blandiris deliciis: vel si novis e fructibus, aut Pharmacis Mercator, Institor, Pharmacopola, Odorarius, sanitatem, oblectamenta quaeris, aut lucrum, novas hic certe habes Rerurm, Imaginum, Vocabulorum Myriades, quae & oculos, & mentem, & desiderium omni ex parte explere possint.” («Iacobus Mascardus Typographus Lectoris. » In Hernandez, *Rerum Medicarum*, n.p.)

keep us from drowning in tempests, and allow us to ply the menacing seas while we discover new lands and ultimately engage in commerce.³⁵

For all his enormous contribution, Freedberg excludes Iberia from his history of the Academy and particularly from the history of the publication of Recchi's manuscript. In Freedberg's narrative Spain appears as an obstacle. Thus Freedberg presents Hernández as incompetent, barely capable of organizing the material he collected (247). Ricchi appears as a physician cowered into silence by the Spanish king, fearful of sharing with others the fruits of his labors (249). Although he acknowledges that it was a Spanish official in Rome, Alfonso de Las Torres, who finally put the money to publish the work, Freedberg does not make much of it, nor does he make much of the fact that Rome and Naples were at the time cultural satellites of Spain.³⁶ Yet the very evidence Freedberg presents shows that Spain was a willing participant throughout the many years it took the Academy to bring the book to light. Linceans like Johannes Heckius (253) and Cassiano dal Pozzo (262) repeatedly had access to Hernández's manuscripts and illustrations at El Escorial. Moreover when Cassiano visited Madrid in 1626 he obtained as a present for the pope the *Codex Badianus*, an illustrated herbal written in Latin in 1552 by two Nahuatl intellectuals, Juan Badiano and Martín de la Cruz.³⁷ More important, Freedberg

³⁵ "Ne dicam quicquam de ingentibus illis arborum trabibus, quibus domicilia nobis paramus, quo tutiores a ferarum incursionibus, & tempestatum inundationibus persistamus, & naves aedificamus, quibus nos nostraq. committentes audacissimi homines turbulentissimo, & minacissimo oceano fidimus ignotas Terras, ignotaq. hominum commercia exquirimus." ("Liber Tertius. Arbores describit." In Hernandez, *Rerum Medicarum*, 44).

³⁶ Dandeleit, *Spanish Rome*.

³⁷ Martín, De la Cruz and Juan Badiano. *The Badianus manuscript, Codex Barberini, Latin 241, Vatican Library; an Aztec herbal of 1552*. Introduction, translation and annotations by Emily Walcott Emmart (Baltimore: John Hopkins University, 1940).

unwittingly shows that the academicians received help at every turn by learned Spanish or Creole clerics living in Rome who repeatedly provided Linceans with animals, plants, documents, and much needed interpretations (261, 265).³⁸ Freedberg's demonstrates how

Freedberg misidentifies De la Cruz as Juan. He also presents Badiano as a humble "Indian" given to self-deprecating remarks, compounding the image of exploited Indians and haughty Spaniards. Clearly Freedberg is unaware of the rhetorical and cultural conventions of classical Nahuatl (263-64). The Codex, originally entitled *Libellus de medicinalibus Indorum herbis*, resembles in many ways than one the images and text in Hernández's original manuscript, clearly showing that Hernández's was a collective work in which Nahua intellectuals played a central role.

³⁸ The commentaries by Johannes Faber on some of Hernandez's illustrations of animals, one of the longest sections of the *Rerum Medicarum Novae Hispaniae Thesaurus*, appended under the title *Aliorum Novae Hispaniae Animalium Nardi Antonii Recchi Imagines et nomina. Ioannis Fabri lyncei Bambergensis Philosophi, Medici, publici Professoris Romani, & Summo pontifici ab herbariis studiis Expositione* (Hernandez 1651, pp.457-840), relies utterly on information Faber obtained in Rome and Naples from several Spanish and Spanish American intellectuals. Among those Faber relies the most are: Gregorio de Bolivar, a Spanish Franciscan who spent twenty five years in the most faraway places in Peru and Mexico as well as additional years in the East Indies, very learned in three indigenous languages (Throughout Faber copies verbatim page after page of Bolivar's unpublished treatise on the natural history of the New World): "Et ecce, dum sic haeremus, commodum ipsum salutatum advenit Reverendus admodum pater F. Gregorius de Bolivar Hispanus Placentinus, Ordinis S. Francisci de observantia dicti, qui annos XXV integros in America vixit, Regnum utrumque Peruavum & Mexicanum, plurimasque adhuc incognitas aliis, nec descriptas novi orbis provincias peragravit, verbo & exemplo infideli illi populi (cuius tres diversas linguas optime callet) Christi Evangelium annunciando, & ad veram ac Catholicicam fidem illum inducendo: cuius rei gratia ad Molucas quoque Insulas & Orientem ipsum penetravit" (506); Bernardino de Cordoba, a grandee addicted to the study of nature who assembled a collection of exotic things and animals from the Indies in Naples: "Accessi statim hic Neapoli D. Bernardinum de Corduba, virum, ut antiqua Nobilitate clarum, ita Musis amoenioribus, & naturalium studiis rerum addictissimum, qui ob id plurimas tam bestias exoticas, quam res Indicas alias adseruat" (550); Pedro de Aloaysa, a Dominican born in Lima representing the American interests of his order in Rome and who in long, friendly conversations educated Faber on all things American: "Est autem vir hic doctissimus, Ordinis S. Dominici sodalis, in America & quidem in principalissima Peruani regni civitate Limana natus, qui adfectum etiam librum habet de Americanis sui ordinis negotiis, praelo propediem committendam. Huius amicissima confabulatione, cum saepe hic Romae de Americanis rebus colloqueremur, mirabiliter fui recreatus" (695); and Bartolomé dela Ygarza, a Spanish Dominican, who lived in America for seven years whose knowledge of American animals and plants he transmitted to Faber most willingly "Huius, uti & plurium aliorum animalium, atque plantarum Americanarum

difficult it has become for Anglo-American scholarship to bring Iberia back into narratives on the origins of “modernity.”

II

In this section of my essay I offer an example of how a more generous geographical understanding of the history of science can yield new readings of the past, altering time-honored narratives. Alexander von Humboldt (1769-1859) has long been hailed as a founding father of the science of ecology and a genius. He has been credited with single-handedly creating a new discipline that relied on painstaking measurement to identify hitherto uncharted regularities in the mechanism of the planet as a whole. Humboldt, for example, demonstrated that individual species were part of larger plant communities and that these communities were distributed geographically according to environmental variables such as elevation above sea level, temperature, and soil composition (Figure 7). After a lengthy visit to Spanish America (1799-1804), Humboldt went on to publish some thirty volumes on subjects ranging from botany to the political economy of Cuba and Mexico, consolidating his reputation as one of the leading men of science of the first half of the nineteenth century in Europe.³⁹

...descriptions mihi lubens communicavit Reverendus admodum P. Fr. Bartholomaeus dela Ygarza Hispanus, ex Ordine S. Dominici, qui septennis in Americam delatus” (743).

³⁹Douglass Botting, Humboldt and the Cosmos (New York: Harper & Row., 1973); L. Kellner, Alexander von Humboldt (New York: Oxford University Press, 1963).

Heroic narratives are today out of favor and historians no longer portray Humboldt as a lone genius. Janet Browne, for example, has situated Humboldt's ecological thinking within the larger history of the discipline of biogeography and shown that Humboldt drew upon the ideas of contemporary German scholars such as Johann (1729-1798) and Georg Forster (1754-1794) and Karl Ludwig Willdenow (1765-1812). But for all her efforts to historicize figures such as Humboldt and to show his indebtedness to other Europeans, Browne remains wedded to the notion that exotic places are worth mentioning solely as backdrops to the exploits of European naturalists; she thus has no place in her study for the discourses and ideas circulating in Spanish America that could have influenced Humboldt.⁴⁰ In contrast, the British historian David Brading has shown that Humboldt's works on the political economy of Mexico and Cuba were possible only because he drew upon the reflections of scholars in New Spain and on decades of data collection by colonial bureaucrats.⁴¹ I have myself demonstrated that Humboldt's antiquarian scholarship on Mesoamerican societies grew out of his encounter with rich empirical and interpretative traditions in Mexico.⁴² Here I propose a new narrative for the history of biodistribution that takes seriously the intellectual milieu Humboldt encountered in Spanish America and that takes into account the discourses about space and nature formulated in Spanish America during the seventeenth and eighteenth centuries.

