

The Case for Non-Institutional Research Schools in the History of Science:
Matthew Fontaine Maury as a Student in the School of Humboldt

By

Patrick Richard Anthony

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Approved:

Alistair Sponsel, Ph.D.

David Blackbourn, Ph.D.

Celia Applegate, Ph.D.

Laura Stark, Ph.D.

Often in the loneliness of his calling, has the 'well done' of this great man cheered and encouraged the student with his speciality.

Matthew Fontaine Maury

26 May 1859

At his memorial address in 1869, ten years after the Prussian scientist Alexander von Humboldt (1769-1859) died at the age of ninety, Louis Agassiz commented on the irony of Humboldt's ubiquitous influence: "Every schoolboy is familiar with his methods now, but does not know that Humboldt is his teacher."¹ Given the pervasiveness of Humboldt's influence and the fact that he was not, like a Liebig or a Helmholtz, affiliated with any particular institution, statements like Agassiz's have led historians to treat Humboldt as though *all* scientists were his students, and thus that Humboldt played the role of master to no one in particular. As biographer Laura Dassow Walls has argued, Humboldt was "a victim of his own success: his presence everywhere meant that he was nowhere in particular, leaving behind no field or school to bear his name."²

Yet some of Humboldt's followers did indeed consider themselves his students, not because of the all-pervasive, *Zeitgeist*-like influence he supposedly exerted on the scientists of his time, but because Humboldt directly encouraged, instructed, and supported them. The Scottish geologist Roderick Murchison praised one such figure, Robert Hermann Schomburgk, as "one of those, in fact, formed in the school of Humboldt."³ Another member of "the school of Humboldt," I will argue, was Matthew Fontaine Maury (1806-1873), the American

¹ As quoted in Laura Dassow Walls, "'Hero of knowledge, be our tribute thine:': Alexander von Humboldt in Victorian America," *Northeastern Naturalist*, Special Issue 1: Alexander von Humboldt's Natural History Legacy and Its Relevance for Today (2001): 129.

² Walls, "'Hero of knowledge, be our tribute thine:,' 128-129.

³ As quoted in D. Graham Burnett, *Masters of All They Surveyed: Exploration, Geography and a British El Dorado* (Chicago: The University of Chicago Press, 2001), pp. 98-99.

oceanographer whom Humboldt directed and cultivated through private correspondence and publicly printed letters—that “good word” of which Maury so often spoke. “With unerring judgment he knew how to encourage, and when to commend,” Maury wrote in 1859, the year of Humboldt’s death. “Often in the loneliness of his calling, has the ‘well done’ of this great man cheered and encouraged the student with his specialty, the philosopher with his researches.”⁴ Perhaps Agassiz was right: the “schoolboy” may not have known “that Humboldt is his teacher.” But Maury certainly did.

This essay examines surviving letters from the correspondence carried out between Maury and Humboldt between 1847 and 1859. What remains of their direct correspondence is limited: just five letters addressed to Humboldt and three to Maury, though the letters themselves indicate a much more extensive communication in addition to the numerous charts and manuscripts Maury sent Humboldt via Johann Flügel (Prussia’s American consul and correspondent at the Smithsonian Institution), and the awards and public letters of support Humboldt sent in return via Friedrich von Gerolt (Prussian Minister Plenipotentiary to the United States). Nevertheless, the “epistolary behavior” evident in this correspondence, along with the public actions it spurred, exhibit all the characteristics of the “research schools” described by historians J. B. Morrell and Gerald L. Geison: the charismatic appeal of the research school leader; the research reputation with which that leader opened doors for students; and the institutional benefits gained by the students as a result.⁵ At a crucial moment in Maury’s career,

⁴ Matthew Fontaine Maury to Marshall Lefferts, 26 May 1859, in Ingo Schwarz, ed., *Alexander von Humboldt und die Vereinigten Staaten von Amerika. Beiträge zur Alexander-von-Humboldt-Forschung, 19. Briefwechsel* (Berlin: Akademie Verlag, 2004), Dokument 45.

