Center for Environmental Research at Hornsby Bend

Austin WATER

2022 CER Lunchtime Lectures - Humboldt, Science, and The Geography of Nature

Western Culture and the Study of Nature

January – Natural Philosophy and the Study of Nature
February – Natural History and the Taxonomy of Nature
March – Ecological Imperialism and the Geography of Nature
April – Physical Geography and the Science of Nature

Humboldt and the Science of Nature

May – The Science of Nature: Humboldt and the Empirical Earth
June – The Romance of Nature: Science, Imagination, and the Poets of Nature
July – The Invention of Modern Nature: The Earth as a "Natural Whole"
August – The Evolution of Nature: Humboldt, Darwin, and Biogeography
September – The Economy of Nature: Ecology, Culture, and Cosmos

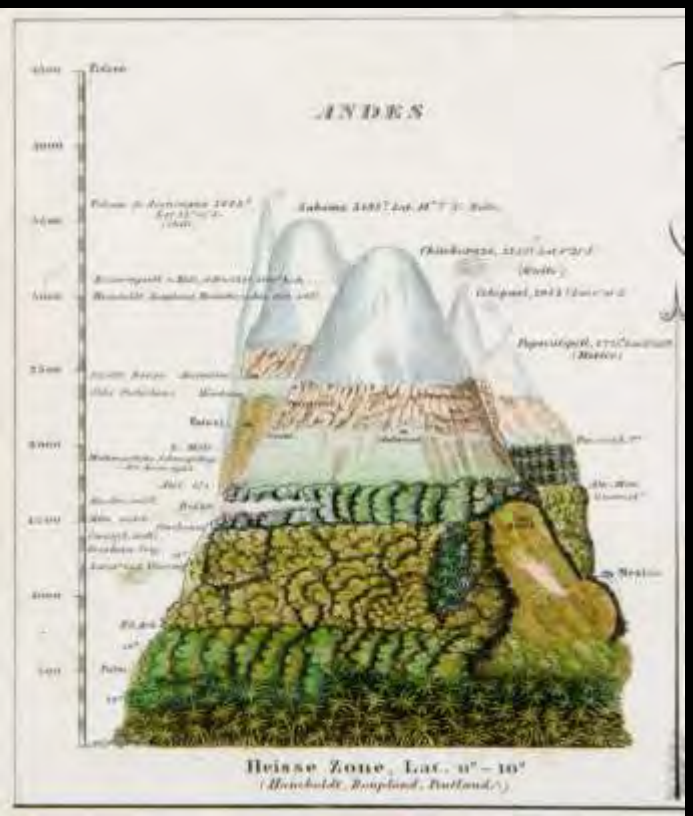
Humboldt and the Geography of Nature

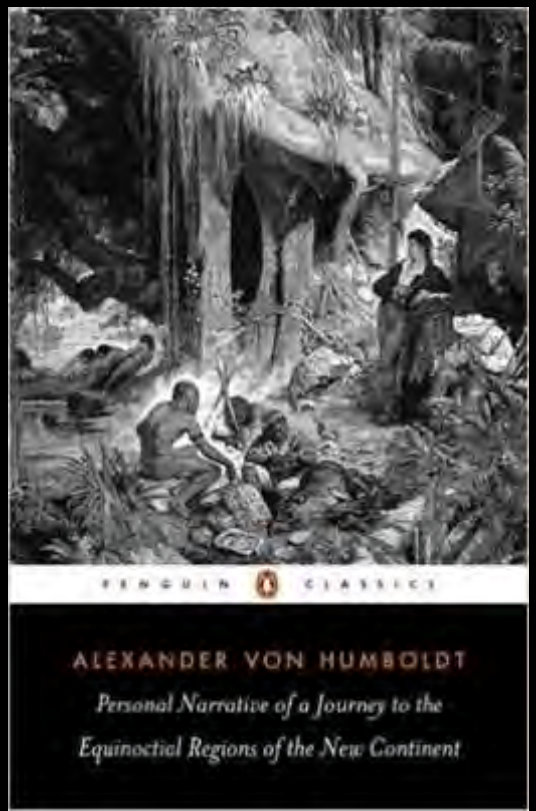
October – The Great Disruptors: Physical Geography as Modified by Human Action
November – The Earth Managers: New Science and Environmental Change
December – The Anthropocene: Gaia and the Geography of Nature

Center for Environmental Research at Hornsby Bend

The Invention of Modern Nature: The Earth as a "Natural Whole"

Kevin M. Anderson Ph.D.
Austin Water Center for Environmental Research





1796 – Their mother, Marie-Elisabeth, dies in November 1796.

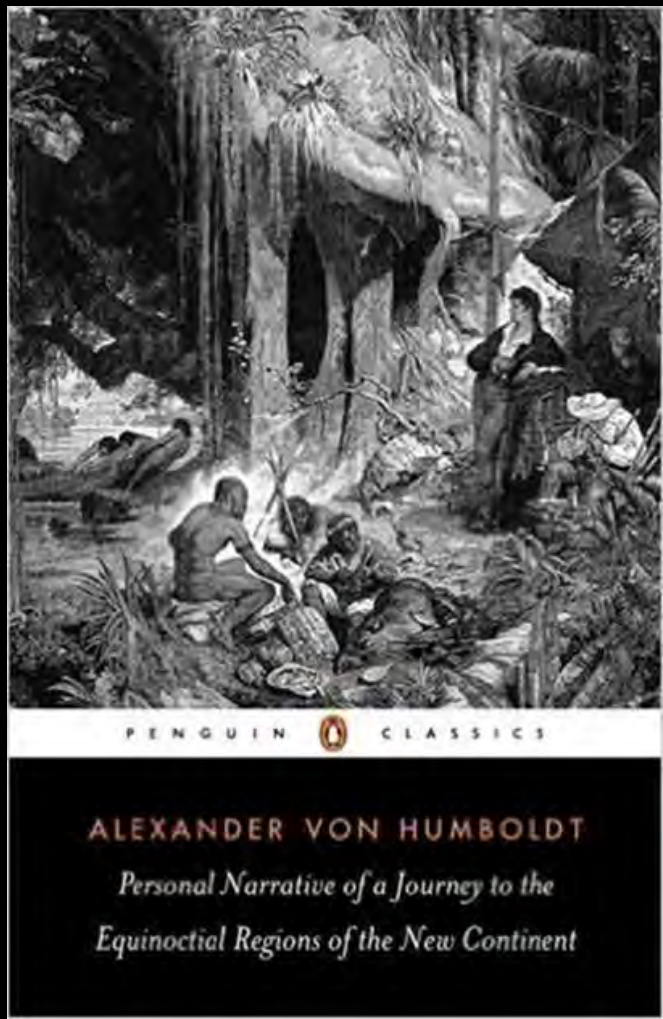
- “We have always been strangers”
- The Humboldt brothers came into a considerable inheritance.
- Alexander abandons his career in the Prussian Ministry of Mines and plans an expedition outside of Europe.
- Alexander is 27

1796 – Humboldt the Scientific Traveler

"I have made the irrevocable decision to embark on this journey. I shall avail myself of the next few years to prepare for the voyage and assemble all necessary instruments. I shall spend one or one-and-one-half years in Italy to study the volcanoes. I shall then travel to England stopping first in Paris. Then it's off to the West Indies."

The Torrid Zone – Equinoctial Regions of the New Continent

"What attracted me about the torrid zone was no longer the promise of a wandering life full of adventures, but a desire to see with my own eyes a grand, wild nature rich in every conceivable natural product, and the prospect of collecting facts that might contribute to the progress of science." Humboldt, *Personal Narrative*



James Cook's Voyages
1768–71
1772–75
1776–79
ARCTIC OCEAN
ASIA
Vancouver Island
NORTH AMERICA
PACIFIC OCEAN
Hawaii
ATLANTIC OCEAN
ENGLAND
Whitby
EUROPE
AFRICA
Christmas Island
Marquesas Islands
Tonga Island
Tahiti
SOUTH AMERICA
Rio de Janeiro
AUSTRALIA
Easter Island
Tasmania
Cook Islands
New Zealand
Tierra del Fuego
Cape of Good Hope
Cape Horn
ANTARCTICA
0 2,000 4,000 miles
0 2,000 4,000 kilometers

The Republic of Letters

Nature, Science, Imagination, Liberty, and Revolution

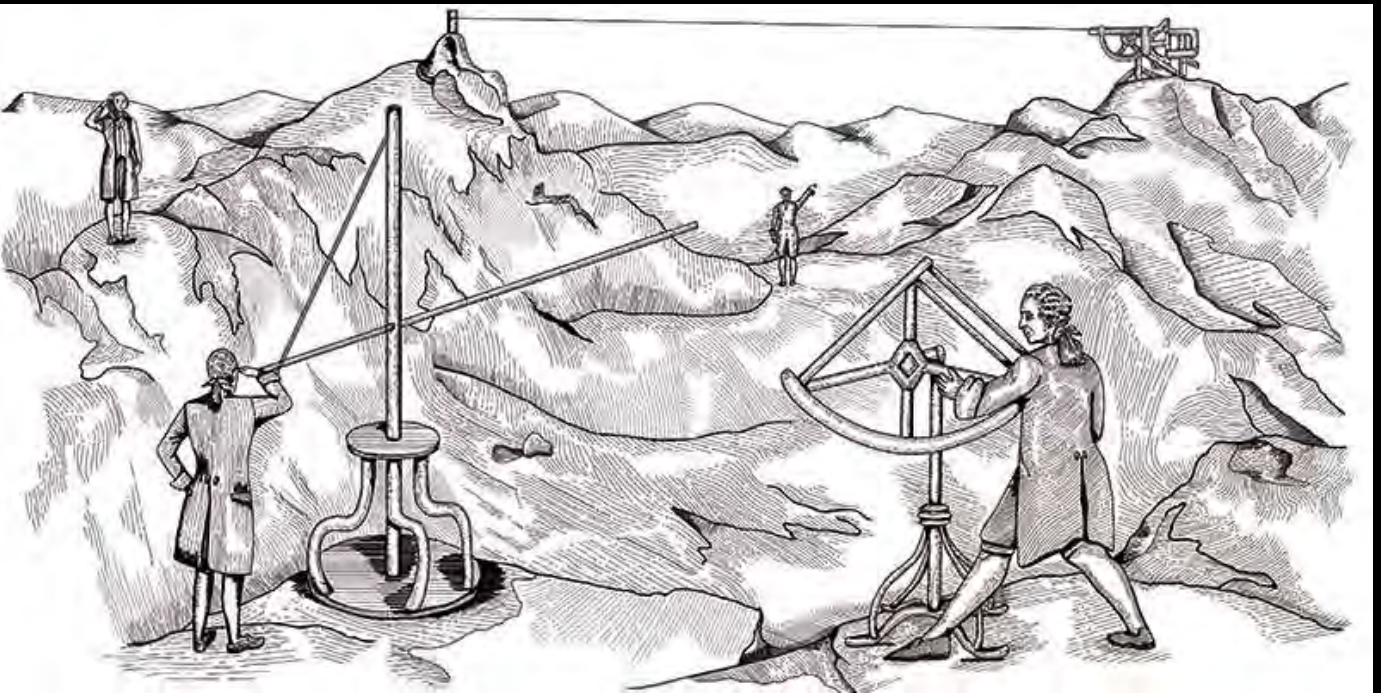
Humboldt's South American Expedition, 1799–1804

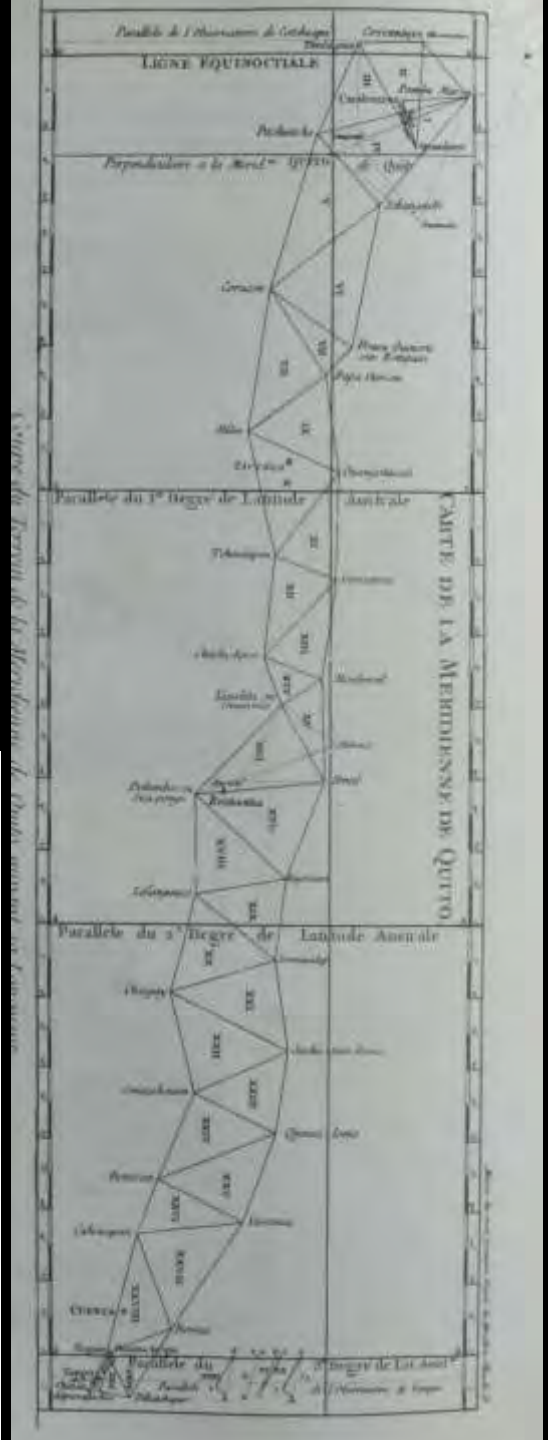
Map by Alexander Karnstedt, Wikipedia Commons