⁴⁰ Janet Browne, The Secular Ark. Studies in the History of Biogeography (New Haven: Yale University Press, 1983).

⁴¹ David Brading, First America, the Spanish Monarchy, Creole Patriots, and the Liberal State, 1492-1867 (Cambridge: Cambridge University Press, 1991), 526-532.

⁴² See my How to Write the History of the New World. Histories, Epistemologies, and Identities in the Eighteenth-Century Atlantic World (Stanford: Stanford University Press, 2001).

The Euro-Creole Origins of Biodistribution

A generation ago, the Catalan geographer Pablo Vila maintained that “geo-botany was born of the encounter between two sages,” namely, Humboldt and the late eighteenth-century Colombian naturalist Francisco José de Caldas (1768-1816). Pointing to the remarkable similarities between Humboldt’s research program and that of Caldas, Vila forcefully argued for the “Euro-Creole” origins of the new science.⁴³ Caldas was a self-taught naturalist and astronomer who after having dazzled Humboldt became one of the leading naturalists in José Celestino Mutis’ botanical expedition to New Granada. Lionized by Humboldt for his fabulous collection of South American plants and natural history books on the “tropics,” the powerful Mutis (1732-1808) hired Caldas, who spent the following three years (1802 to 1805) traveling throughout the Ecuadorian Andes identifying and classifying varieties of quinine plants for his patron. Impressed by the results, Mutis called Caldas back to Bogota, the capital of the Kingdom of New Granada, to direct a brand-new astronomical observatory. Once in the city, Caldas also edited a weekly, the Semanario de la Nueva Granada, and became increasingly involved in the local patriotic societies that sought to change society through enlightened reforms. During the wars of independence triggered by the political vacuum in the colonies caused by Napoleon’s invasion of Spain in 1808, Caldas joined the patriot armies as both

⁴³ Pablo Vila, “Caldas y los orígenes eurocriollos de la geobotánica,” Revista de la Academia Colombiana de Ciencias 11 (1960): 16-20.

ideologue and military engineer. Captured by Spanish armies in 1816, he was shot in the back by a firing squad, signaling the end of an entire generation of patriot naturalists.⁴⁴

In 1801, when he encountered Humboldt in Colombia, according to Vila, Caldas was already charting the geographical distribution of plants in the northern Andes. By the time Humboldt published his 1805 Essai sur la géographie des plantes in France, Caldas had already produced several biogeographical maps of the northern Andes (1802) [Figure 8], a memoir on the geographical distribution of plants near the equator (1803), and a study of distribution of quinine relative to height above sea level and temperature (1805).⁴⁵ These documents clearly indicate that Caldas was thinking about mapping biodistribution in terms identical to those later made public by Humboldt. Vila, therefore, insists on the “Euro-Creole” origins of theories of biodistribution.

For all Vila’s insights, the evidence clearly shows that Caldas learned cross-sectional mapping of heights from Humboldt, not the other way around. The Prussian naturalist found a lonely and self-taught Caldas botanizing in southern Colombia while making a living as an itinerant merchant. Humboldt was impressed by the creativity of this Andean “genius,” for Caldas had built instruments from scratch, kept extraordinarily accurate astronomical observations, and invented a mathematical formula to calculate

⁴⁴ On Caldas, see John Wilton Appel, Francisco José de Caldas. A Scientist at Work in New Granada (Philadelphia: American Philosophical Society, 1994). On Mutis, see Marcelo Frías Núñez, Tras el Dorado vegetal. José Celestino Mutis y la Real Expedición Botánica del Nuevo Reino de Granada (1783-1808) (Sevilla: Diputación Provincial de Sevilla, 1994).

⁴⁵ All these unpublished maps and memoirs by Caldas are kept at the Archive of the Royal Botanical Garden in Madrid, División III, Serie Botánica, Fondo Mutis. The full title of Humboldt’s essay is Essai sur la géographie des plantes: Accompagné d'un tableau physique des régions équinoxiales, fondé sur des mesures exécutées, depuis le dixième degré de latitude boréale jusqu'au dixième degré de latitude australe, pendant les années 1799, 1800, 1801, 1802 et 1803 (Paris: Levrault, Schoell et Compagnie, 1805).

altitude by noting the temperature of boiling water at different heights. Caldas seems at first not to have been overly impressed by the Prussian and was skeptical of Humboldt's reliability as an observer: "Can we hope to get anything useful and knowledgeable from a man who would traverse our kingdom with so much haste [four to five months]? Isn't he going to broadcast prejudices and false information to Europe as almost all travelers do?" Caldas, however, soon changed his tune and looked forward to benefiting from his encounter with Humboldt (including the promise of a trip to Europe that Humboldt later withdrew in haste when he met the handsome and aristocratic marquis Carlos Montúfar in Quito, whom Humboldt subsequently took to Europe). "I will seek to learn and suck knowledge from this sage to gain some small measure of enlightenment and overcome [my] barbarism." In fact, Caldas first obtained from friends a cross-sectional map of Andean heights Humboldt had completed some time in October 1801 and was thus inspired to develop his own. Clearly Caldas was the junior member in this so-called "Euro-Creole" partnership.⁴⁶

Asserting the "Euro-Creole" origins of biodistribution as Vilas does understandably bolstered patriotic pride in Colombia, but left Eurocentric narratives in the history of science unchallenged.⁴⁷ For Vila's insights can be easily made to fit into diffusionist narratives of scientific discovery: Caldas emerges from our more careful analysis simply as the precocious disciple of the learned European traveler. In this

⁴⁶ Letters by Caldas to Santiago Arroyo, July 20, September 21, and October 6, 1801 in Jeanne Chenu ed., Francisco José de Caldas: Un peregrino de las ciencias (Madrid: Historia 16, 1992) [hereafter FJC], 107, 131, 133.

⁴⁷ For a recent example of this type of patriotic literature, see Jorge Arias de Greif, "Encuentro de Humboldt con la ciencia en la España Americana: Transferencias en dos sentidos," El Regreso de Humboldt. Exposición en el Museo de la Ciudad de Quito Junio-Agosto del 2001, ed. Frank Holl (Quito, Ecuador: Municipio de Quito, 2001).

chapter I seek to present an alternative narrative, one that focuses less on the origins of Humboldt's cross-sectional maps and more on the origins of his ideas about the Andes as a microcosmic space, a natural laboratory for testing theories of biodistribution. Although Humboldt might have arrived in Spanish America with a scientific agenda already framed by the writings of Karl Willdenow and the Forsters, he encountered a local intelligentsia obsessed with describing the rich ecological variations within their polities. Humboldt learned to read the Andes as a natural laboratory for the study of the geography of plant communities in part because local Spanish American scholars had for decades (if not centuries) been developing this idea.

The Microcosm and Paradise

Over the two hundred years before Humboldt's arrival, a tradition of natural history writing had arisen in Spanish America that considered the Andes a providentially designed space, a land seemingly endowed with all the climates of the world and thus potentially capable of housing or producing any natural product. This tradition resulted from the meeting of Indian and European conceptions of space. Upon arrival, the Spaniards encountered civilizations in the Andes that from a European perspective exhibited curious patterns of settlement. Instead of relying primarily on markets to access "exotic" commodities, Andeans sought to control faraway resources by sending migrants to occupy distant ecological niches. Andean groups were fissiparous communities deployed in "vertical archipelagos." Spaniards soon learned to take advantage of these peculiar spatial arrangements for purposes of labor mobilization and commercial

agriculture.⁴⁸

The immensely rich diversity of ecological niches encountered by the Spaniards in the Andes prompted colonial scholars to associate the region with the biblical paradise. Paradise, it was thought, had once contained all the fauna and flora of the earth. In an effort to recreate this primitive space, naturalists in the Renaissance established botanical gardens. As John M. Prest has argued, the so-called discovery of America set off a vogue for collecting exotic plants in hopes of reviving paradise.⁴⁹

In the early modern period, mountains were second only to botanical gardens as sites for envisioning paradise. As late as the eighteenth century, Carolus Linnaeus (1707-1778) imagined paradise as a very tall equatorial peak with a multitude of climates. The many microclimates of this mountain had once sustained all the fauna and flora of the world. As the oceans receded, however, species began to colonize distant geographical regions from the tropics to the Arctic, as they sought environments that resembled the niches in paradise for which they had originally been designed. Linnaeus used the ancient construct of paradise as an equatorial mountain to explain biodistribution.⁵⁰

Steep equatorial mountains with microclimates that reproduce those of the rest of world, however, were not bygone primeval spaces. They could be found in America. Columbus was perhaps the first to think that the lands he had just discovered had been home to the Garden of Eden. Like his contemporaries, Christopher Columbus thought that paradise was at the top of an extremely tall mountain, the nipple of a breast-shaped

⁴⁸ John Murra, Formaciones económicas y políticas del mundo andino (Lima: Instituto de Estudios Peruanos, 1975).