⁵ J.B. Morrell, “The Chemist Breeders: The Research Schools of Liebig and Thomas Thomson,” *Ambix* 19 (1972): 1-46; Gerald L. Geison, “Research Schools and New Directions in the Historiography of Science,” *Osiris* 8 (1993): 226-238. “Epistolary behavior” is a phrase coined by Anne Secord. See Anne Secord, “Corresponding Interests: Artisans and Gentlemen in Nineteenth-Century Natural History,” *The British Journal for the History of Science* 27, no. 4 (December 1994), 407.

when he faced harsh criticism from scientific elites, both for the theoretical tone of his work and for the practical rather than erudite nature of his background as a navy officer, Humboldt provided Maury the patronage and guidance of a research school leader. But charisma and prestige alone do not make a research school successful. As Morrell and Geison have shown, a research school leader must also provide students with the means of carrying out a successful research program, and of “colonizing” a field. What Morrell described as “reliable experimental techniques” in the context of Justus von Liebig’s laboratory at the University of Gießen, I will call reliable *geographical* techniques in the case of Humboldt’s global enterprise of physical geography, an enterprise Maury eagerly took up. Humboldt, in turn, was able to secure the extension of his program of physical geography—quite literally in the case of his declaration that Maury had founded a new science with his book *The Physical Geography of the Sea*, a title taken explicitly from Humboldt.⁶ Moreover, by making himself integral to the endeavors of his successors, Humboldt was able to further his reputation as a “statesman in the field,” a figure who no longer *does* science, but becomes a *steward of* science, known to scientists and non-scientists alike.⁷

This argument is at once empirical and theoretical. On the one (empirical) hand, I aim to show how, contrary to the mythology of Humboldt’s ubiquitous evaporation, he was actively engaged in the role of research school leader with respect to Maury. On the other (theoretical) hand, the implication is that the research school as unit of analysis need not be bound to institutions. The correspondence-based pedagogical program carried out between Humboldt and

⁶ John Walter Wayland, *The Pathfinder of the seas; the life of Matthew Fontaine Maury* (Richmond: Garret & Massie, 1930), 91-92.

⁷ In my use of the “statesman in the field,” I borrow from Sharon Traweek’s ethnography of late twentieth-century physics communities in the United States. The “statesman” is, however, not unique to this time and place, but rather, as I hope to show, applicable also to nineteenth-century geography and oceanography (and surely many more contexts besides). See Sharon Traweek, *Beamtimes and Lifetimes: The World of High Energy Physics* (Cambridge, MA: Harvard University Press, 1988), 102.

Maury (who met only once in Berlin in 1853) was, I argue, an *informal* or *non-institutional* research school, one that operated not through the instruction of a cohort, but the tutoring of a pupil.

The scholarship on research schools has focused overwhelmingly on physical sciences at German universities. Following in the tradition of Morrell's pathbreaking study of Justus von Liebig, the "chemist breeder" at the University of Gießen, historians of science Kathryn Olesko and Suman Seth have carefully analyzed the pedagogical programs of Franz Neumann, with his "physics seminar" in nineteenth-century Königsberg, and Arnold Sommerfeld, who groomed such physicists as Werner Heisenberg, Wolfgang Pauli, and Hans Bethe at the University of Munich. Where Olesko argued that Neumann's emphasis on Friedrich Bessel's method of quantifying error actually stunted creativity and engendered hostility towards new ideas among his students, Seth found just the opposite, for Sommerfeld was interested not in "disciplining deviance [but] inspiring independence."⁸

But research schools are bound neither to the university nor to the physical sciences. This essay follows the more widely applicable conception of research schools described by James A. Secord: "a research school, like a discipline, is essentially a descriptive category for charting patterns of changing and contingent social relations," Secord has argued: "Although it cannot explain those patterns in a causal sense, it does suggest fruitful ways of exploring them."⁹ Secord's study of the Geological Survey of Great Britain was the first and most comprehensive effort to take Morrell's concept out of the laboratory and into the field. My study takes a new tack, bringing the research school as a unit of analysis to the Victorian era republic of letters so

⁸ Kathryn Olesko, *Physics as a Calling: Discipline and Practice in the Königsberg Seminar for Physics* (Ithaca, NY: Cornell University Press, 1991); Suman Seth, *Crafting the Quantum: Arnold Sommerfeld and the Practice of Theory, 1890-1926* (Cambridge, MA: MIT Press, 2010), 68.