Scientific Travelers, Measurement, and America

French-Spanish Geodesic Mission to the Equator 1735-45

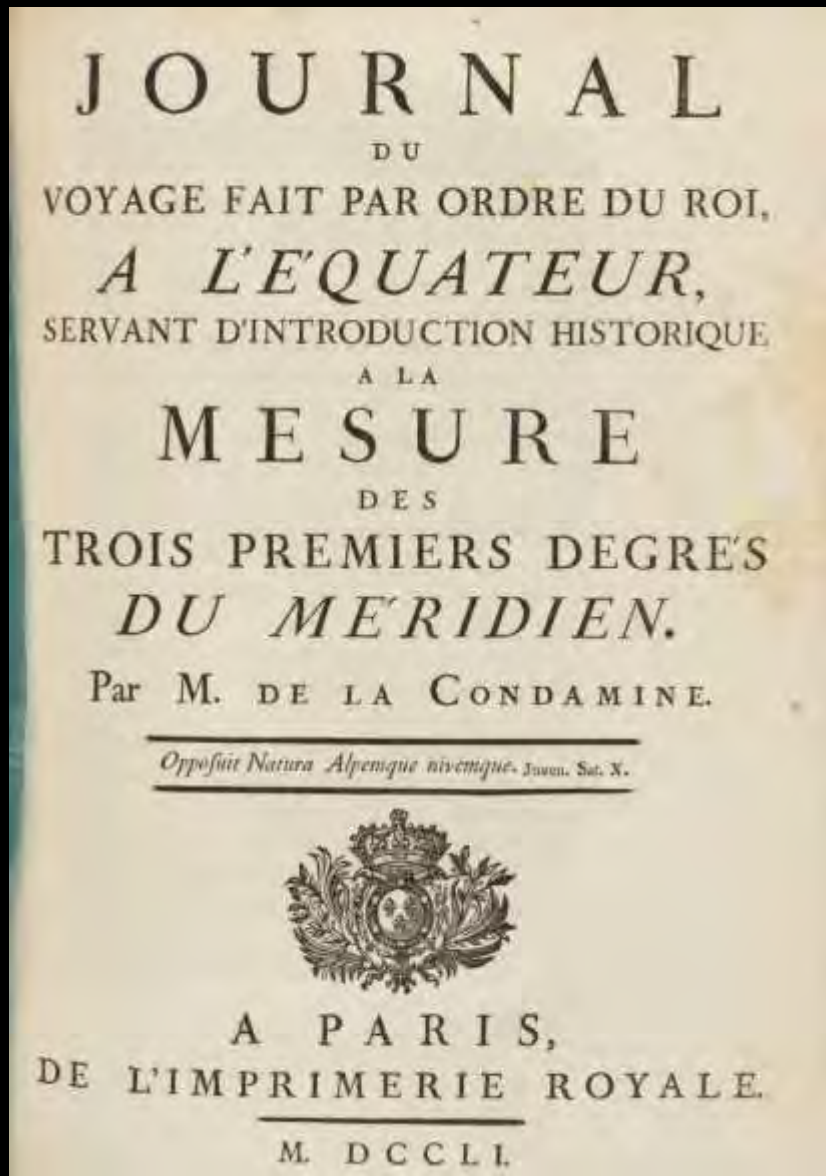
- Paris Academy of Sciences in partnership with Spain sent a mission to the Spanish American province of Quito
- Measure the length of a degree latitude at the equator and prove that the Earth bulges at the Equator





The equatorial mission was led by French astronomers Charles Marie de La Condamine, Pierre Bouguer, Louis Godin and Spanish geographers Jorge Juan and Antonio de Ulloa. They were accompanied by several assistants, including the naturalist Joseph de Jussieu and Louis's cousin Jean Godin.

Charles Marie de La Condamine
(1701-1774)



JOURNAL
DU
VOYAGE FAIT PAR ORDRE DU ROI,
A L'EQUATEUR,
SERVANT D'INTRODUCTION HISTORIQUE
A LA
MESURE
DES
TROIS PREMIERS DEGRE'S
DU MERIDIEN.
Par M. DE LA CONDAMINE.

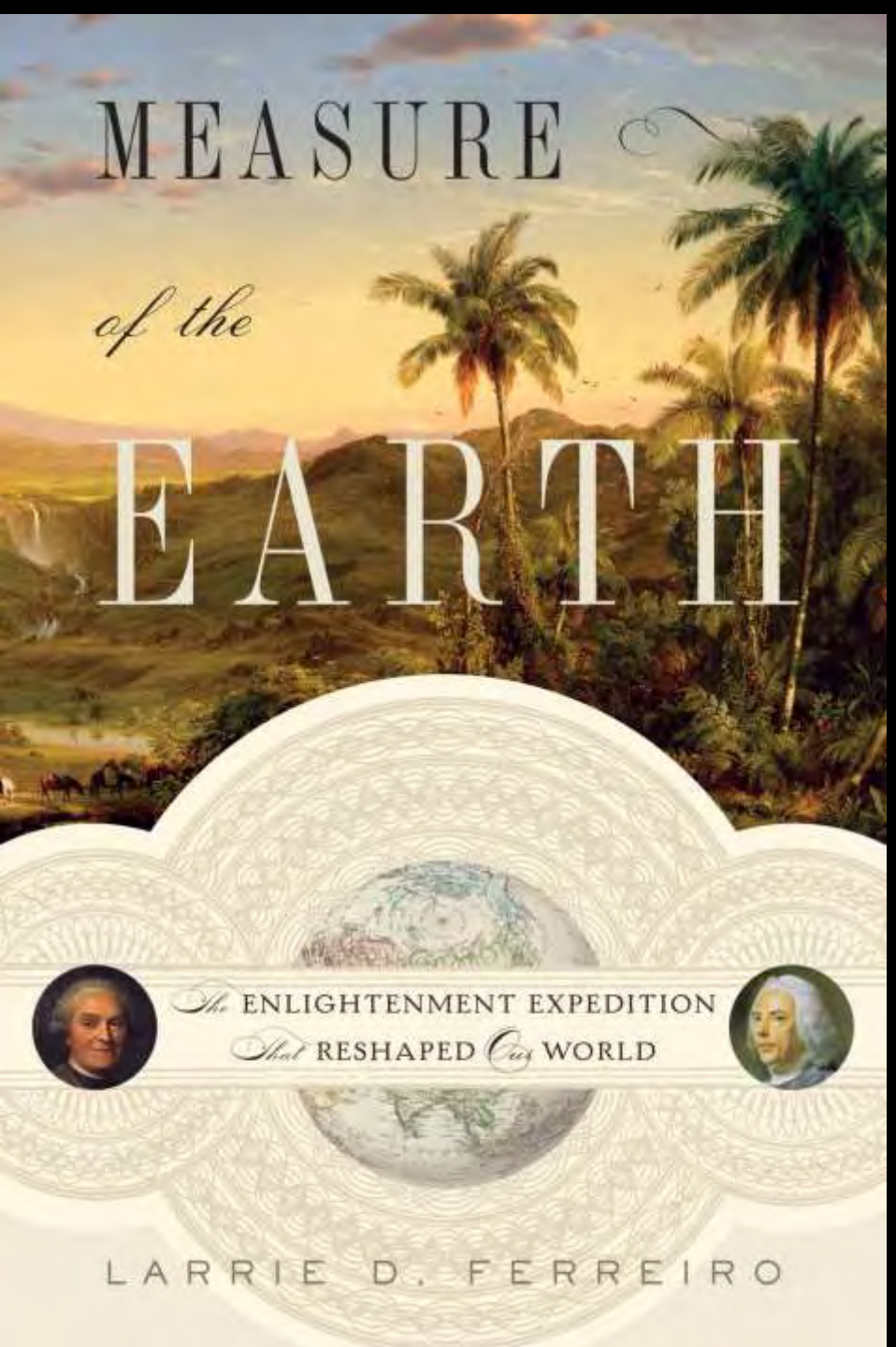
Oppositi Natura Alpesque nivesque. Juven. Sat. X.

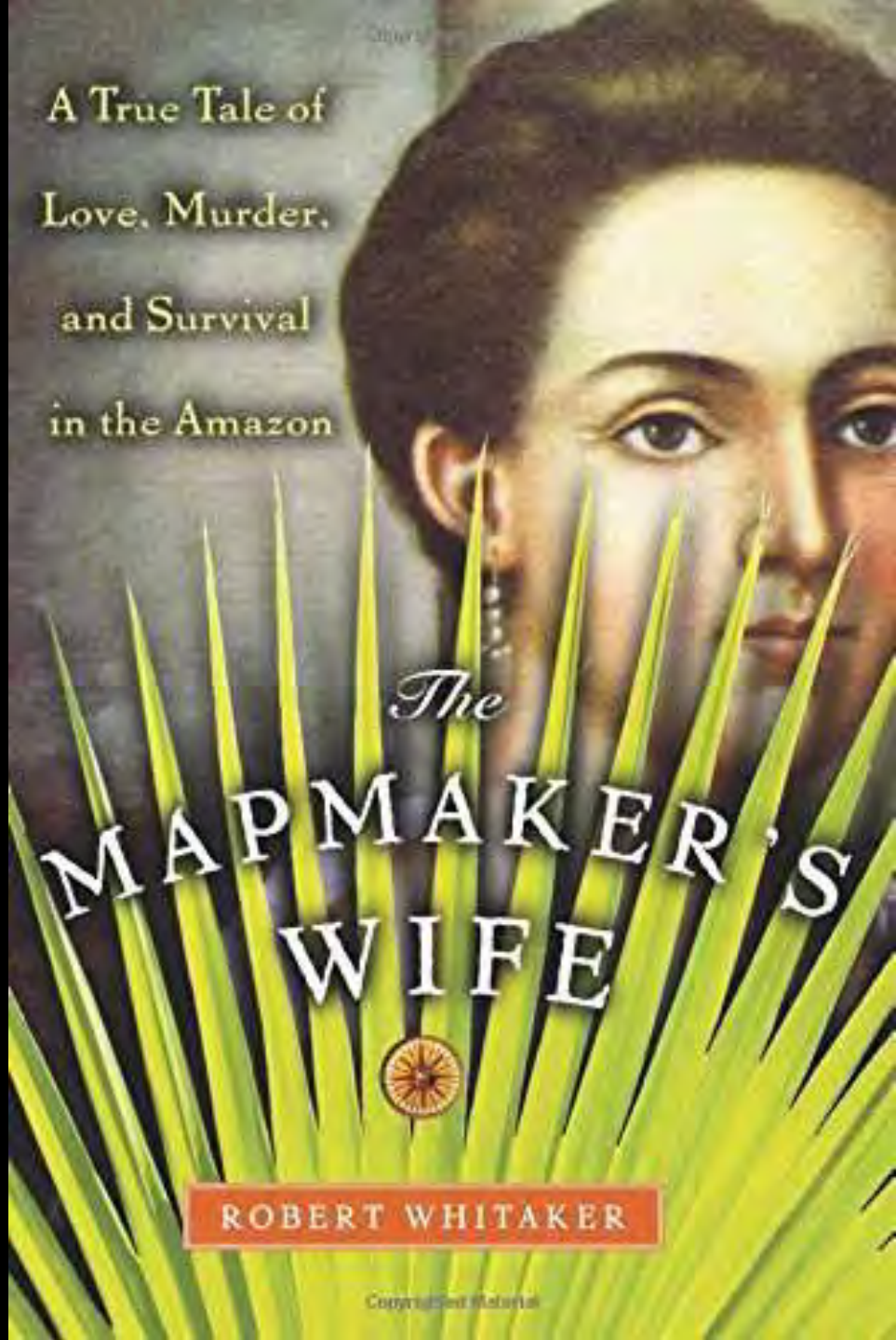
A PARIS,
DE L'IMPRIMERIE ROYALE.
M. DCC LI.

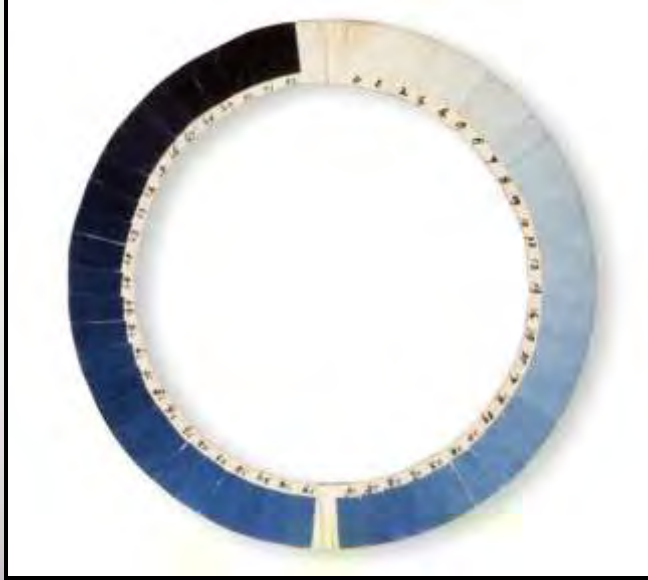
First Scientific Exploration of the Amazon River 1743

La Condamine returns by traveling down the Amazon with Ecuadoran geographer and topographer Pedro Maldonado.

La Condimine publishes the first accurate map of the Amazon River


MEASURE
of the
EARTH
The ENLIGHTENMENT EXPEDITION
That RESHAPED Our WORLD
LARRIE D. FERREIRO


A True Tale of
Love, Murder,
and Survival
in the Amazon
The
MAPMAKER'S
WIFE
ROBERT WHITAKER



Cynometer – to measure the blueness of the sky at different altitudes

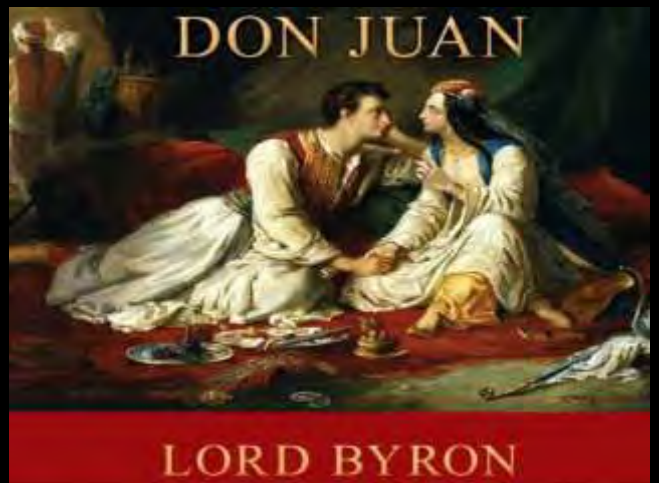
1797 Measuring the Earth

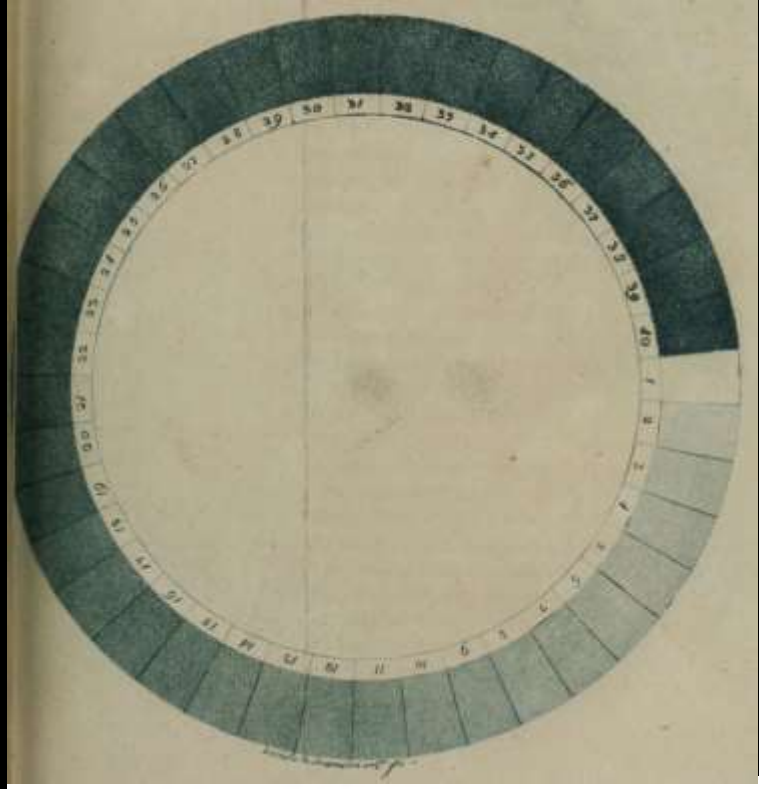
- Assembled an array of the newest and best scientific instruments
- Scientific journey through the Alps taking magnetic, topographical, and meteorological measurements – practice for a bigger journey

O! 'darkly, deeply, beautifully blue,'
As some one somewhere sings about the sky,
And I, ye learned ladies, say of you;

Humboldt, 'the first of travellers,' but not
The last, if late accounts be accurate,
Invented, by some name I have forgot,
As well as the sublime discovery's date,
An airy instrument, with which he sought
To ascertain the atmospheric state,
By measuring 'the intensity of blue:'
O, Lady Daphne! let me measure you!