⁴⁹ Prest, The Garden of Eden.

⁵⁰ Carl Linnaeus, "On the Increase of the Habitable Earth," Select Dissertations from the Amoenitates Academicae, trans. F.J. Brand, 2 vols. (1781; New York: Arno Press, 1977), vol.1, 71-127.

peak that reached beyond the sublunary sphere. To be perfect, paradise had to transcend the laws of physics, and in classical cosmology heavenly matter in the celestial sphere was not subject to change. Only above the spheres of earth, water, air, and fire, could the generation and transmutation of the elements be avoided.⁵¹

Spaniards did not find in the New World peaks so tall as to be impervious to the laws of matter in the sublunary sphere. Nevertheless, they found in Andean mountains a way to explain why the torrid zone was in fact temperate, even though the ancients had predicted it to be uninhabited owing to the scorching heat of the equatorial sun.

Naturalists like José de Acosta (1540-1600) held the Andes in awe as they discovered that climate was as much a function of elevation above sea level as of temperature. The equatorial mountain ranges Acosta encountered contained within relatively small vertical spaces all the climates of the terrestrial sphere. Spanish naturalists seem to have ascribed paradisiacal properties to the Andes (and the New World generally) as they sought to identify the meteorological mechanisms that kept the scorching tropics temperate.⁵²

The first author to make this connection explicit was Antonio León Pinelo (1590-1660). Written between 1645 and 1650 but not published until the mid-twentieth century, León Pinelo's Paraiso en el Nuevo Mundo sought to prove that paradise had once been located on the eastern slopes of the Andes (Figure 9). León Pinelo's work grew out of his dissatisfaction with all extant literature attempting to pin down the original position of the

⁵¹ Christopher Columbus, "Tercer Viage," The Four Voyages of Columbus: A History in Eight Documents, Including Five by Christopher Columbus in the Originals Spanish with English Translations, ed. and trans. Cecil Jane, 2 vols. (New York: Dover, 1988), vol. 2, 29-47. On paradise in the supralunar sphere, see Charles S. Singleton, "Stars over Eden," Annual Report of the Dante Society 75 (1975): 1-18.

⁵² José de Acosta, Historia natural y moral de las Indias, ed. José Alcina Franch (Madrid: Historia 16, 1987), book II, passim, esp. chap. 12 and 14, and book III, chap. 19-20.

Garden of Eden. Ancient learned consensus held that paradise had been situated somewhere in the Middle East or Asia. The new philological and geographical knowledge of the Renaissance gave novel twists to these age-old speculations. León Pinelo dismissed both new and old theories and argued that the correct reading of Genesis placed paradise in the Andes.

To prove this, León Pinelo engaged in highflying philological speculation. He demonstrated that the Amazon, Magdalena, Orinoco and Plate Rivers had the properties ascribed in Genesis 2:6-15 to the four rivers of paradise, namely the Gihon, Tigris/Heidekel, Euphrates/Perath, and Pishon. He showed that the reference in Genesis 3:24 to an angel with a flaming sword guarding the entrance to the garden was simply a metaphor for Andean volcanoes surrounding Eden. He also argued that the tree of knowledge, whose fruit when tasted caused the Fall of Man, had most likely been the Peruvian granadilla (passion fruit or Passiflora edulis), for its flowers and leaves resembled the instruments of Christ's passion on the cross (nails, sponge, lance, wounds, bindings, and crown of thorns). The tree thus pointed to both the original sin and its redemption (Figure 10). More important for my argument, León Pinelo maintained that of all places on earth only the South American tropics near the Andes enjoyed the topographical and meteorological conditions that could have been home to a garden as temperate and as bountiful as Eden.

León Pinelo was skeptical that paradise could have been on top of a mountain, for life in the Andes proved that the thin air of very high altitudes made breathing difficult. Nevertheless, he maintained that of all places in the world only the Andes could have reached the middle region of the sphere of air, where corruption and the transformation of

the elements were considerably retarded. In addition, the Andes helped him explain how a place on the equator, which should have been rendered uninhabitable by the scorching heat of the sun, was in fact the most temperate environment on earth. Andean heights offset the tropical position of Peru on the terrestrial sphere, yielding a perfect meteorological balance.

Once he showed that paradise on the equator was not an oxymoron, León Pinelo set out to demonstrate that the natural history of Peru was sufficiently rich to make his case. His catalogue of local fauna and flora, however, was somewhat atypical because he offered only a list of wonders. Forced to offer reliable criteria to measure the organic capacity of the terrain, León Pinelo turned to a description of curiosities, believing that the more wonders brought forth from the land, the more likely it had once been home to paradise. It is not clear how León Pinelo drew the connection between natural wonders and the sacredness of the place, but early modern scholars thought that God best revealed his omnipotence through nature's play (artistry) rather than through nature's regularities.⁵³ Judging by the sheer size of León Pinelo's catalogue of local wonders (it took up at least one third of his treatise), Peru far surpassed any other competitor.

León Pinelo also suggested that the abundance of microclimates in the Andes was the cause for the wealth of wonders he had catalogued. The Andes allowed him to explain why Peru was so bountiful. León Pinelo identified three habitats in the Andes, each distinctively rich in its own way: the low-lying areas of the coast and the Amazons, the middle ground or llanos, and the high-altitude sierras. These multiple ecological niches rendered the area particularly productive, for as a crop withered in one niche it flourished

⁵³ On marvels and curiosities in the early modern period, see Daston and Park, Wonders and the Order of Nature, 1150-1750.

in another. More remarkable was the fact that its many microclimates made Peru hospitable to all crops and products. Whereas the plants of America were not easily acclimatized in Europe, all European crops yielded immense harvests in Peru.⁵⁴

The Political Economy of Paradise

León Pinelo's natural history was chiefly concerned with cataloguing wonders and curiosities, not with thinking broadly about ways in which the microcosmical attributes of Andean space could be used to generate wealth. His forceful, patriotic argument seemed disconnected from a discourse on the economy. It fell to eighteenth-century intellectuals to undertake this task. To capture this transition we may consider similar developments in Europe. Lisbet Koerner has shown that Linnaeus's taxonomy and natural history were intimately linked to cameralist discourses seeking to transform Sweden into a self-sufficient economy. Linnaeus sent students abroad to collect flora in the hope of weaning the polity from its dependency on imports. According to this utopian view, naturalists would provide, through careful acclimatization of plants in botanical gardens, all the raw materials needed for the kingdom of Sweden to become autarkic. Given Linnaeus's views on biodiversity, the effort consisted not merely in reproducing paradise but in making it economically viable.⁵⁵

Spanish Americans who lived in the Andes did not have to send naturalists abroad to create wealth. They simply turned to the microcosm next door. Unlike Linnaeus,

⁵⁴ For his views of the Andes as a privileged space, see Antonio de León Pinelo, El paraíso en el Nuevo Mundo, ed. Raul Porras Barrenechea, 2 vols. (Lima: Comité del IV Centenario del Descubrimiento del Amazonas, 1943), vol. 1, 307-313, 383-396.