⁹ James A. Secord, "The Geological survey of Great Britain as a Research School, 1839-1855," *History of Science* 24 (1986): 261.

central to the communication of scientific knowledge in the mid-nineteenth century. In this period letters were also, as Martin Rudwick noted and as I aim to demonstrate, an important “means of enhancing the writer’s *credibility*.”¹⁰ Drawing upon Rudwick’s analysis of “the continuum of relative privacy” and the “fields of competence” that distinguished amateurs from elites, I will demonstrate how Maury’s success (both in terms of extending Humboldt’s research program and in improving his own stature in the milieu of American ocean science) hinged upon critical moments when the private realm of correspondence was displaced and made public.¹¹

This essay proceeds in three sections, beginning with a history of research schools that tracks Humboldt’s development from pupil to patron (Sect. I). Humboldt not only benefited from participation in small scientific collectives like the “Society of Arcueil,” but also grew into a mentor figure whose high status could land university positions and even create university chairs. When in 1847 Maury sought out a correspondence with Humboldt’s, the latter readily employed his charisma and research reputation to encourage Maury’s pursuit of ocean science and to attain institutional benefits critical for his professional standing (Sect. II). Paired with Maury’s *Physical Geography of the Sea* (1855), the Humboldt-Maury correspondence also suggests that Humboldt was the foremost source of inspiration for Maury’s use of vertical profile maps, a geographical technique integral to the “school of Humboldt” (Sect. III). I conclude with a recapitulation of my case for non-institutional research schools in the history of science.

¹⁰ Martin Rudwick, *The Great Devonian Controversy: The Shaping of Scientific Knowledge Among Gentlemanly Specialists* (Chicago: University of Chicago Press, 1985), 433.

¹¹ Rudwick, *The Great Devonian Controversy*, 431, 419-420.

I. Humboldt in the History of “Research Schools”

Humboldt centrality to Maurice Crosland’s book *The Society of Arcueil* has important implications for this study. In the historiography of research schools, Crosland’s was a pioneering study of patronage and pedagogy. Published in 1967, Crosland showed how, during the reign of Napoleon I, the private homes of Claude Louis Berthollet and Pierre-Simon Laplace became the “focal point” for the training of younger men of science, who imbibed a common “Newtonian framework,” “a world of particles governed by forces of attraction.”¹² In light of Crosland’s emphasis on pedagogy, Owen Hannaway suggested in his 1969 review that the Society might be more accurately described as “an embryonic research school.”¹³

Two things are worth flagging here: First, 1969 is also the year in which Thomas Kuhn published a Postscript to his 1962 book *The Structure of Scientific Revolutions*. In the language of “schools” and “students,” the 1969 Postscript encouraged further study of small scientific collectives as language communities and crucial sites for the inculcation of tacit and craft knowledge.¹⁴ Second, although “research school” was not, like “Society,” an actor’s category, Hannaway’s review placed the pedagogical program of private home on equal footing with that of a university—an important historiographical precursor to my analysis of Humboldt and Maury’s correspondence-based school.

Equally important is Humboldt’s unique position within the Society (or School, if you like) of Arcueil. As Crosland wrote, “Humboldt was perhaps the perfect member of the Arcueil

¹² Maurice P. Crosland, *The Society of Arcueil: A View of French Science at the Time of Napoleon I* (Cambridge, Mass.: Harvard University Press, 1967), 301.

¹³ Owen Hannaway, “The Society of Arcueil: A View of French Science at the Time of Napoleon I (Book Review),” *Isis* 60, no. 4 (December 1969): 581.

¹⁴ Thomas S. Kuhn, *The Structure of Scientific Revolutions*. 3rd ed. (Chicago: University of Chicago Press, 1996), Postscript.

group.”¹⁵ Younger than Berthollet and Laplace, yet older and already more accomplished than other students (having traveled through the Americas from 1799 to 1804 and begun publishing his findings), Humboldt could benefit from *and* offer patronage, he could teach and be taught. Given his subsequent maturation as a mentor and patron of younger scientists, the Society of Arcueil appears to have been a critical site for Humboldt’s own education as a research school leader.

Earlier in life, while travelling to England with Georg Forster in 1790, Humboldt acknowledged the dynamic role of prestige and patronage in gaining access to elite scientific circles. After participating in James Cook’s second circumnavigation of the globe, Forster gained continent-wide renown as the author of *A Voyage Around the World*, published in 1777. Thereafter Forster tactfully positioned himself as an arbiter of travel literature, working as an extremely heavy-handed editor and translator.¹⁶ Still in 1790 his name appears to have carried some weight: “Forster’s name, which stirs general interest . . . provides us everywhere with access to notable persons,” the twenty-one-year-old Humboldt wrote from Oxford.¹⁷ From London he wrote: “Forster’s personal attributes and his name have been endlessly useful to me. [...] Banks, Sibthorp, Smith, Aiton, Paradise, Dalrymple and especially Hawkins have proven to us their great courtesy.”¹⁸ And again, reflecting back on the journey a year later, Humboldt recalled how “Forster’s name provided me entry everywhere, and I became acquainted with

¹⁵ Crosland, *The Society of Arcueil*, 110.