Lord Byron, *Don Juan*
Canto 4, Stanza 112 (1820)





1798 Paris – Capital of Science and Liberty

Paris was the perfect place from which to launch the expedition, so he joined Wilhelm and Caroline there.

Meets Louis-Antoine de Bougainville and invited on a trip around the globe…

Scientific Traveler
Louis-Antoine de Bougainville
(1729-1811)

- first French circumnavigation of globe 1766-69
- *Voyage around the World* 1771
- Bougainville urged Humboldt to accompany him on a major expedition around the globe, likely to last five years

A

VOYAGE

ROUND THE

WORLD.

Performed by Order of

HIS MOST CHRISTIAN MAJESTY,

In the Years 1766, 1767, 1768, and 1769.

BY

LEWIS DE BOUGAINVILLE,

Colonel of Foot, and Commodore of the Expedition, in the Frigate La Boudeuſe, and the Store-ſhip L'Etoile.

Tranſlated from the French

By JOHN REINHOLD FORSTER, F. A. S.

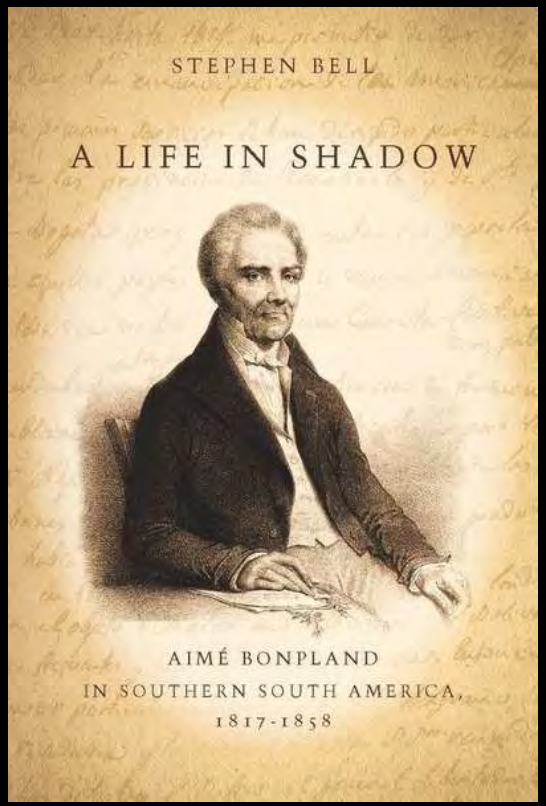
LONDON,

Printed for J. NOURSE, Bookſeller to HIS MAJESTY, in the Strand; and T. DAVIES, Bookſeller to the Royal Academy, in Ruſſel-ſtreet, Covent-garden.

MDCCLXXII.

Aimé Bonpland 1773 – 1858

- Bougainville also recruits a 25 year old botanist
- Born in La Rochelle, France 1773
- 1791-1796 studies medicine and botany in Paris
- 1798 meets Alexander in Paris and they become friends and, after Bougainville expedition is cancelled, decide to travel together



1798 Passport "... aged twenty-eight years, height five feet eight inches, light brown hair, gray eyes, large nose, rather large mouth, well-formed chin, open forehead, marked with the smallpox.“

Charles IV of Spain

LA CORUÑA

LUGO

Astorga

CASTILLA

PERPIGNAN

BARCELONA

TARRAGONA

Sierra de Guadarrama

MADRID

Aranjuez

LA MANCHA

Sagunto

VALENCIA

ITINERARIO DE HUMBOLDT POR LA PENÍNSULA IBÉRICA

Diciembre de 1798 / Junio de 1799

“I shall try to find out how the forces of nature intereact upon one another and how the geographic environment influences plant and animal life. In other words, I must find out about the unity of nature.”

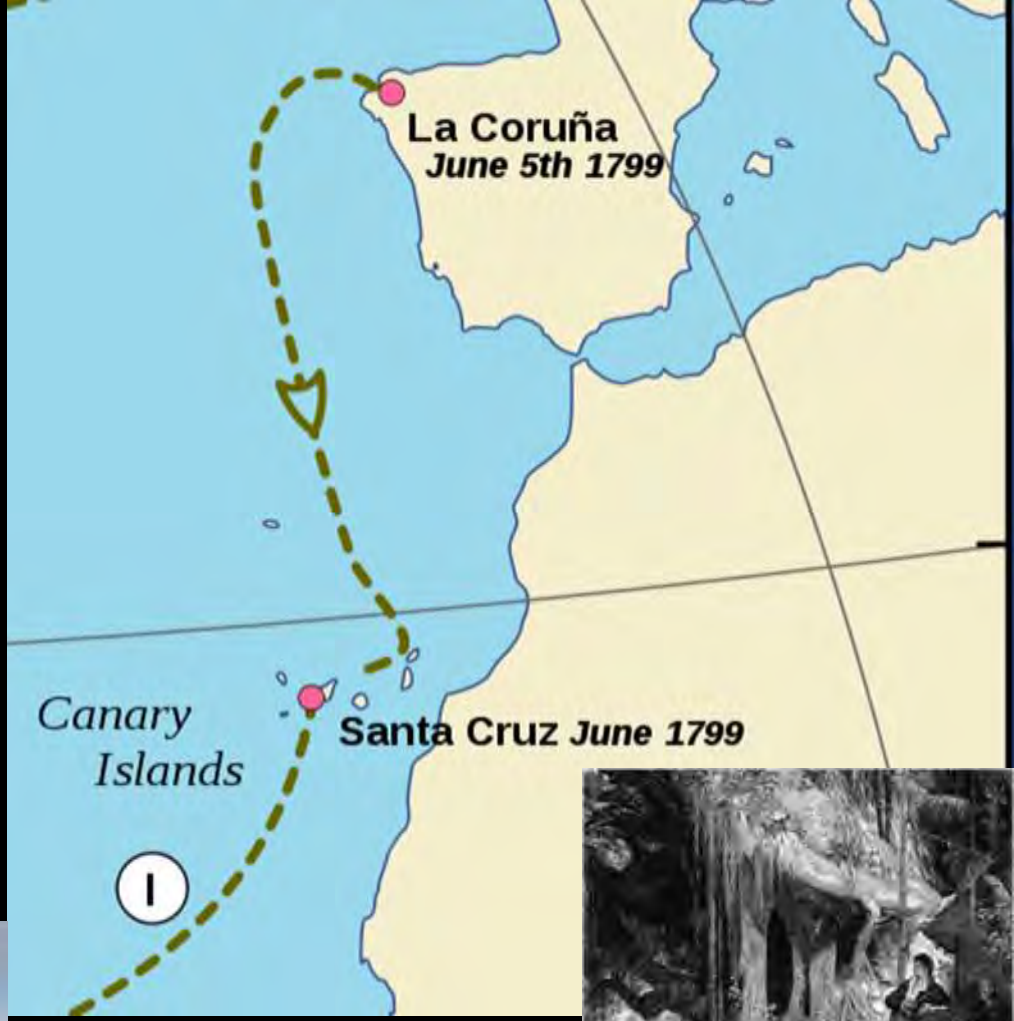
Armed with authorization from the King of Spain, Humboldt and Bonpland made haste to sail, taking the ship *Pizarro* from Spain on June 5, 1799 bound for Cuba

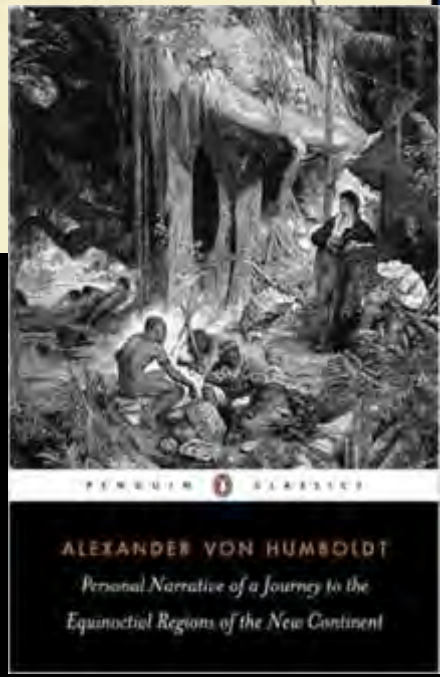
"Separated from the objects of our dearest affections, and entering into a new life, we are forced to fall back on ourselves, and we feel more isolated than we have ever felt before"

The Scientific Traveler

"My constitution was such that I never suffered from seasickness, and every time I made a sea voyage, I always felt a great urge to work."

Darwin was seasick throughout his voyage





Canary Islands

June 1799

They stayed six days on the island of Tenerife, where Humboldt and Bonpland climb the volcano Teide

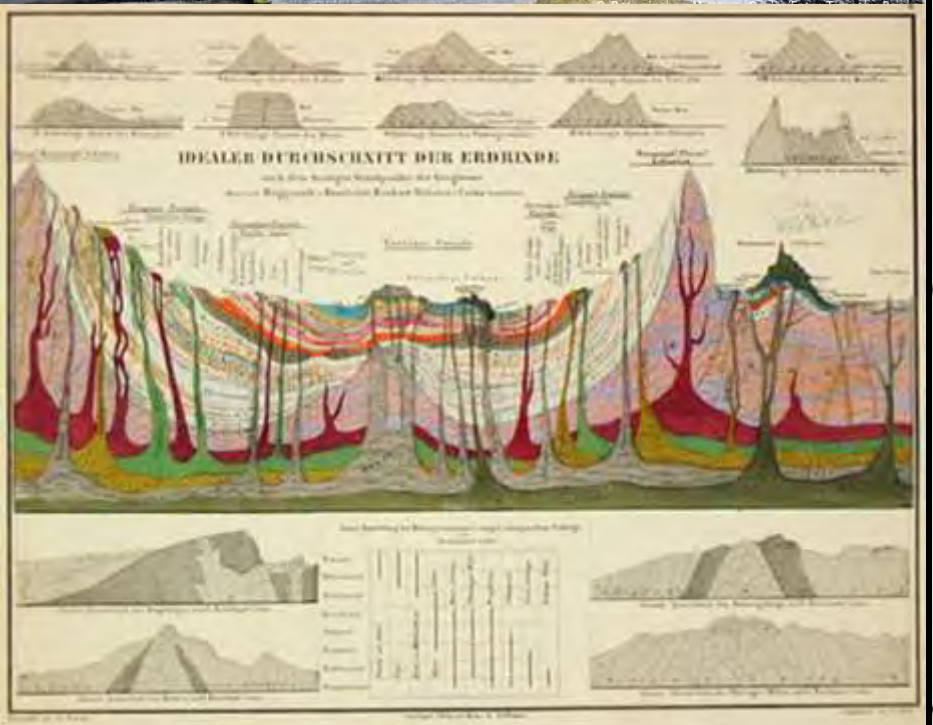
Canary Islands
Climb Pico de Teide, Tenerife

Vue de l'intérieur du Cratère du Pic de Ténériffe

De l'Imprimerie de Langlois

Humboldt and Volcanoes

Vulcanism vs Neptunism



The Torrid Zone - Arrival in South America July 16, 1799

After fever breaks out on ship, they land in Cumaná, Venezuela and enter the tropics

Ferdinand Bellermann, Landschaft in Venezuela, 1863

Mad Things in the Torrid Zone

"How colorful the birds are, the fishes, even the crabs (sky blue and yellow)! We've been running about like mad things, and in the first three days couldn't identify anything at all – we're forever throwing away one thing so as to be able to pick up another.