⁵⁵ Lisbet Koerner, Linnaeus: Nature and Nation (Cambridge, Mass.: Harvard University Press, 1999).

however, Spanish American intellectuals did not seek to make their national economies autarkic. They sought instead to transform their kingdoms into commercial emporia by using the microcosmic ecological attributes of the Andes, namely, by supplying the consumers of the world with all they needed. A flurry of utopian debates on how to harness the untapped wealth of the Andes greeted Humboldt upon his arrival in the kingdoms of New Granada and Peru. To understand these debates we need first to explain the institutional and cultural context in which they took place.

Having been soundly defeated by the British in the Seven Years War (1756-1763), the Spanish Bourbons sought to introduce aggressive economic, administrative, and cultural reforms in every corner of their far-flung empire. Like their British-American cousins who felt entitled to their “English freedoms,” Spanish American settlers had enjoyed until the post Seven Years War reforms unparalleled degrees of autonomy and self-rule. Spanish American societies were kingdoms, not colonies, autonomous polities in the loosely held composite monarchy that was the Iberian Catholic monarchy. These “kingdoms” (hierarchical polities organized on the principles of socio-racial estates and corporate privileges) enjoyed numerous forms of local political representation (from city councils to cathedral chapters) that came under attack with the Bourbon reforms.

Determined to transform these kingdoms into colonies, the Spanish Bourbons turned to the new sciences. The Spanish empire had long been losing territories along with status and prestige in the New World to other European powers. Some Spanish intellectuals maintained that the loss of territories began with losses in the struggle over naming, surveying, and remembering. The writing of histories of “discovery” and

colonization, and the launching of cartographic and botanical expeditions, therefore, became a priority for the state, and many such expeditions visited the New World. Naturalists sought to benefit the economy by identifying new products (dyes, spices, woods, gums, pharmaceuticals) or alternatives to already profitable staples from Asia. Spanish botanical expeditions to the Andes, for example, put a premium on finding species of cloves and cinnamon to challenge British and Dutch monopolies in the East Indies.⁵⁶ The logic behind sending botanical expeditions to the New World was best expressed in 1777 by the architect of these policies, the physician Casimiro Gómez Ortega who promised José Gálvez, minister of the Indies, that “twelve naturalists...spread over our possessions will produce as result of their pilgrimages a profit incomparably greater than could an army of 100,000 strong fighting to add a few provinces to the Spanish empire.”⁵⁷

One of these expeditions was organized to survey and give names to the resources of New Granada, a territory that had been recently transformed by the Spanish Bourbons into a Viceroyalty (kingdom) with its administrative center in Bogota in the hopes of bringing an end to the immensely profitable British and Dutch illegal trade off the coast

⁵⁶ Antonio Lafuente and A. Mazuecos, Los Caballeros del punto fijo (Barcelona and Madrid: Ediciones del Serbal: CSIC, 1987); Arthur R. Steele, Flowers for the King (Durham: Duke University Press, 1964); Antonio González Bueno, ed., Expedición botánica al virreinato del Peru (1777-1788) (Barcelona: Lunwerg Editores, 1988); Francisco Javier Puerto Sarmiento, La ilusión quebrada: Botánica, sanidad y política (Barcelona: Ediciones del Serbal 1988); Xavier Lozoya, Plantas y Luces en México (Barcelona: Ediciones del Serbal 1984); Iris H. W. Engstrand, Spanish Scientists in the New World: The Eighteenth-Century Expeditions (Seattle: University of Washington Press, 1981); Juan Pimentel, La física de la monarquía (Madrid: Doce Calles, 1998); and Marcelo Frías Núñez, Tras el dorado vegetal (Seville: Diputación Provincial de Sevilla, 1994).

⁵⁷ Quoted in Francisco Javier Puerto Sarmiento, Ciencia de cámara: Casimiro Gómez Ortega (1741-1818): el científico cortesano (Madrid: Consejo Superior de Investigaciones Científicas, 1992), 155-156.

of Venezuela. José Celestino Mutis was the head of the expedition and his ideas typify the spirit of the enterprise; they also capture how quickly notions of the Andes as a microcosm were grafted onto the original Spanish expeditionary project.

Mutis arrived in Bogota in 1761 as part of the viceroy's entourage. He quickly set out to explore the land, and when he heard about the official campaign to send botanical expeditions to the New World he requested his efforts be acknowledged. In 1783 he found himself in charge of the so-called "Botanical Expedition of the New Kingdom of Granada."⁵⁸ Spanish merchants had long benefited from their monopoly over the trade in quinine. In a century in which "fevers" were at the center of medical thought in Europe, the febrifuge virtues of quinine made it extremely profitable. Quinine came from the bark of a tree found in a very small area of Loja on the eastern slopes of the Ecuadorian Andes. Mutis, however, was determined to find quinine-producing cinchona trees in the Andean slopes of Colombia as well. Although different from the trees of Loja, Mutis eventually found new species in Colombia. He simply assumed that similar areas (elevation above sea level, temperature, distance from the equators) should produce similar trees.⁵⁹

Many of the efforts of the expedition under Mutis were fueled by the assumption that similar environments engendered similar botanical species and that the Andes were a treasure-trove of microclimates. Thus, in 1785, Mutis alleged to have found in Colombia a substitute for Asian tea. Mutis launched a campaign to convince Spanish authorities that his Colombian product was as good if not better than the tea Europeans had been

⁵⁸ On this expedition see Frías Nuñez, Tras el dorado vegetal.

⁵⁹ See his article on quinine in Diario de Madrid, 11 November 1880, # 315. The article is reproduced in Flora de la Real Expedición Botánica del Nuevo Reino de Granada, 47 vols. (Madrid: Ediciones de Cultura Hispánica, 1954-), vol. 44, 42-43.

importing from China. Behind these efforts lay the idea that the Colombian Andes were providentially designed with microclimates capable of furnishing the world with any product. “Countless are the natural productions with which Divine Providence has endowed this New Kingdom of Granada,” Mutis argued in a letter sent to José Moñino y Redondo, Count of Floridablanca (1728-1808), the Spanish state minister whose recent illness the new Colombian tea would likely cure. The striking organic potential of New Granada, Mutis maintained, was due to the fact that this kingdom “was like a center of the Americas in which similar or equivalent productions to those found in the immense space of the Old and New Worlds have been gathered.”⁶⁰

The members of the expedition led by Mutis did their utmost to spread the news of the fantastic economic potential of New Granada. For example, around 1790 the Creole lawyer Pedro Fermín de Vargas (1791-1830), a member of the first phase of Mutis’s expedition (1783-1791), portrayed New Granada as a land of unparalleled commercial potential. According to Vargas, this kingdom enjoyed a privileged geographical location where it was possible “to find almost all the climates of the globe.” Colombia was a microcosm owing to the multitude of ecological niches created by the Andes and to the endless agricultural cycle of its equatorial climate. It was also a potential economic leader of the world. If an enlightened ruler were to build roads, and protect and increase the population to accelerate the ‘circulatory rhythms’ of the country, Colombia, according to Vargas, would be poised to supply the world with cinnamon, cloves, tea, betel pepper leaves

⁶⁰ José Celestino Mutis, “Te de Bogotá” Escritos científicos de Don José Celestino Mutis, ed. Guillermo Hernández de Alba, 2 vols. (Bogotá: Instituto Colombiano de Cultura Hispánica, 1983), vol. 1, 177. On this project, see Frías Núñez, “El té de Bogotá: un intento de alternativa al té de China,” Nouveau Monde et renouveau de l’histoire naturelle, ed. Marie-Cécile Bénassy-Berling, 3 vols. (Paris: Presses de la Sorbonne Nouvelle, 1986-1994), vol. 3, 201-219.