¹⁶ Alison E. Martin, “Annotation and Authority: Georg Forster’s Footnotes to the Nachrichten von den Pelew-Inseln (1789),” *Translation and Literature* 15, no. 2 (Autumn 2006): 177-201; Birgit Tautz, “Cutting, Pasting, Fabricating: late 18th-Century Travelogues and Their German Translators between Legitimacy and Imaginary Notions,” *The German Quarterly* 79, no. 2 (Spring 2006): 155-74.

¹⁷ Alexander von Humboldt to Wilhelm Gabriel Wegener, 20 June 1790, in Alexander von Humboldt, *Die Jugendbriefe Alexander von Humboldts, 1787-1799*, eds. Ilse Jahn and Fritz G. Lange (Berlin: Akademie Verlag, 1973), 93-94.

¹⁸ Humboldt to Usteri, Autumn? 1791, in Humboldt, *Jugendbriefe*, pp. 163-64.

more first-rate people in a few weeks that I would have met in as many years.”¹⁹ Aside from providing Humboldt entry to elite scientific circles in London and giving him a prestigious name to drip over the pages of his de facto letter of application to the Mining Academy at Freiberg, Forster also directed an aspect of Humboldt’s research: namely, a study of plant migration that Humboldt called his “Forsterian project.”²⁰ Patronage and pedagogy would remain important components of Humboldt’s scientific enterprise to the end of this life.

A student under Forster and a kind of teacher’s assistant to Berthollet and Laplace, Humboldt ultimately matured into a school leader in his own right. Though much has been made of “Humboldtian Science,” a term coined by Susan Faye Cannon in 1978, historians have written very little about Humboldt’s direct interactions with younger men of science.²¹ Suzanne Marchand’s ambitious study *German Orientalism*—a study of the practices and institutions of *Orientalistik*—offers the most comprehensive coverage of Humboldt’s activities in this respect. Alexander von Humboldt, who published extensively on indigenous cultures in the Americas, and his brother Wilhelm, an accomplished philologist and leading educational reformer, were well positioned as Prussian aristocrats to offer young scholars a wealth of institutional benefits. As Marchand has demonstrated, the Humboldts represented “a continuation of the enlightened patronage role,” helping orientalists to posts in the Prussian Cultural Ministry, founding chairs for Sanskrit and geography at the University of Berlin, and opening “new lines of research” thereby. “If not for [Christian Carl Josias] Bunsen and the Humboldts,” Marchand has argued, “it is hard to imagine non-biblical orientalists getting much of a foothold in German academia;

¹⁹ Humboldt to Friedrich Heinrich Jacobi, 3 Jan. 1791, in Humboldt, *Jugendbriefe*, 117.

²⁰ Humboldt to Usteri, 27 June 1791, in Humboldt, *Jugendbriefe*, p. 95-97. In a letter to Mining Academy director Abraham Gottlob Werner, Humboldt pointed to his “journey to the *Peak of Derbyshire* (in the company of your friend, *George Forster*)” as the animating force behind his “zeal” for geognosy. (Humboldt to Werner, 12 Dec. 1791, in Humboldt, *Jugendbriefe*, 112.)

²¹ Susan Faye Cannon, *Science in Culture: The Early Victoria Period* (New York: Dawson and Science History Publications, 1978).

certainly student interest would not have merited the creation of new posts.”²² Writing to Bunsen in 1851, Humboldt fondly recalled the time when, in 1790, “Georg Forster led me into that distant world [*Vorwelt*] of Sir Joseph Banks, Cavendish, and William Herschel.”²³ Now it was Humboldt who led followers like the orientalist Justus Olshausen and, as I will argue, the oceanographer Matthew Fontaine Maury into a *Welt* of his own making.