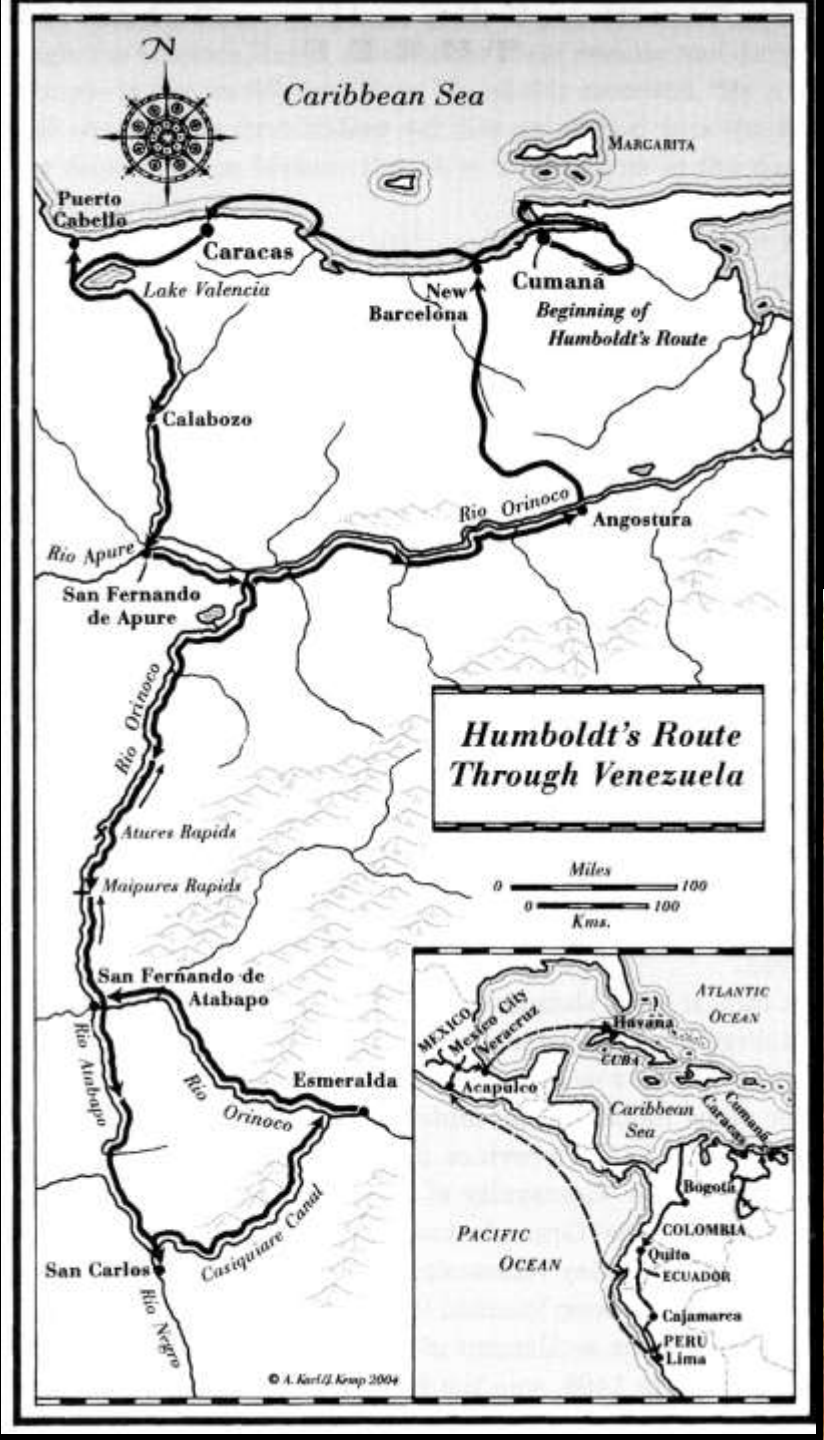
Bonpland assures me that he will lose his mind if the wonders aren't going to cease soon…I can feel it, I shall be very happy here."

Letter to Wilhelm July 16 1799

They proceeded to Caracas where they climbed their first mountain in South America with the young poet Andrés Bello, the former tutor of Simón Bolívar.

Venezuela, the Llanos, and the Orinoco 1799–1800

In February 1800, Humboldt and Bonpland left the coast to explore the course of the Orinoco River and its tributaries.



Los Llanos

"The llanos and pampas of South America are really steppes. During the rainy season they appear beautifully green, but in the dry season they look more like deserts…the infinite monotony of the llanos; the difficulties of travelling in such heat and in an atmosphere darkened by dust; the perspective of the horizon, which constantly retreats before the traveler…all these aspects make the stranger looking at the llanos think they are far larger than they are."

Animal Electricity

They observed the spectacle of native fisherman collecting electric eels (Electrophorus electricus) by “fishing with horses”.

The strategy was to herd horses into a pool containing electric eels, provoking the eels to attack by pressing themselves against the horses while discharging. Once the eels were exhausted, they could be safely collected.

Humboldt and Bonpland captured and dissected some eels, which retained their ability to shock, both received potentially dangerous electric shocks during their investigations.

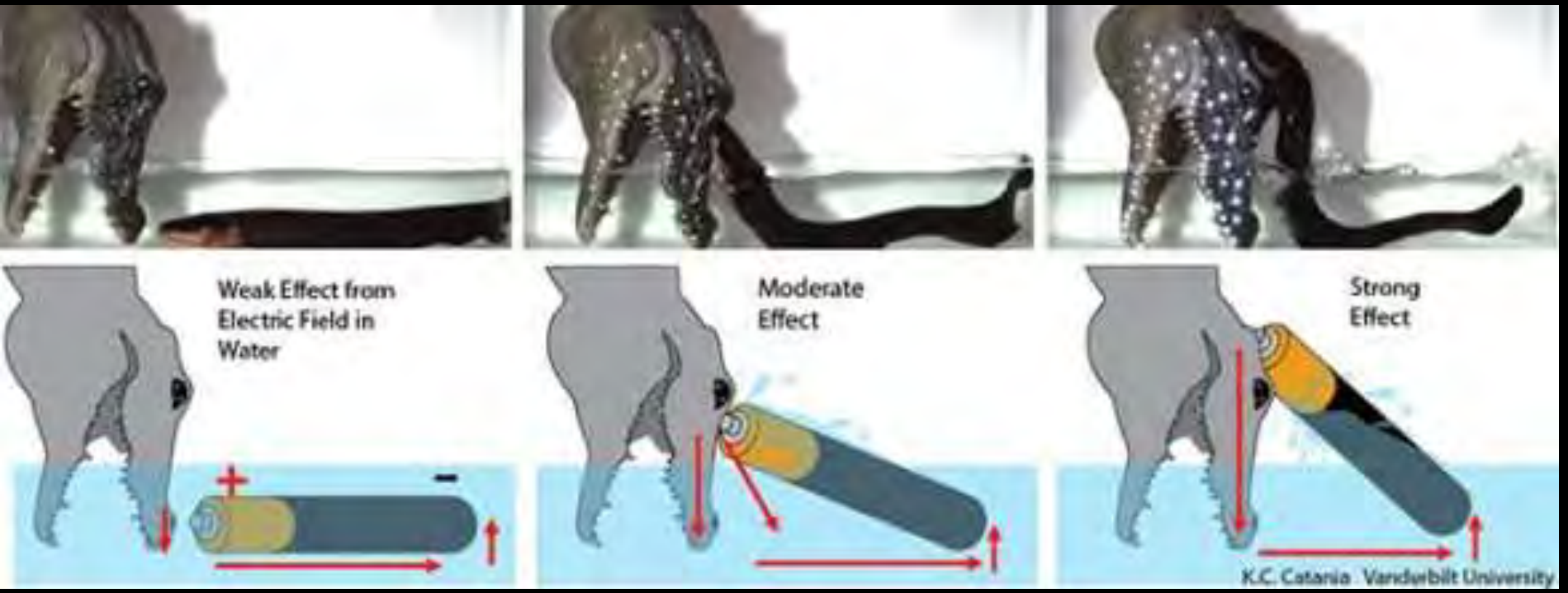
Proceedings of the National Academy of Sciences of the United States of America - April 28, 2016

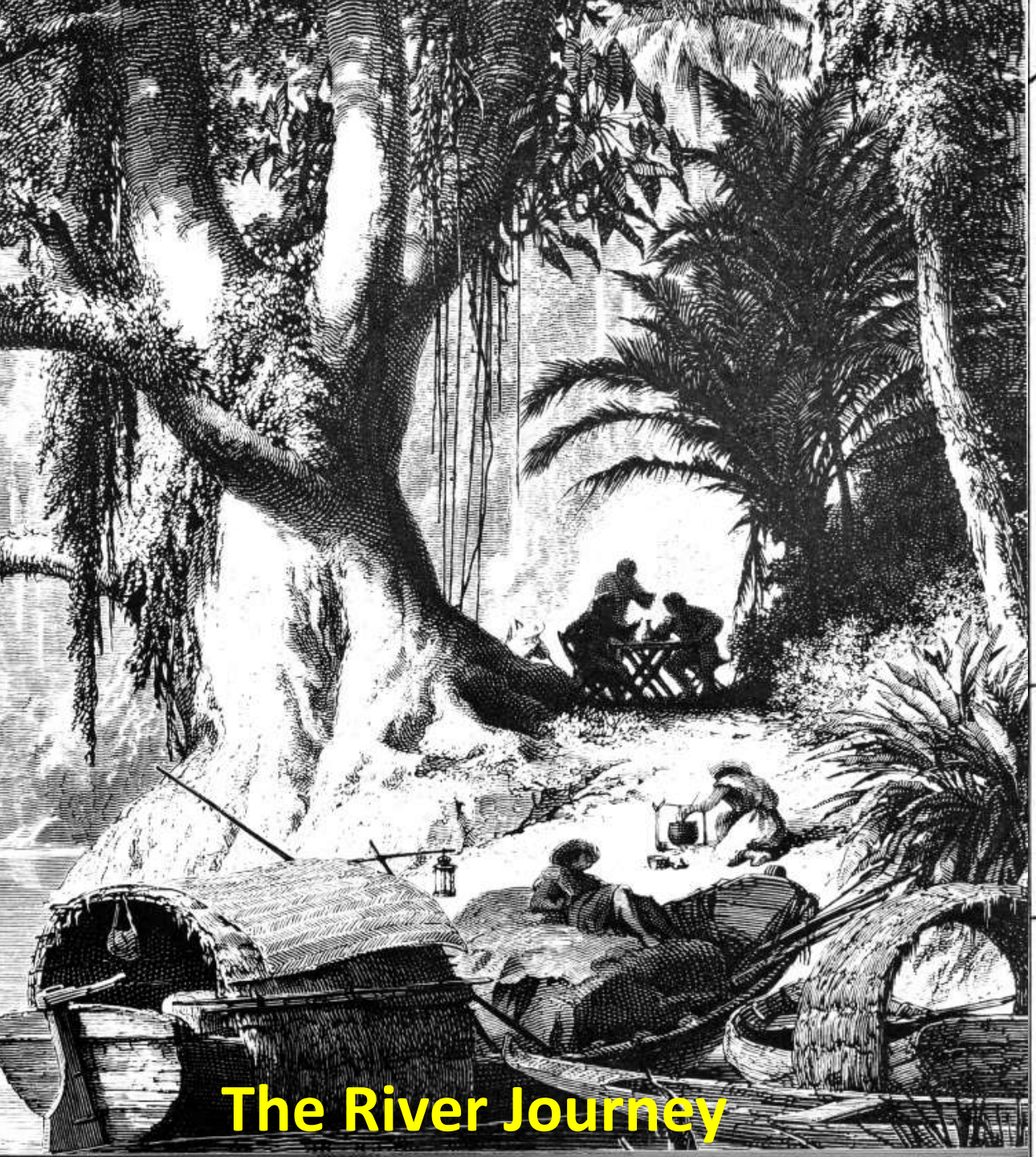
Leaping eels electrify threats, supporting Humboldt's account of a battle with horses

Kenneth C. Catania, Department of Biological Sciences, Vanderbilt University

Electric eels are shown to leap from the water to directly electrify threats. This behavior likely allows electric eels to defend themselves during the Amazonian dry season, when they may be found in small pools and in danger of predation.

The results support Alexander von Humboldt's story of electric eels attacking horses that had been herded into a muddy pool during the dry season in 1800.





The River Journey

The Jungle

"You find yourself in a new world, in a wild, untamed nature. Sometimes a jaguar, the beautiful American panther, on the banks…in this paradise of American jungles, as everywhere else, a long, sad experience has taught all living beings that gentleness is rarely linked to might"

Insect Geography

"It is nearly impossible to write during daylight. One cannot hold the quill still because the poison in these insects is so painful. All of our work happened by the fire in part of an Indian hut where no sunlight came in and you had to crawl in on your stomach. There one almost suffocates from the smoke, but suffers less from the mosquitoes.“

Onthophagus humboldti

Uroxys bonplandi

Insect Geography

"Our imagination is struck only by what is great, but it belongs to the philosophy of nature to pause at what is little"

Natives and Nature

"In Maipures, we took refuge with the Indians in the middle of a waterfall, where the waters rage and the spray drives off the insects.

In Higuerote, they dig themselves into the sand at night, so that only their heads protrude and the whole body is covered with three to four inches of earth.

You might think it was a fable until you see it with your own eyes."


Cacajao.
H. del. 1800
Nov. Spec. Simia caudata
cauda haud prehensilis.
Simia melanocephala, imberbis, ex fusco flavescens, capite aterrimo, pilis omnibus occipitis antrorsum reflexis, cauda brevi, digitis palma longioribus.