(a stimulant that is chewed in South East Asia and that could have been replaced with coca leaves), and indigo of even better quality than equivalent Asian merchandise. The coastal plains of Cartagena and Santa Marta alone would provide the cotton needed by all factories of the world.⁶¹

Other members of the expedition used the pages of Papel Periódico de la Ciudad de Santafé de Bogotá (1791-1797), a periodical created by fiat of the viceroy in order to stimulate a colonial public sphere and to spread the optimistic message that the key to the future prosperity of the kingdom lay in its microcosmic qualities. The future director of the Royal Botanical Garden at Madrid, Francisco Antonio Zea (1770-1822), led the charge for this message in 1790. Under the pseudonym of Hebephilo, Zea called on the youth of Bogotá to become republican patriots, interested solely in the greater good of society. Such virtuous citizens armed with the tools of the new sciences would one day witness New Granada becoming a trade emporium, for it was a privileged land, “a favorite of Nature. For here Nature has shown herself in all her magnificence; here [she] has revealed even to the blind and the ignorant the bright pageant of her marvels.”⁶² A few days later, a reader of Papel Periódico made Zea’s views explicit by clarifying the reasons to be hopeful. “Nueva Granada,” the reader argued, “is surrounded by the most beautiful and most diverse variety of climates, which are located at very little distance from one another.” Moreover, the land could produce any type of natural commodity in the world, including balms, gums, medicinal plants, cotton, wheat, legumes, fruits, cattle

⁶¹ Pedro Fermín de Vargas, “Memoria sobre la población del reino de Nueva Granada” (ca. 1790), Pensamientos políticos y memoria sobre la población del Nuevo Reino de Granada, (Bogotá: Biblioteca Popular de Cultura Colombiana, 1944), 6 (quotation).

⁶² “Avisos de Hebephilo a los jóvenes de los dos colegios sobre la inutilidad de sus estudios presentes, necesidad de reformarlos, elección y buen gusto en los que deben abrazar,” Papel periódico de la ciudad de Santafé de Bogotá, no. 9, (8 April 1791), 68.

hides, wool, birds, precious stones, reptiles, metals, coveted mercury for amalgamation, and even East Indian cinnamon and cloves. Only idleness, ignorance, and lack of republican virtue, the reader posited, could keep the New Kingdom of Granada from fulfilling its unlimited economic potential.⁶³

It is not surprising, therefore, that when Humboldt arrived in New Granada with rigorous new techniques to measure and chart biodistribution, Caldas embraced them almost overnight, producing studies and maps before Humboldt had the chance to publish his own. It was this prompt embrace that led Vila to suggest that biodistribution was an idea created by both Humboldt and Caldas. Yet this was not so. Caldas's charts and maps were simply a spatial representation of much older ideas.

Like Mutis, Vargas, and Zea, Caldas was deeply committed to the notion that New Granada was a microcosm, providentially designed to enjoy unlimited economic potential. "From the bosom of New Granada," Caldas insisted, "all the perfumes of Asia, African ivory, European industrial commodities, northern furs, whales from the South Sea, [in short], everything produced on the surface of our world [can be obtained]."⁶⁴ The microcosmic attributes of the Andes prompted Caldas to present New Granada as a

⁶³ Sabio patriota, "Al señor autor del periódico," *Papel periódico*, no. 11 (22 April 1791), 81. Many other articles emphasized the same theme of New Granada as microcosm of the world; for example see, Observador amigo del país, "Discurso," *ibid.*, no. 11 (22 April 1791), 86; Luis de Atigarraga, "Disertación sobre la agricultura dirigida a los habitantes del Nuevo Reyno de Granada," *ibid.*, no. 56 (9 March 1792), 36-37; Diego Martín Tanco, "Discurso por el cual se manifiestan los medios de aumentar la población de este reyno," *ibid.*, no. 76 (27 July 1792), 197; "Idea del nuevo Reyno de Granada," *ibid.*, no. 256 (12 August 1796), 1537-1538.

⁶⁴ Caldas, "Estado de la geografía en el Virreino de Santa Fe de Bogotá con relación a la economía y al comercio (1808)," *FJC*, 276.

natural laboratory to study correlations between behavior, race, and climate.⁶⁵ In addition to being a microcosm New Granada was geographically designed to be a trade emporium, a new Tyre or Alexandria. It was located at the center of the world and equipped with navigable rivers to carry staples from the interior to the coast as well as ports facing both the Atlantic and the Pacific. “Nueva Granada,” Caldas maintained, “appears destined for greatness by its geographical position for universal commerce.”⁶⁶ This type of logic led another member of Mutis’s expedition, the naturalist Jorge Tadeo Lozano (1771-1816), compiler of a yet unpublished “Fauna of Cundinamarca,” to predict in 1806 that his patria was poised to become in “a few centuries a vast empire that ... will equal the most powerful in Europe.”⁶⁷

These ideas also surfaced in Peru, another place that witnessed botanical studies sponsored by the crown. Hipólito Unanue (1755-1833), editor of a periodical in Lima, El Mercurio Peruano (1791-1795) and a physician committed to reform, typifies scholars in Peru who gave León Pinelo’s old ideas a new twist. Like Caldas, Unanue thought that Peru was destined to become a trade emporium. In addition to the microcosmic qualities of the Andes, Unanue focused on the physical features of the land, pointing to Peru’s yet unfulfilled potential. “It seemed,” Unanue argued, “that after having created the deserts of Africa, the fragrant and lush forests of Asia, and the temperate and cold climates of Europe, God made an effort to bring together in Peru all the productions he had dispersed in the other three continents. In this manner God has sought to create [in Peru] a temple for

⁶⁵ Caldas, “Influjo del clima sobre los seres organizados (1808),” Obras completas, 112 and “Ensayo sobre el estado de la geografía,” FJC, 275.

⁶⁶ Caldas, “Estado de la geografía en el virreinato,” FJC, 276-277.

⁶⁷ Tadeo Lozano quoted in Gonzalo Hernández de Alba, Quinas Amargas. El sabio Mutis y la discusión naturalista del siglo XVIII (Bogotá: Academia de Historia de Bogotá and Tercer Mundo Editores, 1991), 148.

himself worthy of his immensity, [a temple] majestically surrounded by all the treasures hidden in this kingdom.”⁶⁸ Peru was, in short, “the most magnificent work Nature has ever created upon the earth.”⁶⁹ God had revealed a predilection for Peru in the subtleties of its physical structure. For instance, Peru had been chosen by God to keep the balance of the planet. The massive weight of the Andean mountains was responsible for tilting the earth’s axis and thus for the very existence of Europe, which otherwise would have remained under water.⁷⁰ Like Mutis, Unanue speculated that certain local products were suitable substitutes for popular products whose monopoly was in the hands of Spain’s European rivals. Coca, whose sharp, acrid particles stimulated circulation and digestion, could one day replace tea and coffee in the global economy.⁷¹ Enjoying such unparalleled physical properties, Peru was poised to supply the world with all it needed.

Curiously these ideas about the microcosm found audiences throughout the Spanish American lands, including the mountainous areas of Mexico and flat plateaus like Buenos Aires. For example, Creoles in Buenos Aires, who had long called the pampas a “desert,” useful only for wild-cattle grazing, also imagined the kingdom of La Plata as a microcosm. In their imagination La Plata became a land of multiple ecological niches poised like ancient Tyre to be “the center of all the commercial circulation of the

⁶⁸ Unanue, “Geografía física del Peru,” Mercurio Peruano, no. 4 (1792), 11; see also *ibid*, 16. Peru as a temple of God has its façade to the north: its dome is the celestial vault at the Equator; its columns are the mountains; and its perpetual lamp are the volcanoes.

⁶⁹ Unanue, “Geografía física,” 21. Like Caldas Unanue thought that the Andes was a privileged laboratory to study the influence of climate on humans (Observaciones, 47, 171).

⁷⁰ Unanue, “Geografía física,” 22-26. For a detailed analysis of Unanue’s views, see Cañizares-Esguerra, “La utopía de Hipólito Unanue: Comercio, naturaleza, y religión en el Perú,” Saberes andinos: Ciencia y tecnología en Bolivia, Ecuador y Peru, ed. Marcos Cueto (Lima: Instituto de Estudios Peruanos, 1995), 91-108.