Before turning to the Humboldt-Maury correspondence, it is worth noting how figures traditionally described as “Humboldtian”—Charles Darwin and Joseph Dalton Hooker—shared a different relationship to Humboldt than Maury did. Whereas Maury benefited from a correspondence in which he posed questions to Humboldt about natural phenomena (questions about the possible existence of the North-West Passage, for instance, or about “the existence of a ridge or submerged mountain range” between Virginia and Brazil), it was Humboldt who tended to query Darwin and Hooker about their findings (Darwin after his *Beagle* Voyage and Hooker during his Himalayan travels).²⁴ Indeed, Hooker once remarked in a letter to Darwin that he wished Darwin had been there when he met Humboldt in Paris, “for Humboldt had lots of time there, & such quantities of things to ask about, that demanded much better answers than I could give.”²⁵ Maury’s dependence upon and debt to Humboldt was more immediate than that of Darwin and Hooker, who revered Humboldt primarily for the *Personal Narrative* he had written relatively early in his career. That is to say, Darwin and Hooker revered Humboldt for things he *had done*, not things he *was doing*.

²² Suzanne L. Marchand, *German Orientalism in the Age of Empire: Religion, Race, and Scholarship* (Cambridge: Cambridge University Press, 2009), 159, 95, 116, 96.

²³ Humboldt to Bunsen, 29 Sept. 1851, in Ingo Schwarz ed., *Briefe von Alexander von Humboldt an Christian Carl Josias Bunsen* (Berlin: Rohrwall Verlag, 2006), 139.

²⁴ Maury to Humboldt, 5 Sept. 1849, in Ingo Schwarz ed., *Alexander von Humboldt und die Vereinigten Staaten von Amerika. Beiträge zur Alexander-von-Humboldt-Forschung, 19. Briefwechsel* (Berlin: Akademie Verlag, 2004), 257-258; Humboldt to Charles Darwin, 18 Sept. 1839, DCP-LETT-543; SBB-PK IIIA Nachl. Alexander von Humboldt, gr. Kasten 8, Nr. 41, 42, 43, 44.

²⁵ Hooker to Darwin, Feb. 1845, DCP-LETT-832.

In light of their tendency to use familial language while referring to Humboldt, Darwin and Hooker's reverence for him might be understood as that which one feels for a father, uncle, or grandfather who, in Hooker's words, "must not be so judged, as he was ever the same in his younger days."²⁶ Most famously, Darwin wrote that Humboldt was "the parent of a grand progeny of scientific travellers."²⁷ Writing directly to Humboldt, Hooker assured him that his work on the Himalayas "shall go forth as the offspring of Baron Humboldt's matured experience."²⁸ Never short of hubris in his later years, Humboldt had in fact described himself as the "*Urvater* of all German authors."²⁹ And it is worth noting that Humboldt's paternalism was felt by Maury as well. In his final letter to Humboldt, Maury likened himself to a "child that brings its caps full of pebbles gathered on the sea shore to its protector."³⁰ But although Darwin famously credited Humboldt for inspiring his entire career, he also criticized Humboldt's synthetic description of the universe, *Kosmos*, for its "semi-metaphisico-poetico-descriptions" and "long semiantiquarian discussions." "There is so much repetition of the Personal Narrative," Darwin wrote, "& I think no new views."³¹ Darwin and Hooker undoubtedly stood in awe of Humboldt, that "most extraordinary" and "wonderful man" who provided both inspiration and, more concretely, a wealth of ideas, facts, and theories.³² But that might not have kept Darwin from having a good laugh upon learning from Hooker about the elderly Humboldt's "constant

²⁶ Hooker to Darwin, Feb. 1845, DCP-LETT-832.

²⁷ Darwin to Hooker, 6 Aug. 1881, in F. Darwin, ed., *The Life and Letters of Charles Darwin* (New York, D. Appleton & Co., 1905), II: pp. 422-424.

²⁸ Joseph Dalton Hooker to Alexander von Humboldt, 26 Apr. 1849, SBB-PK IIIA Nachl. Alexander von Humboldt, gr. Kasten 8, Nr. 41.

²⁹ Humboldt to Johann Flügel, 20 June 1854, in *Alexander von Humboldt und die Vereinigten Staaten von Amerika*, 333.

³⁰ Maury to Humboldt, 5 May 1859, in *Alexander von Humboldt und die Vereinigten Staaten von Amerika*, 479.

³¹ Darwin to Edward Cressy, May 1848, DCP-LETT-1171.