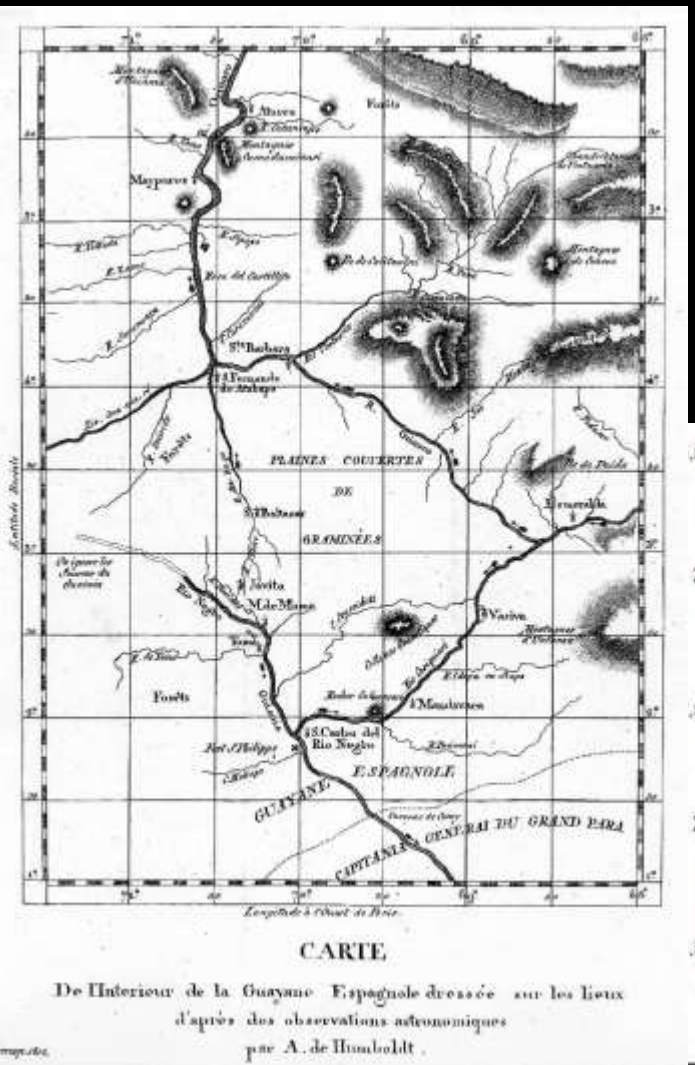
Equinoctial Regions – Entering the Wild

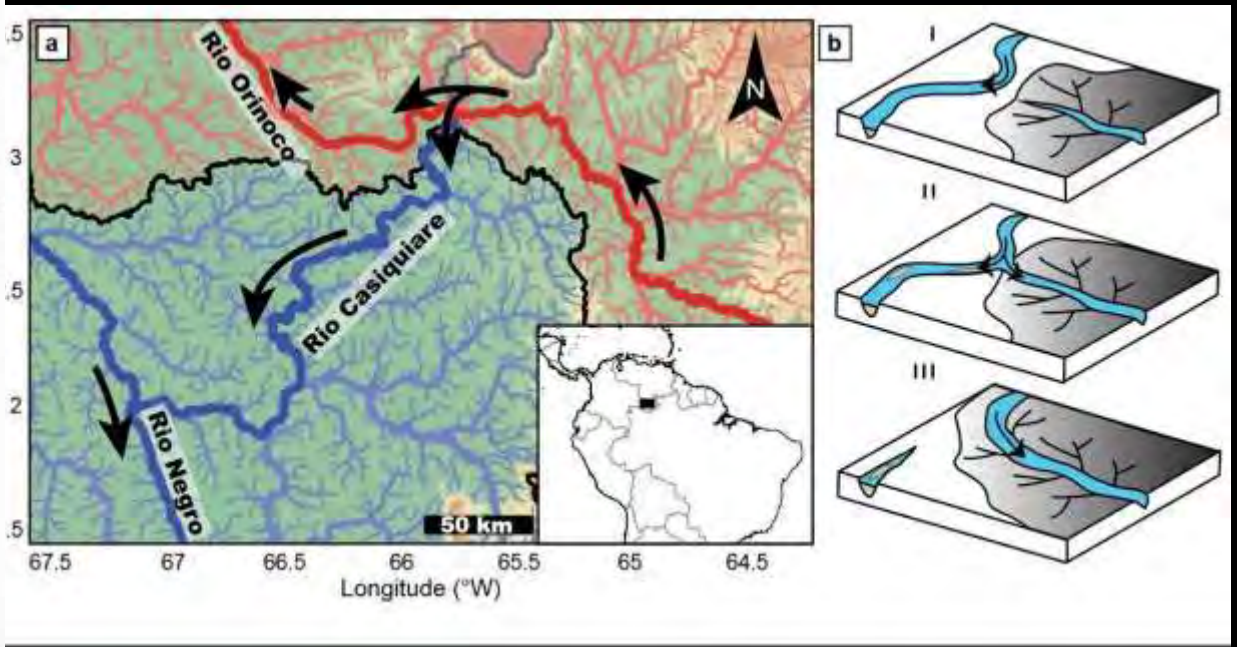
"The uninhabited banks of the Casiquiare, covered in jungle, busied my imagination. In this interior of a new continent you get used to seeing man as not essential to the natural order….crocodile and boa are the masters of the river…this view of a living nature where man is nothing is both odd and sad. Here, in a fertile land, in an eternal greenness, you search in vain for traces of man; you feel you are carried into a different world from the one you were born into."

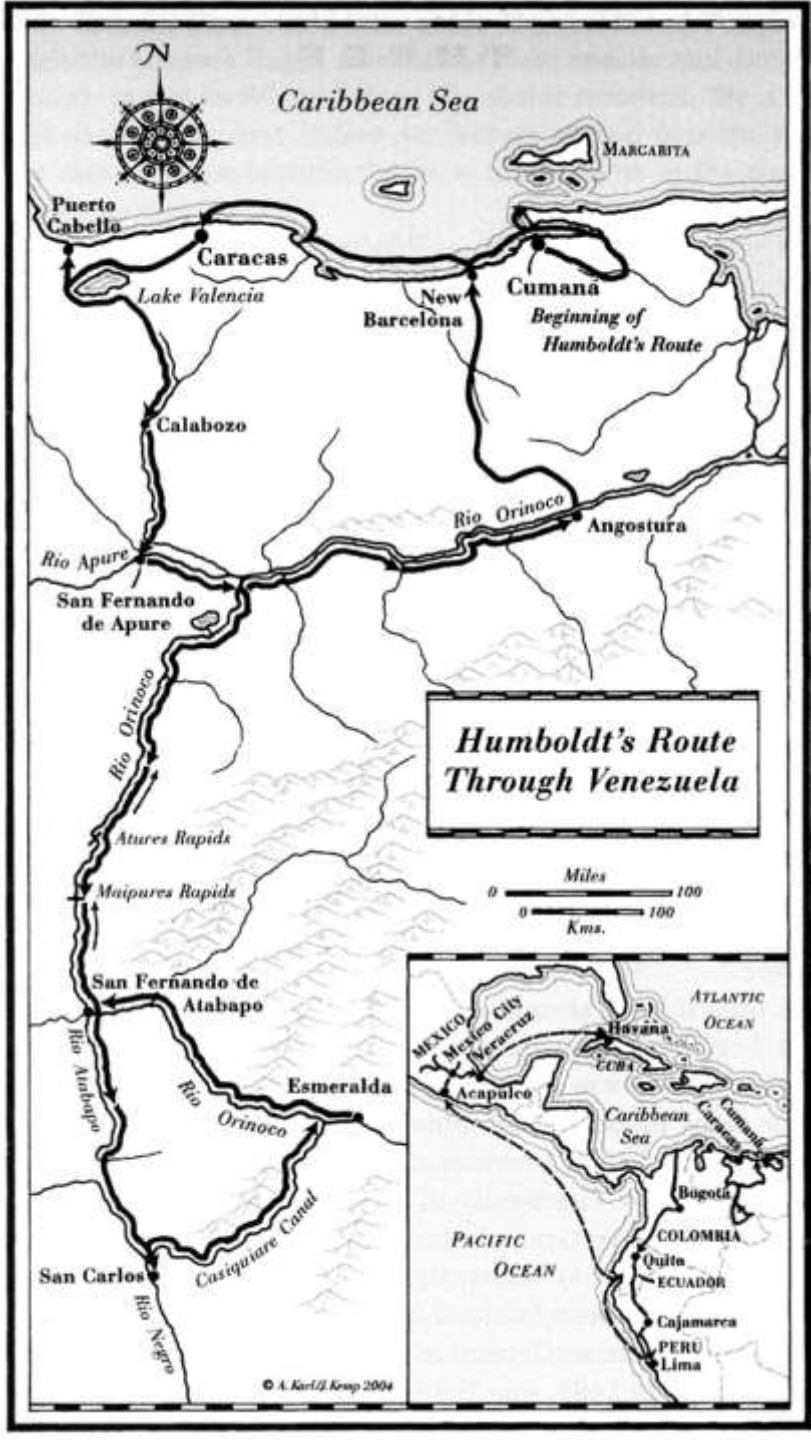
Ferdinand Bellermann, Landschaft in Venezuela, 1863

Casiquiare Canal

This trip, which lasted four months and covered 1,725 miles proved the existence of the Casiquiare canal (a communication between the river basins of the Orinoco and Amazon rivers).



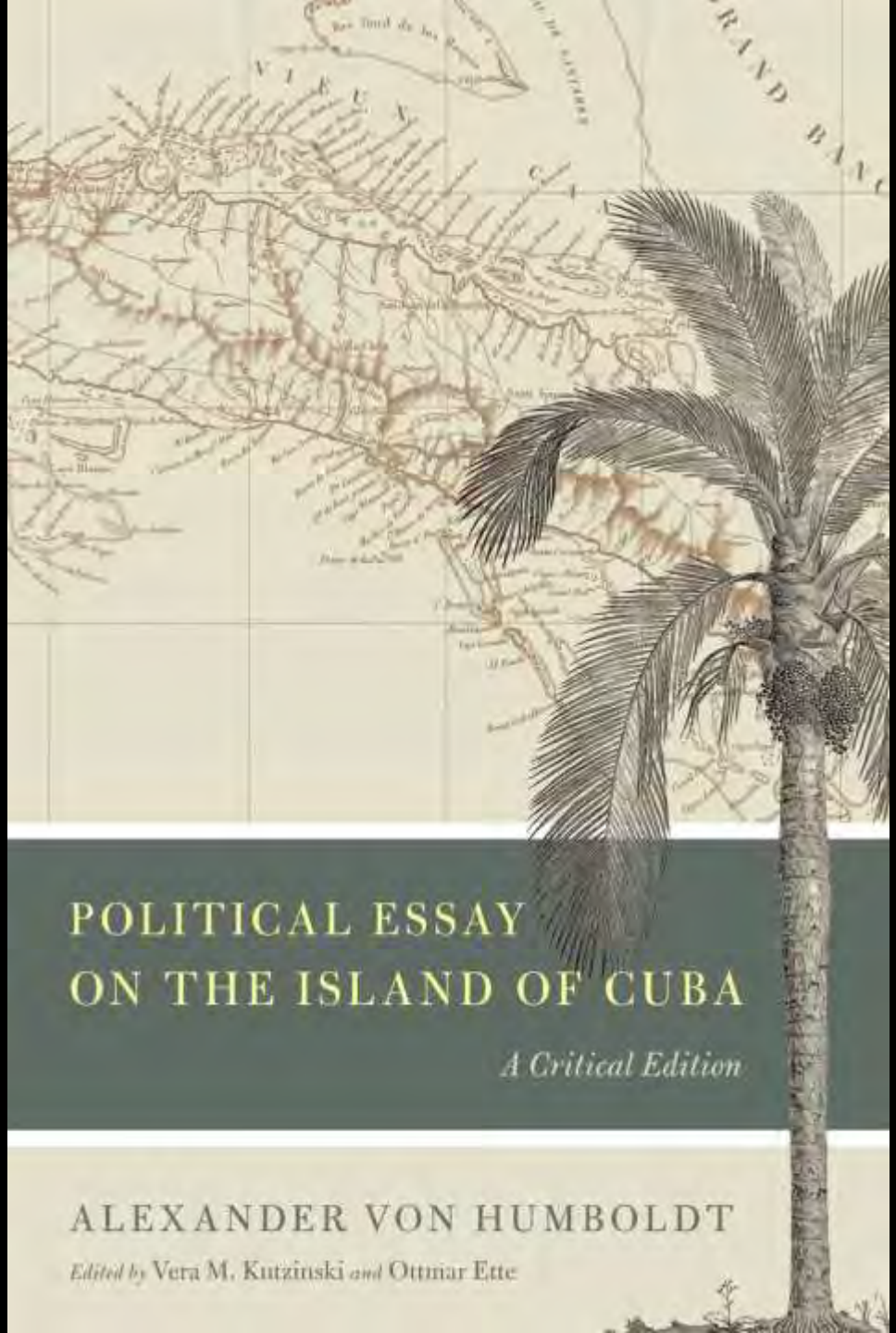




Cuba 1800


Havana
Trinidad Mar. 1801
III
Dec. 1800
Caracas
Cumaná
July 16th 1799
Cartagena

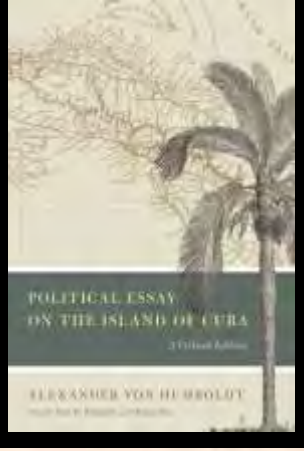

CHEIROSTEMON platánoides.


POLITICAL ESSAY
ON THE ISLAND OF CUBA
A Critical Edition
ALEXANDER VON HUMBOLDT
Edited by Vera M. Kutzinski and Ottmar Ette

Cuba 1800

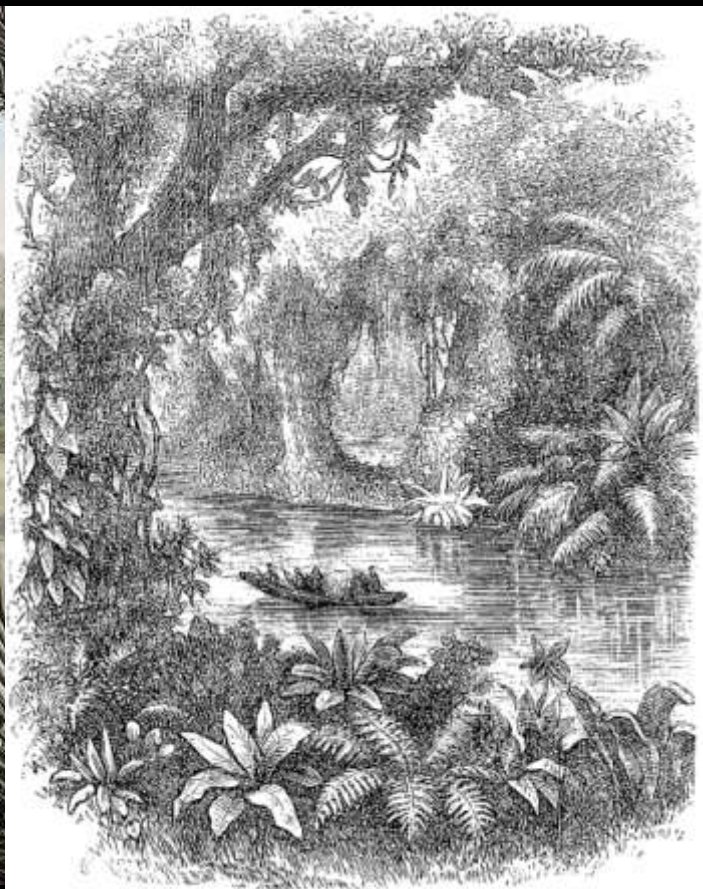
Cuba, landing on December 19 1800. Humboldt collected statistical information on Cuba's population, production, technology and trade.