⁷¹ Unanue, “Disertación sobre el aspecto, cultivo, comercio y virtudes de la famosa planta del Perú nombrada Coca,” Mercurio Peruano, no. 11 (1794), 241-245.

world” and, like ancient Alexandria, “a port communicating the East and the West.” In his 1799 inaugural address to the Nautical Academy financed by the Consulado of Buenos Aires to train qualified sailors for a merchant navy, Pedro Antonio Cerviño (d. 1816) called attention to the Argentine capital’s privileged central position in the world. “Our location [on the globe] is a most felicitous one,” Cerviño maintained, “[because] North America, Europe, Asia, and the Pacific Ocean are all equidistant to us. This marvelous location assures us an immense commercial traffic. [We] will become the warehouse of the universe.”⁷² In 1801 Francisco Antonio Caballe, editor of the short-lived periodical of Buenos Aires, Telégrafo Mercantil, presented the Viceroyalty of la Plata as a land capable of supplying the world with hides, tallow, wheat, cocoa, quinine, indigo, copper, henequen, “all sorts of resins and drugs, not to mention precious and abundant gold and silver...[as well as the equally precious] saltpeter, pearls, and seashells that can be found in the spacious Chaco.” Caballe concluded, “without recourse to hyperbole,” that “round the globe there is not any other land as rich, holding as many variety of products... and [thus] as suitable for establishing strong and powerful commercial institutions” as the Viceroyalty of La Plata.⁷³ By 1802 it had become a truism among Creoles that their kingdom was “like a sea, [in which] we lose ourselves in the horizon...a land of wondrous mountains with the best wood in the universe,” a land “located [right] at the center of the commercial world and deliciously situated at the

⁷² Cervino, “El tridente de neptuno es el cetro del mundo: Discurso inaugural de la Academia Náutica, del 25 noviembre de 1799,” reproduced in José Carlos Chiaramonte, La Ilustración en el Río de la Plata. Cultura eclesiástica y cultura laica durante el Virreinato, (Buenos Aires: Punto Sur Editores, 1989), 295.

⁷³ Caballe, “Continua la idea general del comercio de las provincias del Rio de la Plata,” Telégrafo Mercantil, Rural, Politico-economico, e Historiografo del Rio de la Plata, vol. 4 (11 April 1801), cited in Chiaramonte, La Ilustración, 227 and 229 (on the privileged central position of Buenos Aires).

margins of a mighty river”--in short, a land “with the greatest productive power in the globe.”⁷⁴

Mexico also found an avid audience for these kinds of microcosmic narratives. Juan Manuel de San Vicente, for example, argued in 1768 that Mexico, like Babylon, was “the world writ small (an epitome);” its markets demonstrated the abundance of “this second Terrestrial paradise.”⁷⁵ The physician Juan Manuel Venegas offered in 1788 cures for all sorts of diseases with prescriptions based on Mexican plants. For Venegas, New Spain was “the purse of Omnipotence; an Eden capable of providing Europe not only with precious metals, but also with many of the noblest vegetables, roots, woods, fruits, gums, and balms.”⁷⁶ And José Monciño, one of many late-eighteenth-century Creole naturalists intent on writing a materia medica based on local plants and Nahua herbal lore, was convinced that “every single medicinal substance [in the world], with the exception of some three or four, can be abundantly supplied by our land. [Mexico] produces, if not the same medicinal botanical species, others that are of equivalent or perhaps of superior efficacy.”⁷⁷

⁷⁴ “Comercio,” Seminario de Agricultura, vol. 4 (13 October 1802) *ibid.*, 266-267;

“Agricultura,” Seminario de Agricultura, vol. 1 (1 September 1802), *ibid.*, 254.

⁷⁵ San Vicente, Exacta descripción de la magnífica corte mexicana, cabeza del nuevo americano mundo (Cadiz, 1768), reproduced in Anales del Museo Nacional de Antropología de México, 3ra época, vol. 5 (1913), 32, 34.

⁷⁶ Venegas, Compendio de la medicina o medicina práctica (Mexico, 1788), advertencia (n.p.).

⁷⁷ Quoted in E. Trabulse, Historia de la ciencia en México (version abreviada) (Mexico, 1994), 116-117.

Conclusion

Natural history and botany played significant economic and ideological roles in the early-modern world. In the first phase of colonization of the New World, Europeans single-mindedly pursued mineral riches. From Hernán Cortes to Walter Raleigh, conquistadors and explorers saw the New World both as an obstacle on the way to Asia and as an endless source of gold and silver. This was all to change by the seventeenth century. The emergence of a fledgling mass-consumption society in northern Europe set off a plantation boom on the Atlantic shores of the Americas, based on the ruthless exploitation of slave and indentured labor. The new wealth of the Americas suddenly turned “green.” As the other contributors to this volume make clear, growing, harvesting, and distributing sugar, tobacco, coffee, indigo, rice, and quinine, to name only a few food staples and drugs, became sources of fabulous new wealth for both governments and merchants. The Iberian Catholic Monarchy, however, proved slow to adjust to this new era: Under Philip III and Philip IV, the Portuguese footholds in the Indian Ocean and the China Seas were picked off one by one by the Dutch, who transformed the loose multi-ethnic, maritime trading networks of South East Asia into monopolies to control the production and distribution of nutmeg, cloves, and pepper. The Catholic Monarchy could not stem the northern-European barrage in the New World either. It was only in the late eighteenth-century that, under the command of a new Bourbon dynasty, the Spanish monarchy began to compete in the new global agricultural-botanical markets. By then it was simply too late. The possessions of Spain in the New World had already become independent kingdoms, with traditions of self-rule and historical identities resistant to easy colonial subordination. The well-intentioned plans of botanists to use the New

World to grow cloves, cinnamon, and other spices to break the Dutch and British monopolies proved to be a mirage.

But if the great Bourbon botanical plans never materialized, the cultural transformation they brought about was profound. In societies that had long considered themselves kingdoms, the new botany became new cultural capital, namely, providential idioms and discourses highlighting the untapped economic potentials of each polity. Projects designed to turn local societies into subordinate appendages of a new, revitalized modern empire unwittingly offered ideological tools that allowed those communities to think of themselves, literally, as Middle Kingdoms. Like their contemporary Qing counterparts in China, Creole intellectuals came to think of local polities as the center(s) of the world. The old microcosmic narratives initially deployed to prove that America had been the original location of paradise were suddenly redeployed to rethink the future of local kingdoms under duress.

The encounter with the Andes and the long-standing tradition of thinking about local kingdoms as microcosms could have not failed to impress Humboldt. His trip to Spanish America was not planned in advance: he had actually been trying to go to Egypt. He did not voyage to South America deliberately looking to prove Forster's and Willdenow's speculations on biodistribution true; his encounter with the Andes was serendipitous. Prompted by the ceaseless rhetoric about the microcosmic virtues of the Andes, Humboldt began to think of these mountains as a laboratory for testing theories of biodistribution. Historians have managed to write histories of biogeography without acknowledging that crucial components of Humboldt's ideas did not emerge in Europe. Humboldt arrived in a Spanish America humming with discourses of nature in which

each patria was cast as a microcosm wondrously poised to become a trade emporium. Humboldt learned to read the Andes as a natural laboratory for studying the geography of plant communities only because local scholars had for years been toying with this idea. Bringing a Pan-Atlantic perspective to bear on seemingly esoteric subjects such as the origins of the science of biogeography can yield strikingly rich harvests that challenge narratives of subjects that have managed to remain firmly North-Eurocentric in an age of transnational and global historiographies.