³² Hooker to Darwin, Feb. 1845, DCP-LETT-832; Darwin to Charles Lyell, 8 Oct. 1845, DCP-LETT-919.

practice of quoting himself, his travels & his works, for every subject.”³³ The historian Peter Gay described the philosophes of the Enlightenment as “a loosely bound family” whose “pleasure in promoting the common cause was the pleasure in criticizing a comrade-in-arms.”³⁴ A century later, something of this family-like relation—which consists in a mix of adoration and disagreement—can be found among Humboldt and the “Humboldtians,” who disagreed with the former on a variety of matters, from the common ancestry of plants (“Humbolt is a multiple man,” Darwin told Charles Lyell, citing a letter from Hooker) to the classification of volcanoes (which made Darwin “grieve to find Humboldt an adorer of Von Buch”).³⁵ Darwin and Hooker may have been *descendants* of Humboldt, but they were not, like Maury, obedient *students* in “the school of Humboldt.”

II. “By a word from him”: Charisma, Research Reputation, and Institutional Benefits

In retrospect, it appears that Maury’s career as an oceanographer was well underway, both accomplished and secure, by the time he first wrote to Humboldt in 1847. As a young man, Maury had pursued his youthful dream of becoming a naval officer; and from 1825 to 1834 he made three lengthy voyages as a midshipman in the American fleet, earning the rank of lieutenant by 1836. In 1839, however, Maury was rendered unfit for duty after being injured in a stagecoach accident. Unable to serve at sea, Maury channeled his energies into numerous publications on sea voyages and navigation charts, as well as a number of political tracts on navy reform. By 1842, Maury was placed at the head of the Depot of Charts and Instruments of the Navy Department in Washington (later renamed the Naval Observatory); and by the time he

³³ Hooker to Darwin, Feb. 1845, DCP-LETT-832.

³⁴ Peter Gay, *The Enlightenment: An Interpretation. Volume I: The Rise of Modern Paganism* (New York: Alfred A Knopf, 1966), 4.

³⁵ Darwin to Lyell, 25 Aug. 1845, DCP-LETT-905; Darwin to Charles Lyell, 8 Oct. 1845, DCP-LETT-919.

penned Humboldt in 1847, Maury had published a book titled *U.S. Navy Contributions to Science and Commerce* and was preparing a map of the earth's wind field that would make its appearance the following year.³⁶ Thus, on 30 December 1847, Maury described to Humboldt his ambitious vision of an international scientific enterprise that spanned the earth's oceans, fully confident that "[t]he men of war of all nations are already provided with all the instruments, facilities & means for conducting the proposed system of observations."³⁷

Underneath the veneer of success and ambition, though, Maury and his science suffered intense scrutiny—sharpened, no doubt, by Washington's highly politicized environment. As historian Penelope Hardy recently observed, Maury and his opponents—chief among them Alexander Dallas Bache of the Coast Survey and Joseph Henry at the Smithsonian—were all “Washington insiders, whose scientific practice required as much attention to lobbying and leveraged connections as to the calibrations of instruments.”³⁸ Yet while Maury may have been something of a political insider, he was also an outsider to elite scientific circles, owing to his humble origins as a midshipman and the practical orientation of his science. These traits pitted Maury against groups like the “Lazzaroni,” a core of intellectual elites who campaigned for the professionalization of American science. On top of Maury's lack of formal education, his penchant for biblical quotations and “speculative” theoretical claims was infuriating to a New England-educated elite that eschewed such explicit religiosity in science. Moreover, as sectional divisions intensified during the Antebellum era, Maury's Virginia heritage further estranged him from northern elites like Louis Agassiz, a Swiss-born professor at Harvard since 1847, and the

³⁶ On Maury's transformation of the U.S. Navy's Depot of Charts and Instruments from a mere repository “to a place of knowledge production,” see Penelope K. Hardy, “Every Ship a Floating Observatory,” in *Soundings and Crossings: Doing Science at Sea, 1800-1970*, eds. Katharine Anderson and Helen M. Rozwadowski (Sagamore Beach: Watson Publishing International, 2016), 19.

³⁷ As quoted in Hardy, “Every Ship a Floating Observatory,” 31.

³⁸ Hardy, “Every Ship a Floating Observatory,” 20.

abovementioned Bache and Henry, who hailed from Pennsylvania and New York respectively.³⁹ In fact, at the outbreak of the American Civil War in 1860, Maury would quit his post in the U.S. Navy and serve the Confederacy.