Humboldt and Bonpland stayed in Cuba until March 5, 1801

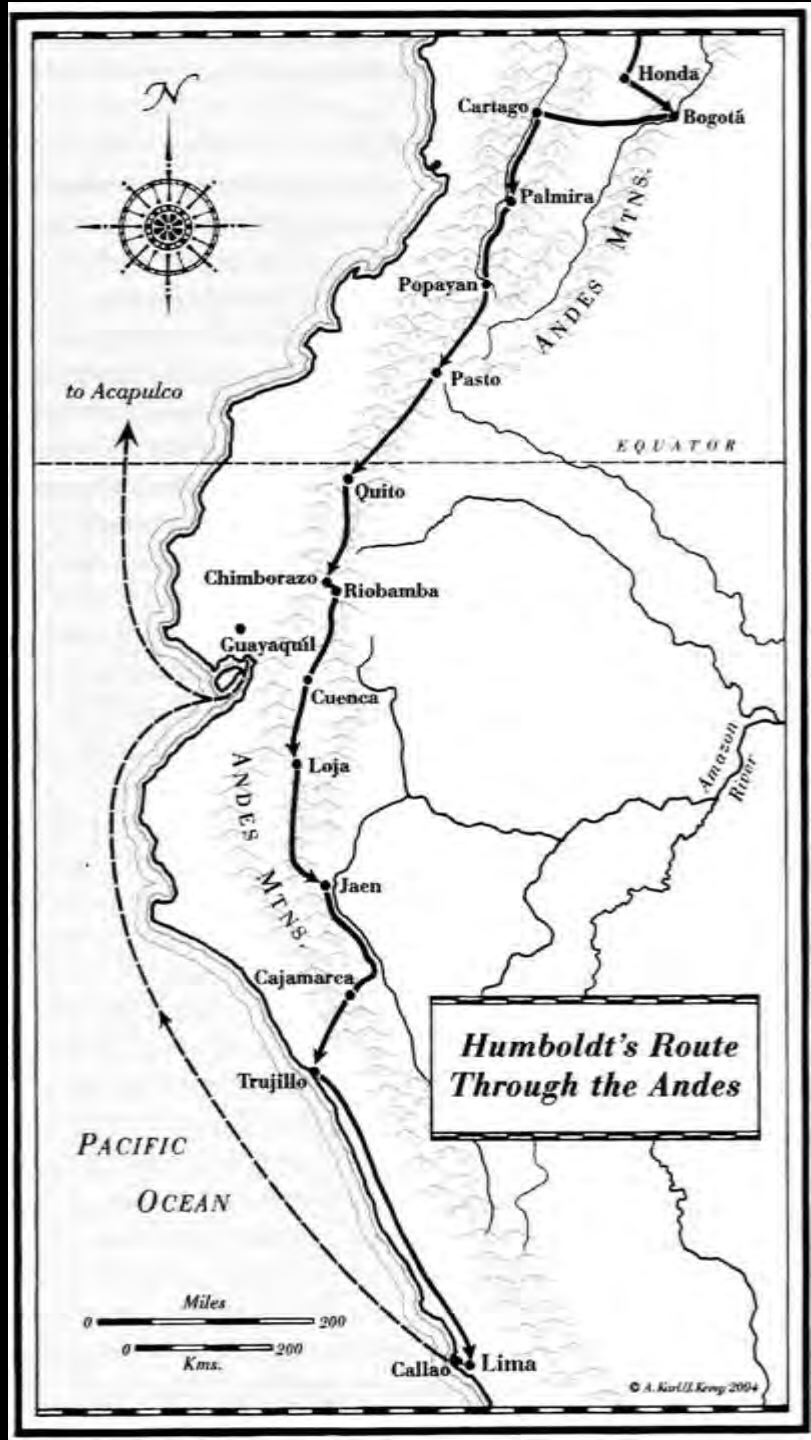


The Andes 1801-3

- Arrive in Cartagena April 1801
- Visited the mud and gas volcanoes of Turbaco
- By canoes up the Rio Magdelena and on foot to Bogota



The Andes Journey 1801-3



The Andes Travel


© Botanisches Museum Berlin/Foto: Timothy Rooks

3. Passage du Serpent

Cargueros

The Andes 1801-3

Bogotá July 1801 - September 1801

José Celestino Mutis (1732 – 1808)

- Spanish priest, botanist and mathematician, the most famous naturalist in the Spanish colonies.
- In 1784, he was elected a foreign member of the Royal Swedish Academy of Sciences
- Mutis had a huge botany collection and Humboldt was impressed by his knowledge, library and team of artists
- Humboldt and Bonpland dedicate their first botanical volume to Mutis

Quito January 1802 – June 1802

Carlos de Montúfar (1780-1816)

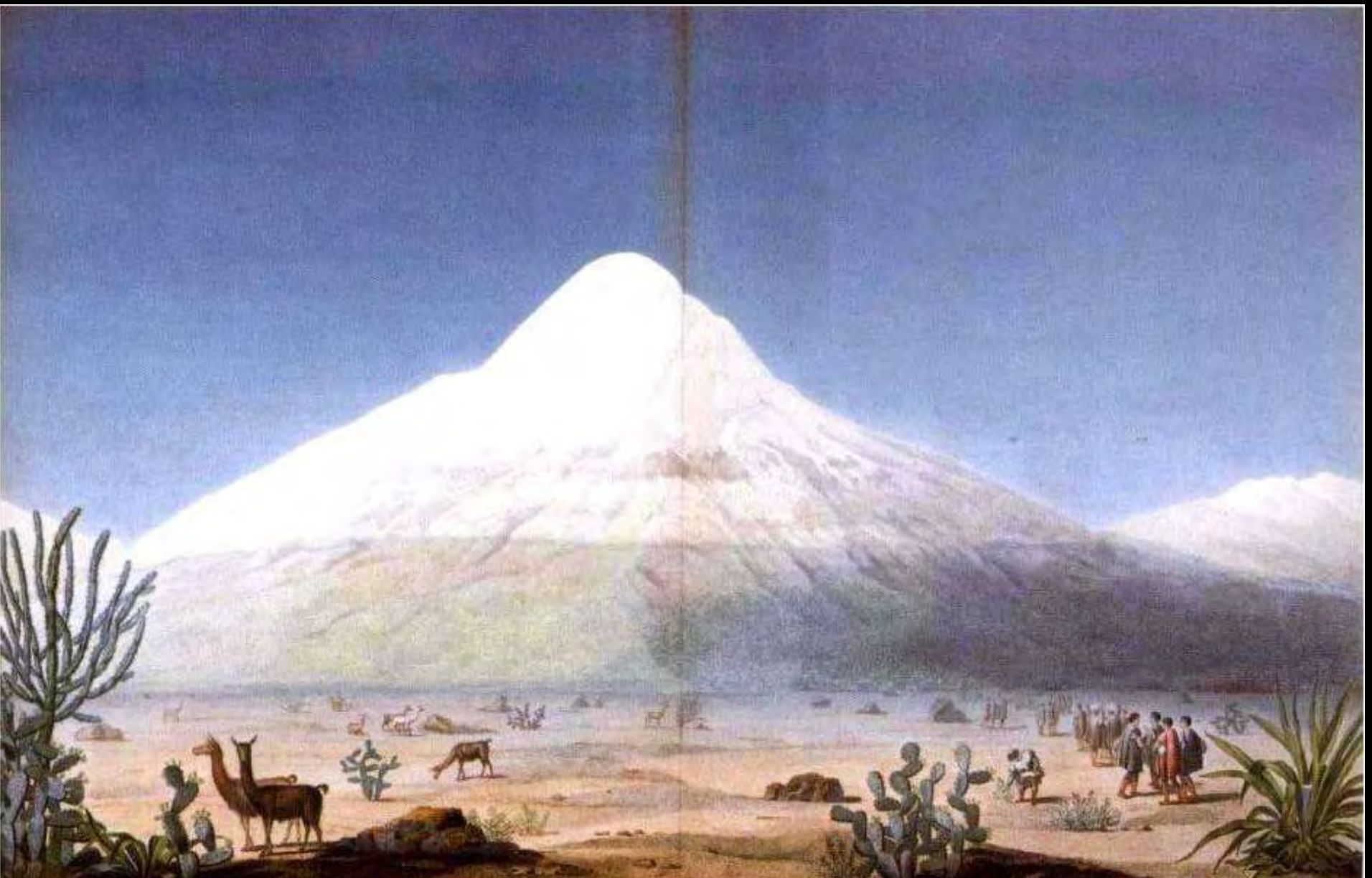
Climbing Chimborazo 1802

Chimborazo is about one hundred miles to the southwest of Quito. It was thought to be the world's highest mountain, and no one had ever made it to the top.

Yet, with three indigenous guides loaded down with instruments, Humboldt and his two traveling companions were determined to scale the 6,310-meter (20,700-feet) Ecuadorian volcano in the bitter cold.

At 15,600 feet their porters refused to go on. Humboldt, Bonpland, Montúfar divided the instruments between them and continued on their own.

Humboldt took out the barometer again and measured their altitude at 19,413 feet. No one had ever come this high—not even the early balloonists. A record only surpassed in 1849 by the botanist Joseph Hooker, who went a few meters higher in the Himalayas.



"I shall try to find out how the forces of nature interact upon one another and how the geographic environment influences plant and animal life. In other words, I must find out about the unity of nature."

A New Vision of Nature - Naturgemälde – Data in visual form

Nature a web in which everything was connected - every plant was placed on the mountain precisely where Humboldt had found them.

Humboldt showed for the first time that nature was a global force with corresponding climate zones across continents. Humboldt saw ‘unity in variety’.

Geographie der Pflanzen in den Tropen-Ländern;

ein Naturgemälde der Anden,

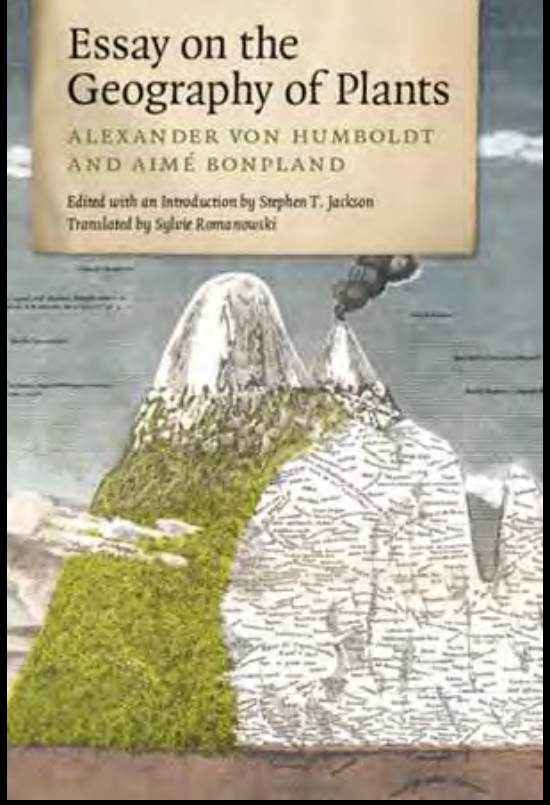
gegründet auf Beobachtungen und Messungen, welche vom 10ten Grade nördlicher bis zum 10ten Grade südlicher Breite angestellt wurden sind, in den Jahren 1799 bis 1803.

von ALEXANDER VON HUMBOLDT und A. G. BONPLAND.

Humboldtian Science

Essay on the Geography of Plants 1807

- An ecological vision - Instead of placing plants in their taxonomic categories, he saw vegetation through the lens of climate and location: a radically new idea that still shapes our understanding of ecosystems today.
- The similarity between coastal plants shows an ancient connection between Africa and South America and suggests continents geologically shift [plate tectonics]
- First to document New World domesticated plants – corn, yucca, potato, tomato, pepper, vanilla, cocoa, etc.