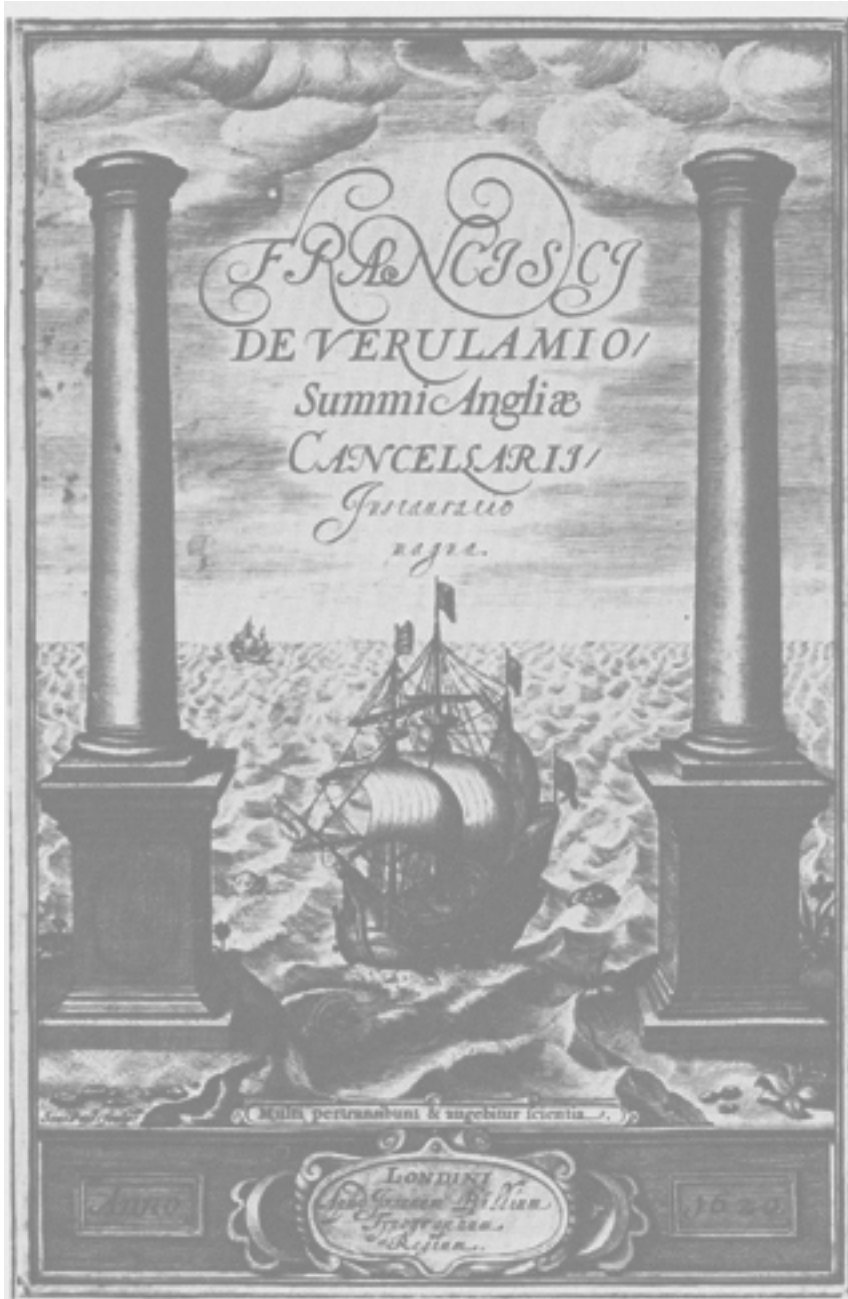


Figure 1: Frontispiece. Francis Bacon. *Instauratio Magna* (London, 1620)



Figure 2: Philippe Galle (after Jan van der Straet) *Nova Reperta* (ca. 1580)



Figure 3: Frontispiece, Andrés García de Céspedes, *Regimiento de Navegación* (Madrid, 1606)



Figure 4: Frontispiece, *Ordenações manuelinas* (Lisbon, 1521)



Figure 5: Bernardo de Vargas Machuca's *Milicia y descripción de las Indias* (Madrid 1599)



Figure 6: Frontispiece Hernandez's *Rerum Medicarum Novae Hispaniae Thesaurus* (Rome, 1651)

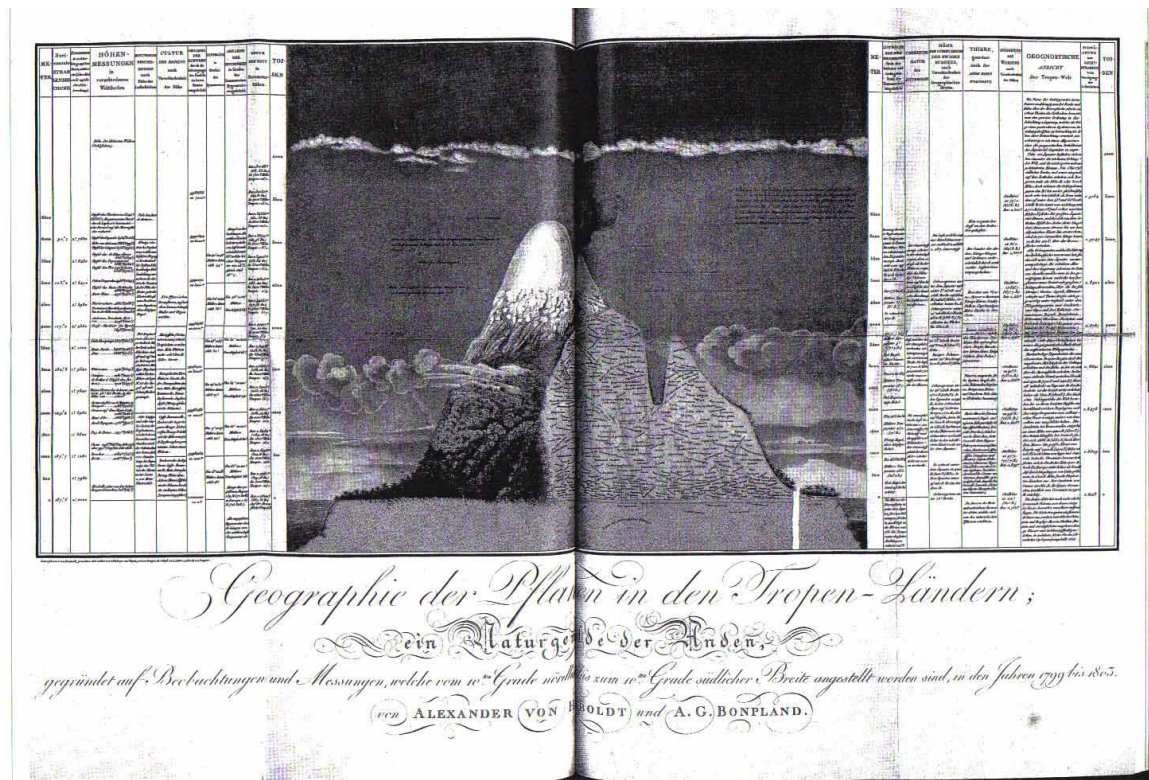


Fig. 7. Alexander von Humboldt's cross-sectional map of the Andes, in which correlations between plant communities, soil composition and heights are shown. Source *Essai sur la géographie des plantes* (Paris, 1805).

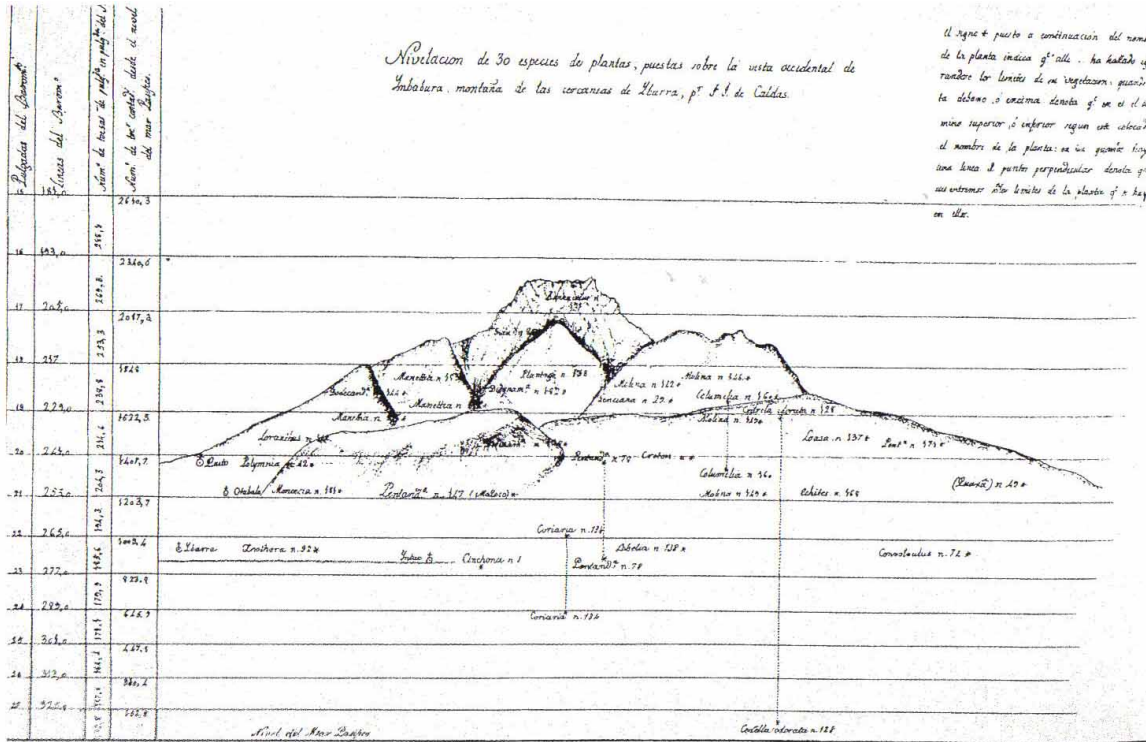


Fig. 8. Cross-sectional map of the Andes indicating correlations between altitude and the distribution of thirty plants. This is one of many maps drawn circa 1802 by Francisco José de Caldas that demonstrates striking similarities with those later published by Humboldt. Caldas was inspired by a map Humboldt drew in October 1801. Source Archivo del Real Jardín Botánico de Madrid (ARJBM), Division III, Signatura M-529. Published with the permission of the ARJBM.