The Humboldt-Maury correspondence was, then, not merely a Victorian display of deference and gratitude, as a quick scan of the letters might suggest. Rather, it constituted a particular dynamic in mid nineteenth-century ocean science that I wish to examine by drawing upon Martin Rudwick's "Diagrammatic 'map' of the tacit and social topography" of early nineteenth-century earth science.⁴⁰ Rudwick's three-dimensional map contains a core "élite" sphere (in which Humboldt already resided), surrounded by an "accomplished" sphere (from which, for instance, the aspiring geologist Charles Darwin made his leap into the élite realm), encompassed by a larger but more modest "amateur" sphere. In 1847, Maury may rightfully be described as an *accomplished* man of science, diagrammatically neighboring Humboldt, Agassiz, Bache, and Henry in the smaller élite core. And yet, in spite of the competence Maury's position at the helm of the Depot of Charts afforded him, Bache and Henry viewed Maury as an *amateur* man of science, more a "chronicler" than a scientist.⁴¹ Moreover, as Martin Rudwick observed, "competence was not attributed once and for all, but earned and cultivated, worked for and maintained."⁴² Bearing Rudwick's assertion in mind, I interpret the Humboldt-Maury correspondence as a trans-spherical appeal from an accomplished man of science to an élite, a technology used to earn and maintain scientific status.

³⁹ Ingo Schwarz and Gerhard Kortum, "Alexander von Humboldt and Matthew Fontaine Maury—two pioneers of marine sciences," *Historisch-Meereskundliches Jahrbuch. Band 10* (Straslund, Germany: Deutsches Meeresmuseum, 2003/4), 169.

⁴⁰ Rudwick, *The Great Devonian Controversy*, 421.

⁴¹ Chester G. Hearn, *Tracks in the sea: Matthew Fontaine Maury and the mapping of the oceans* (Camden, ME: International Marine/McGraw Hill, 2002), 195-98.

⁴² Rudwick, *The Great Devonian Controversy*, 420.

In the first letters, Maury labored to gain Humboldt's favor. He not only deferred to Humboldt's expertise (asking questions about the "*streak* of cold water, several degrees in breadth, which extends from the vicinity of the Capes of V[irginia] down towards Cape St. Roque in Brazil" and about "the difference between the whale of Davis' strait and the whale of Behring strait"), but he also sent the elder scientist a wealth of materials, including a set of his recently completed "Wind & Current Charts." Maury would later send Humboldt numerous books and maps, and he was likely involved in sending through their mutual friend, Francis Lieber, part of a cable once used in trans-Atlantic telegraphy.⁴³ Furthermore, Maury was aware that Humboldt was himself preparing a chart of the north Atlantic, and was then drafting a text about oceans currents.⁴⁴

That Humboldt instructed Prussian consul Johann Flügel to publish a letter praising Maury in Washington's *Daily Advertiser* in 1850 suggests he was well aware of Maury's position vis-à-vis the American scientific élite. It is in this displacement of a private correspondence into the public sphere, moreover, that the dynamics of the research school rise to the surface. To use J. B. Morrell's terminology, Humboldt's *charisma* and *research reputation* brought Maury personal pride as well as *institutional benefits*. "You can hardly doubt the great respect, nay, I may say the amazement, which I feel at the rapid progress which has been made in the United States during the last eight or ten years," Humboldt wrote, reflecting upon once being

⁴³ Maury to Humboldt, 5 Sept. 1849, in *Alexander von Humboldt und die Vereinigten Staaten von Amerika*, 257-58. Maury's first letter to Humboldt, dated 30 December 1847, is not printed in *Alexander von Humboldt und die Vereinigten Staaten von Amerika*, a Berlin-based publication edited by Ingo Schwarz, which compiles all of Humboldt's (known) correspondence with Americans. It is, however, cited in Penelope K. Hardy's chapter in the recently published *Soundings and Crossings* (2016), edited by Katharine Anderson and Helen M. Rozwadowski.

⁴⁴ Schwarz and Kortum, "Alexander von Humboldt and Matthew Fontaine Maury," 169. Regarding Humboldt's chart of the north Atlantic, Schwarz and Kortum have written that "the map is lost, but details may have found their way into the map of the Atlantic Ocean that was included in Heinrich Berghaus' "Physikalischer Atlas," a work published to accompany Humboldt's 'Cosmos'."