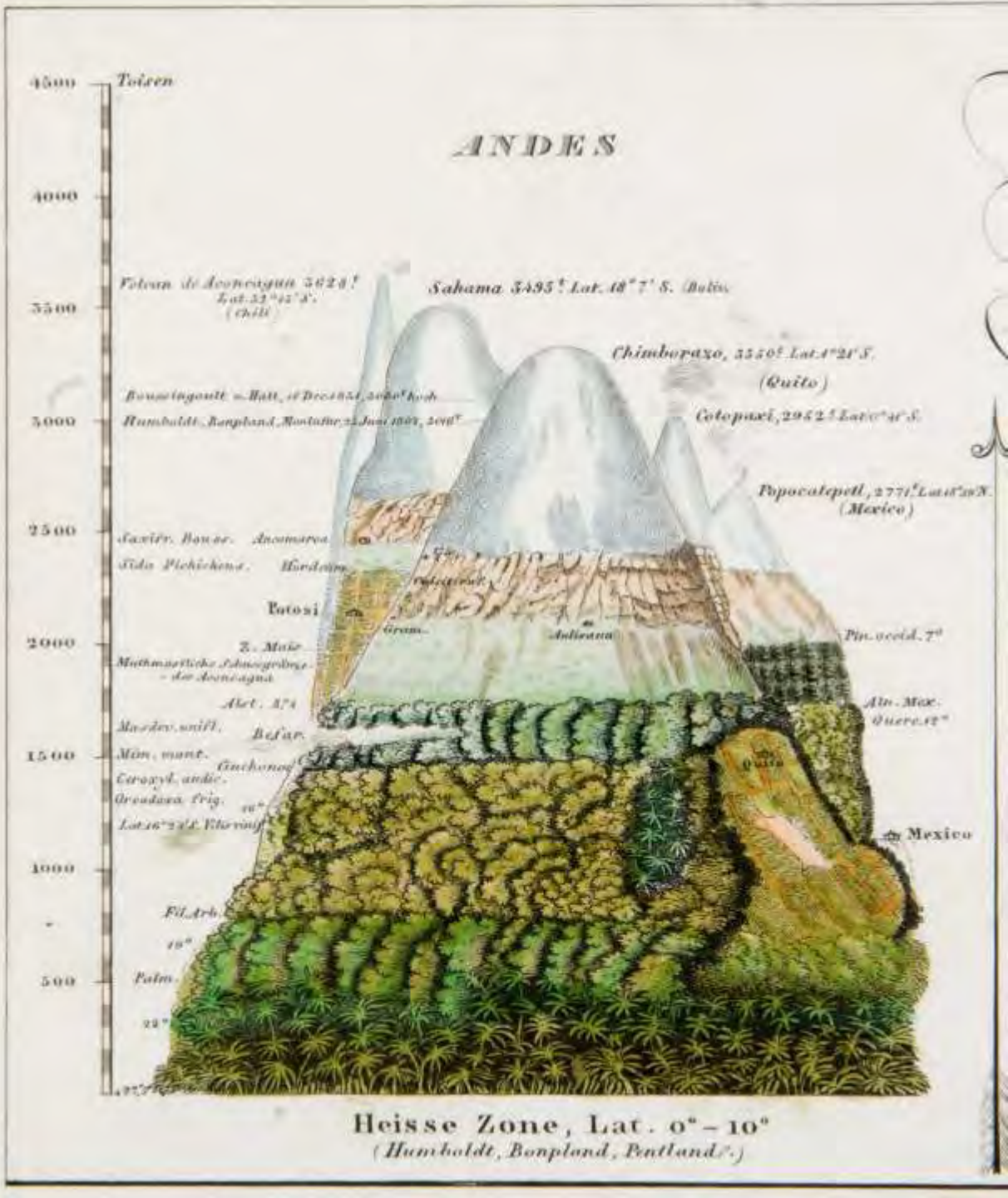


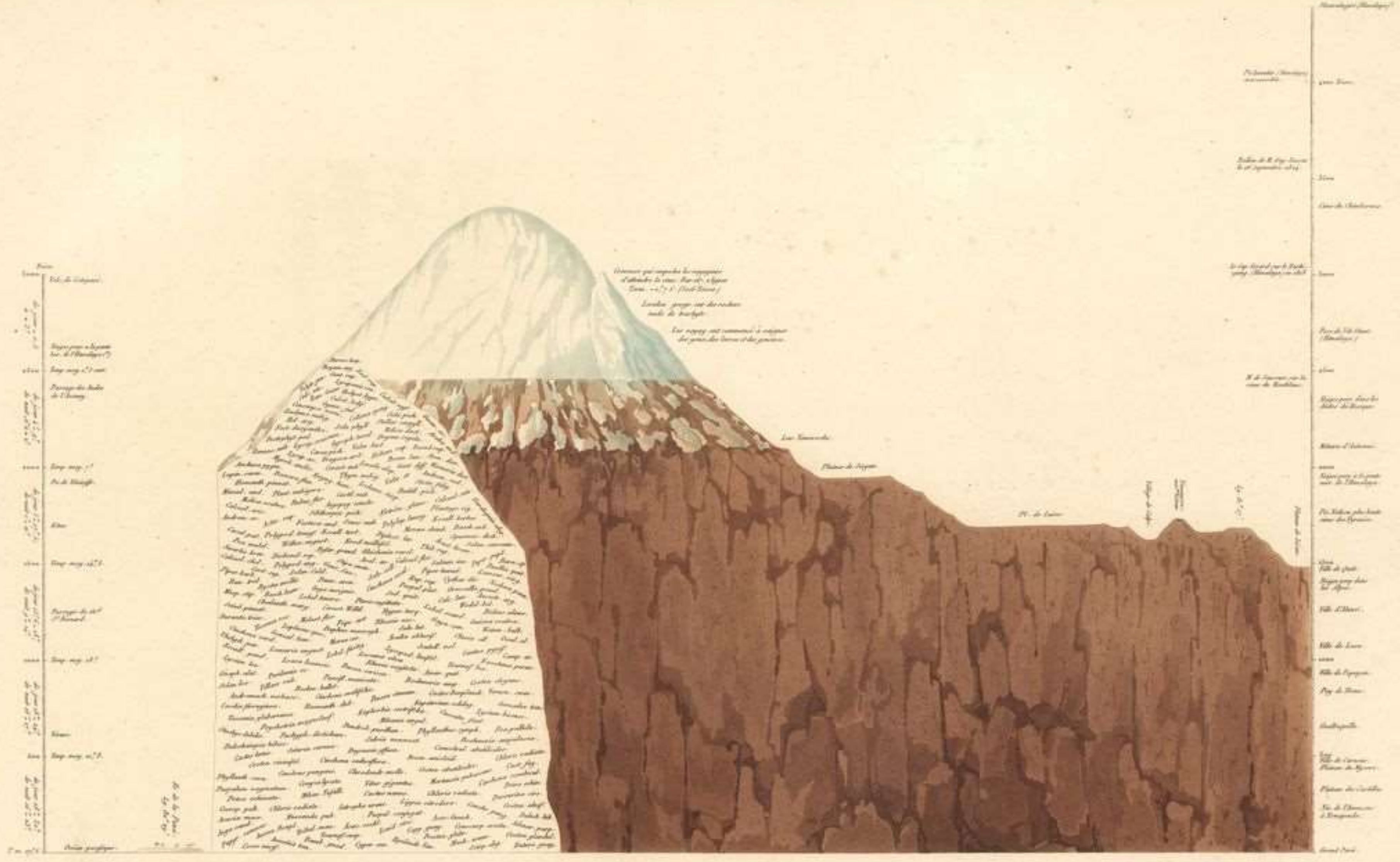
Naturgemälde

Infographic

This variety and richness, but also the simplicity of the scientific information depicted, was unprecedented.

Plants distributed according to their altitudes, ranging from subterranean mushroom species to the lichens that grew just below the snow line.



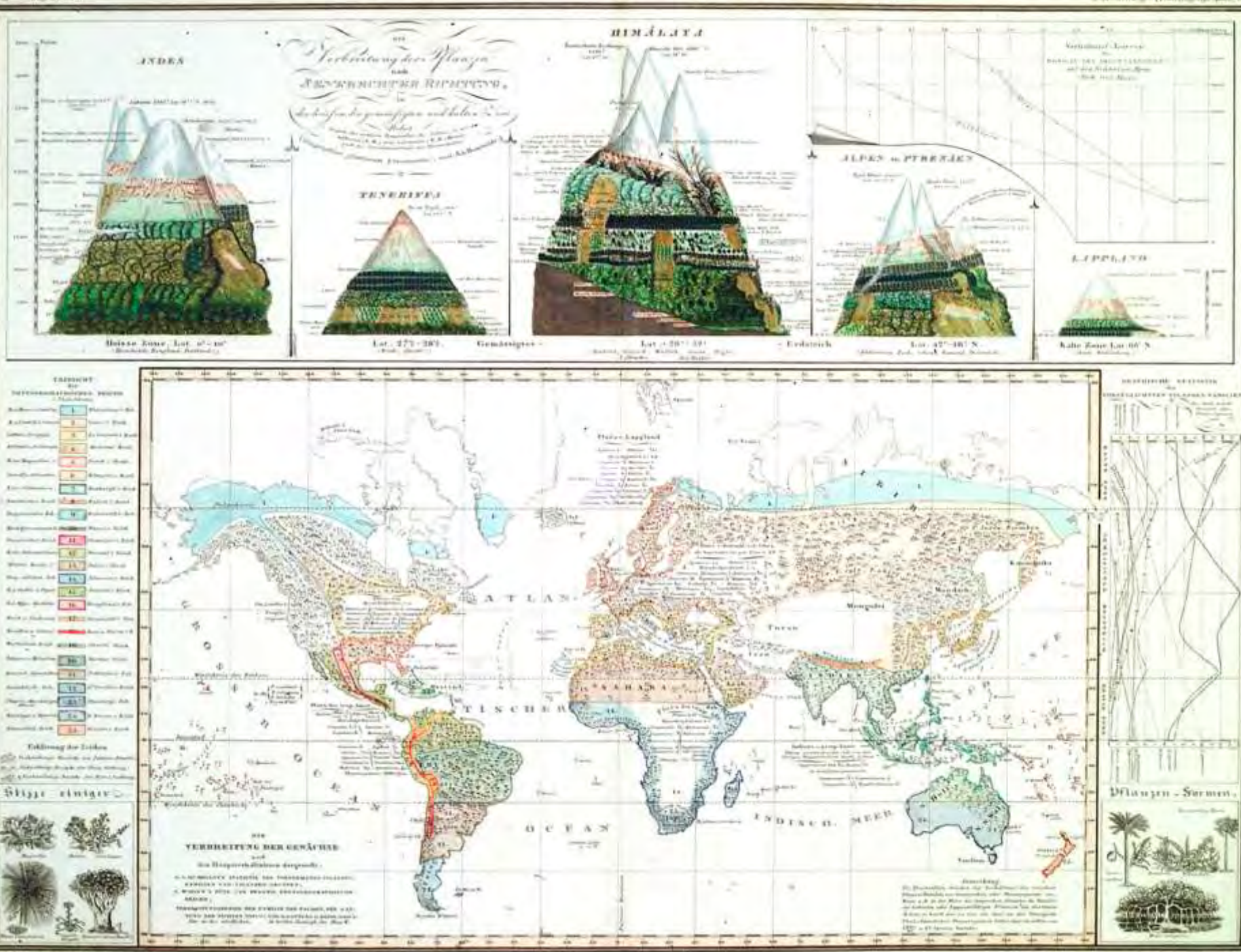


Voyage vers la cime du Chimboraze, tenté le 23 Juin 1802

par Alexandre de Humboldt, Aimé Bonpland et Carlos Montufar

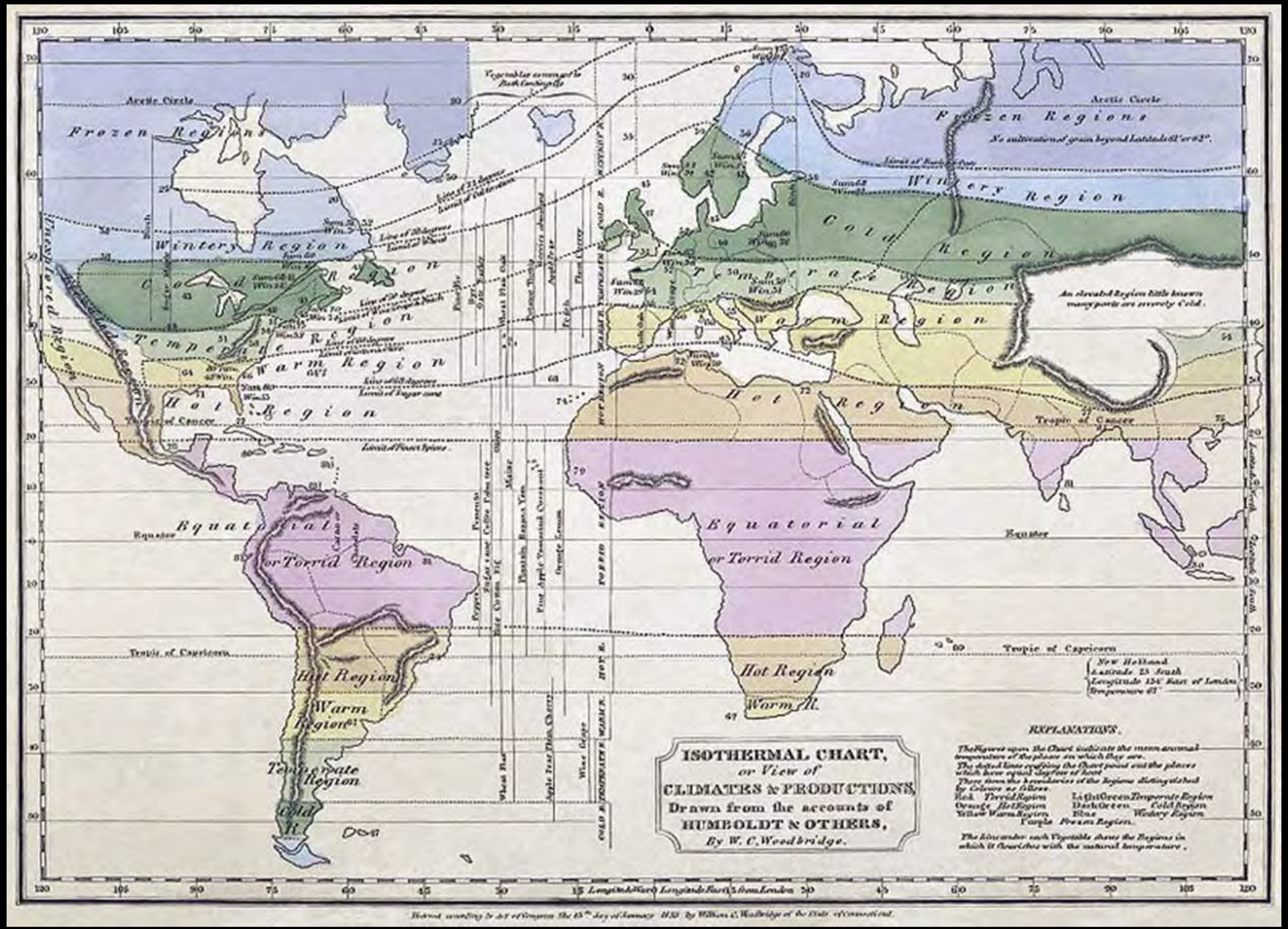
(Esquisse de la Géographie des plantes dans les Andes de Quito, entre les 1° 10' de lat. bor. et les 2° 10' de lat. aust.)

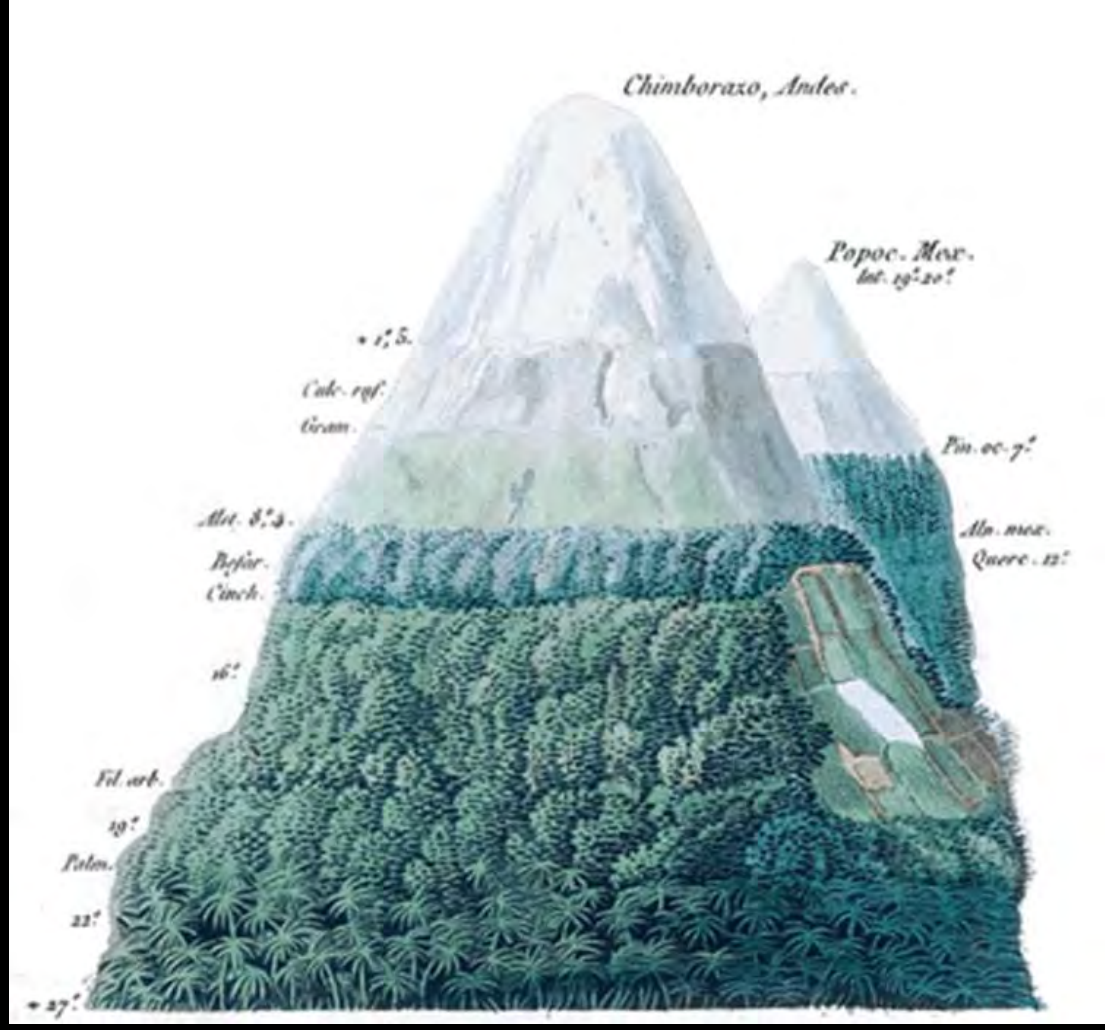
UMRISSE DER PFLANZENGEOGRAPHIE.