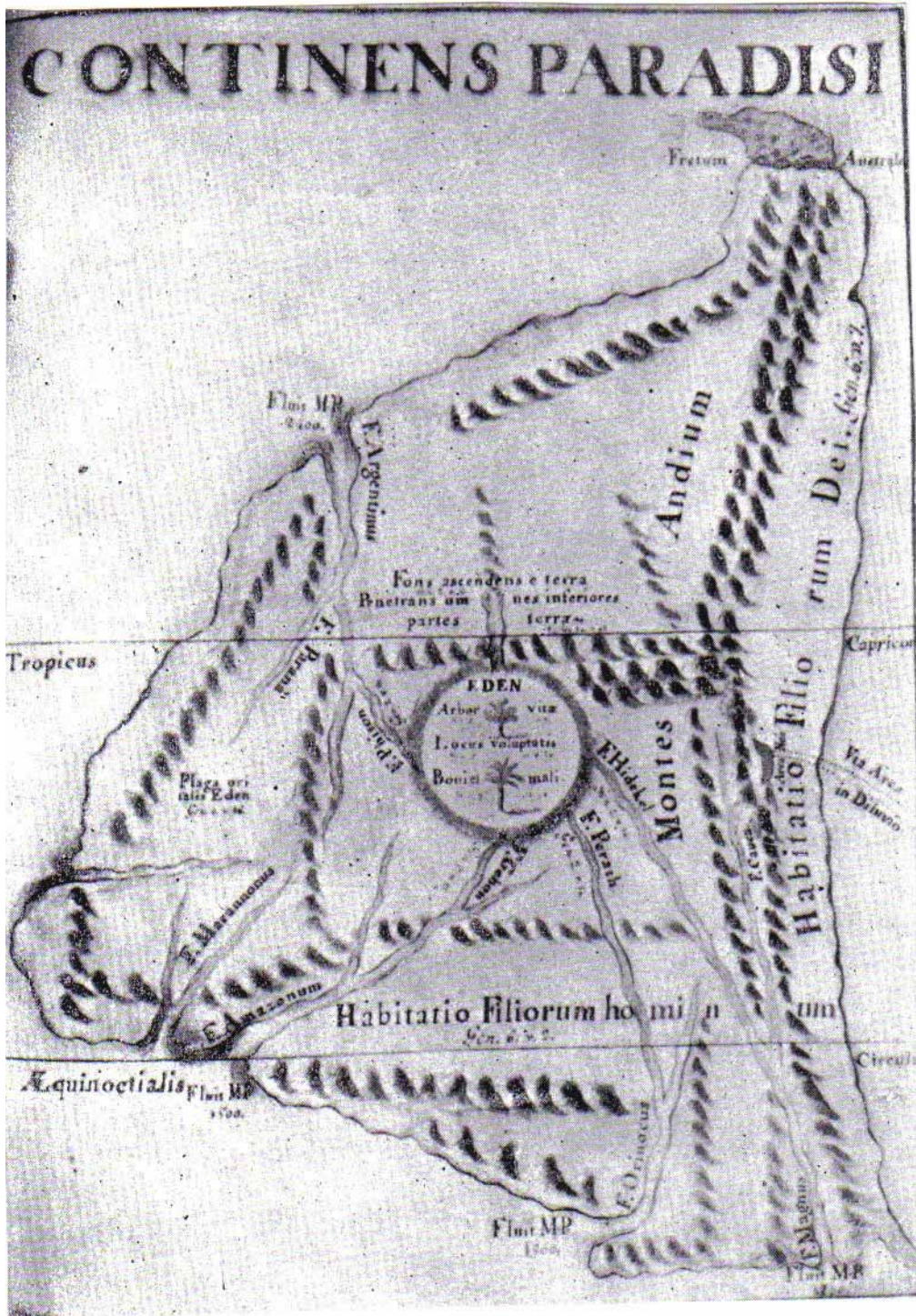


Fig. 9. Location of paradise in South America according to Antonio de León Pinelo. Source, Antonio de León Pinelo, *El paraíso en el Nuevo Mundo*, ed. Raul Porras Barrenechea 2 vols. (Lima: Imprenta Torres Aguirre, 1943).

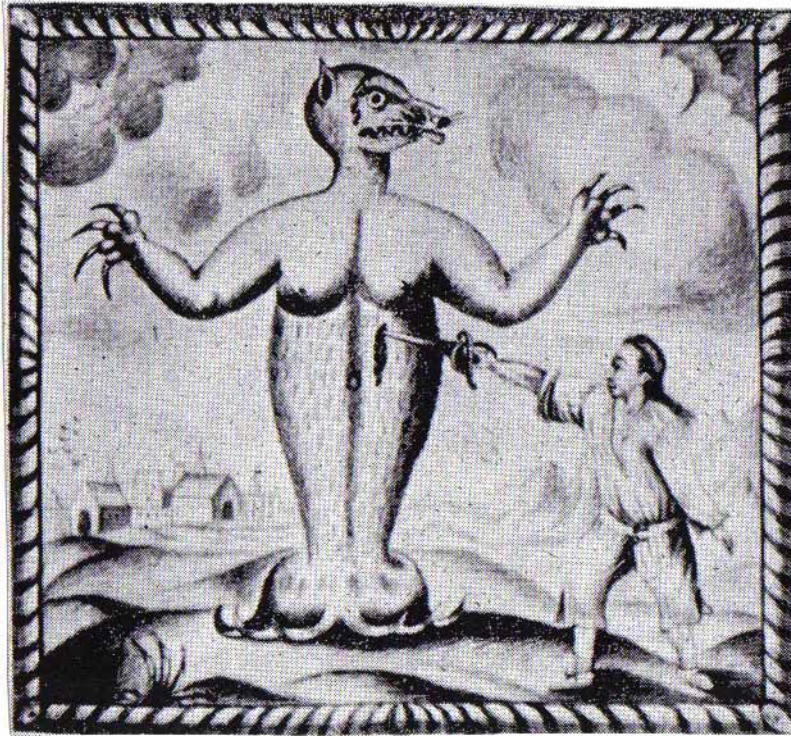


Fig. 10. A monster in Peru. Source: Antonio de León Pinelo, El paraíso en el Nuevo Mundo, ed. Raul Porras Barrenechea, 2 vol. (Lima: Imprenta Torres Aguirre, 1943).



Fig. 11. The passion flower with all the different instruments used in Christ's passion. Source: John Parkinson. Paradisi in sole paradisus terrestris (London, 1629). Pinelo was clearly drawing upon a well-established tradition of theological scholarship concerning this flower. This tradition begins in 1609 with the publication of works by Donato Rasciotti, Copia del fiore et frutto che nasce nelle Indie Occidentali., qual di nuovo e stato presentato all Santità di NSP Paolo V (1609) and Simone Parlasca, Il fiore della Granadiglia, ouere della passione di nostro signore Gieso Christo; spiegato, e lodato con discorsi, e varie rime (Bologna: Bartolomeo Cocchi, 1609).