Humboldtian Science of Nature – Order and Change

To map and to explain the patterns of variation in geographical phenomena





Humboldtian Science

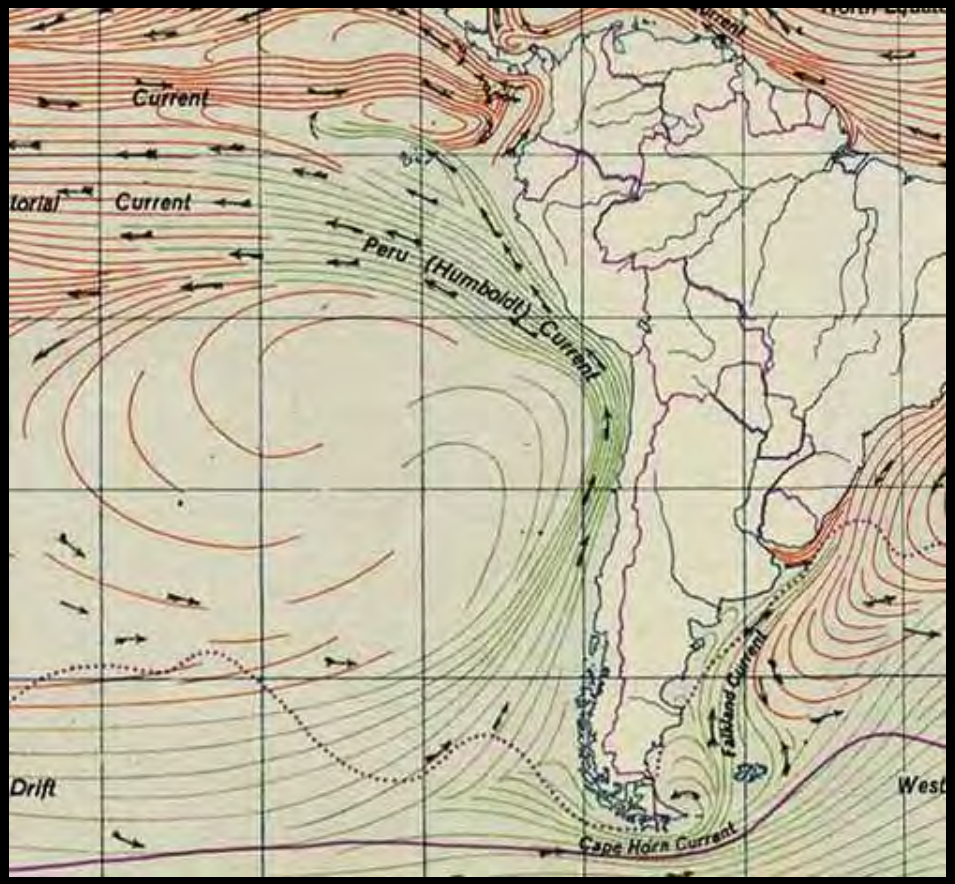
"the accurate measured study of widespread but interconnected real phenomena in order to find a definite law and a dynamic cause"

To the Equator and Lima then north to New Spain 1802-3

They left Quito in June 1802 and trekked south to Peru surveying Inca ruins, researching the chinchona tree (quinine bark), and the Earth's magnetic field at the geographic equator – then he was the first to measure the magnetic equator 7 degrees south.

Arrived in Lima October 1802.

Sail from Lima to Guayaquil January 1803, and along the way is the first to measure the cold coastal current now known as the Humboldt Current.



When the Cotopaxi volcano erupted on January 4, 1803, he and Bonpland travelled up the Rio Guayaquil to Bebahoyo on 6 February in order to examine the phenomenon at close range.

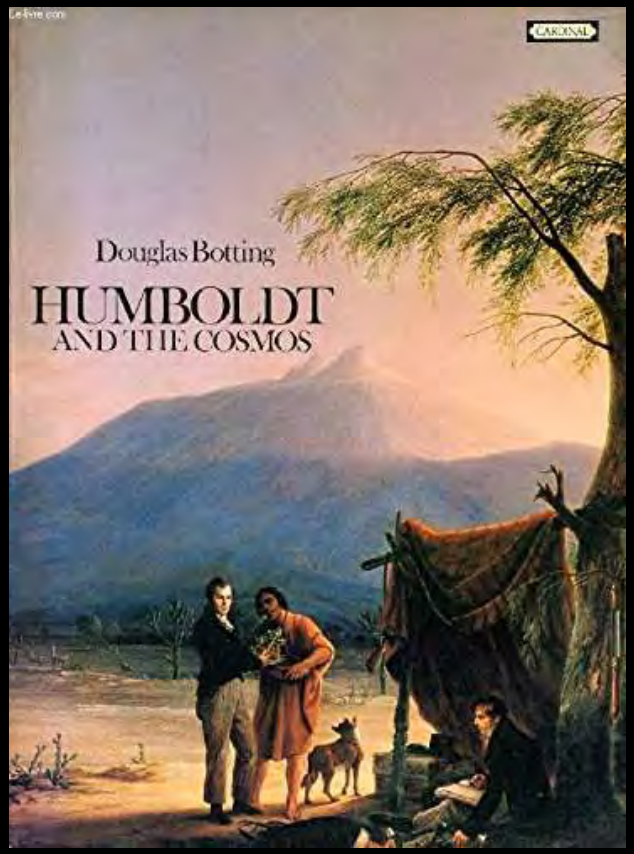
In February 1803 they sail for Mexico…

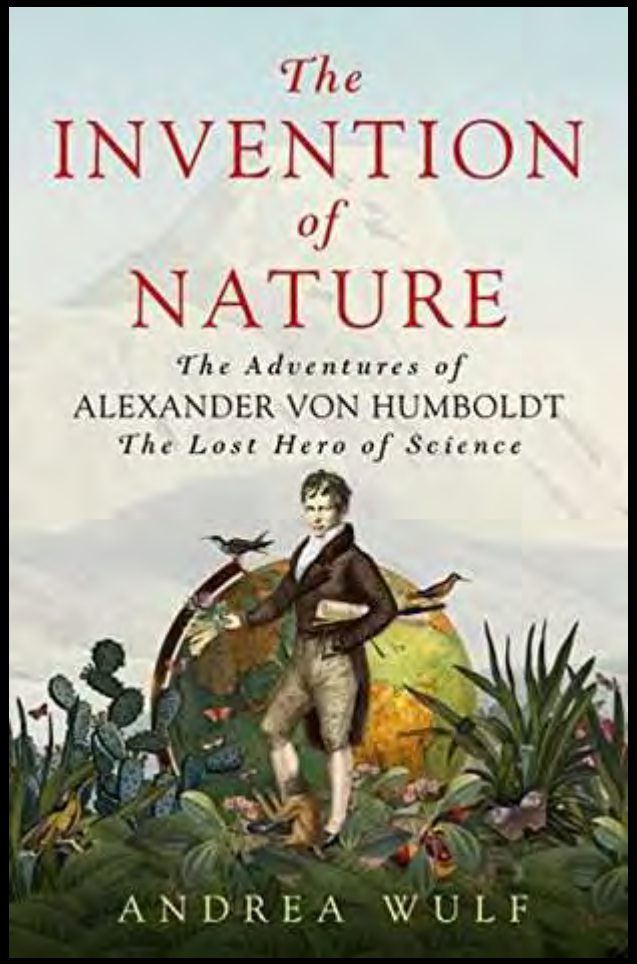
Frederic Edwin Church
Cotopaxi, 1862

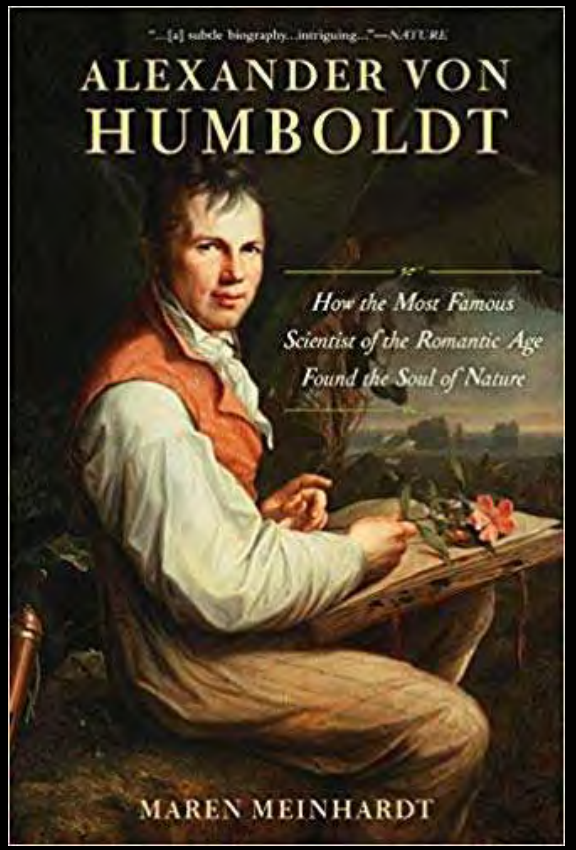
The Earth as a Nature Whole

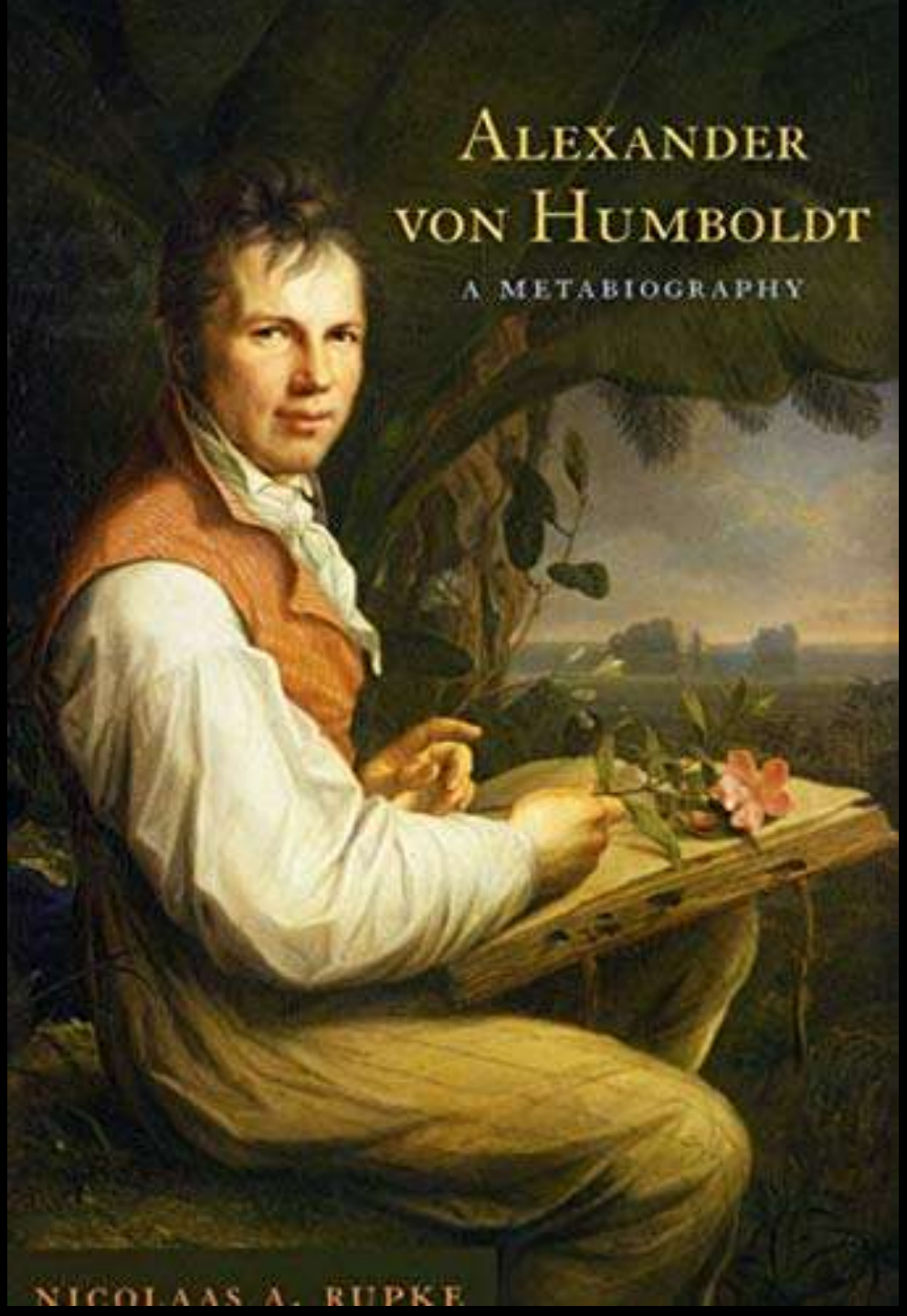
"In the forests of the Amazon River, as on the edges of the high Andes, I got the feeling - that, as if animated by a spirit from pole to pole, one single life has been infiltrated into stones, plants and animals, as well as in the swelling breast of mankind."

Biographies








Alexander
von Humboldt
A METABIOGRAPHY
NICOLAAS A. RUPKE

PENGUIN CLASSICS

ALEXANDER VON HUMBOLDT

Personal Narrative of a Journey to the Equinoctial Regions of the New Continent


Applause