“inclined to doubt . . . whether republican governments from their very nature were not hostile to the active promotion of scientific undertakings.” But he was happily proven wrong, owing in large part, the letter suggests, to Maury’s undertakings: “I beg you to express to Lieut. Maury, the author of the beautiful chart of the winds and currents, prepared with so much care and profound learning, my hearty gratitude and esteem. It is a great undertaking, equally important to the practical navigator and for the advance of meteorology in general. It has been viewed in this light, in Germany, by all persons who have a taste for physical geography.”⁴⁵ In a single letter, deliberately displaced into public view, Humboldt (considered by many to be a founding father of meteorology) raised Maury’s stature not only as a practical but also as a theoretical man of science (“equally important to the practical navigator and for the advance of meteorology in general”), while according him international acclaim “by all persons who have a taste for physical geography”—physical geography being a recognizably Humboldtian phrase, one he would bequeath to Maury.⁴⁶

Maury was naturally elated, and his response also indicates that he believed Humboldt’s letter had actually shaped U.S. policy and science:

Your approval of such an undertaking strengthens mightily my hands for good & facilitates more than I can express, the task before me; it removed difficulties, breaks down obstacles, makes friends for the work, and enlists many laborers for the field, who were before looking on it in idleness. [...] Your letter . . . has had all the influence with my government that opinions from such a source ought to have. [...] It will afford you pleasure to learn that my labors have so far enlisted the interest of the government towards their successful prosecution as to procure a General order requiring every public cruiser to take a deep sea sounding in whatever part of the ocean and as often as practicable, and thus determine the depths of the ocean, the shape of the Marine basins &c.

⁴⁵ Humboldt to Johann G. Flügel, 19 June 1850, in *Alexander von Humboldt und die Vereinigten Staaten von Amerika*, 269-70.

⁴⁶ Peter Galison, *Image and Logic: A Material Culture of Microphysics* (Chicago: Chicago University Press, 1997), 79.

However improbable that a single letter from a Prussian savant had so decidedly shaped U.S. government policy, it is significant that Maury arrived at this very specific understanding of Humboldt's role in their relationship. In exchange for the loyalty and deference Maury showed Humboldt in carrying out a Humboldtian program of science, master granted student the requisite institutional benefits.

Although, according to historians Ingo Schwarz and Gerhard Kortum, Humboldt was aware of the “friction” between Maury and Bache and Henry, and “certainly feared that, if he took one side, he would lose his general influence,” the elder statesman in the field nevertheless continued to support Maury in an exceptional manner.⁴⁷ To be sure, Humboldt also corresponded with Bache, and included him in his public praise, though to a much lesser extent. Humboldt's correspondence with Bache, which was friendly and cordial but lacking the fervor and animation of that he expressed to Maury, suggests the two used one another to an equal degree. Upon receiving from Bache “annual reports (1848 & 1849)” concerning the construction of a canal, Humboldt asked that the American correspondent to procure and print “in a journal of large circulation of say three pages of the English translation by Mrs. Sabine of my *Aspects of Nature* (Longmans 1849,) Vol. 2, p. 319 to 322 with a title Mr. Humboldt's opinion of the Isthmus of Panama.” Bache, in his turn (albeit four years later), requested that his representative, “Mr. Kelley,” “procure through your [Humboldt's] instrumentality such access to public men in France & England as may enable him to have surveys made by the governments of the two countries.”⁴⁸ A deal was struck: American publication opportunities for access to European governments.

⁴⁷ Schwarz and Kortum, “Alexander von Humboldt and Matthew Fontaine Maury,” 175.

⁴⁸ Humboldt to Alexander D. Bache, 10 Feb. 1851, in *Alexander von Humboldt und die Vereinigten Staaten von Amerika*, 278-79; Bache to Humboldt, 27 Nov. 1855, in *Alexander von Humboldt und die Vereinigten Staaten von Amerika*, 364-65.

Whereas the Humboldt-Maury correspondence was a sort of trading block, a fairly even exchange of “instrumentality,” the relationship between Maury and Humboldt was more specifically characterized by efforts to advance the stature of the younger man in such a manner that preserves the legacy of the elder statesman in the field. While campaigning for the establishment of an international oceanographic enterprise—begun under Maury’s supervision at the First International Maritime Meteorological Conference in Brussels in August of 1853—Maury appealed to Humboldt, who was, after all, the first to publicly call for such a concerted effort.⁴⁹ “Pray you will not lend me . . . the powerful aid which a word from you would have in favour of a Main General Meteorological Conference,” Maury wrote in November of 1853, two months after meeting Humboldt for the first time at his home in Berlin.⁵⁰ Within a year of meeting Humboldt, Maury began making use of his mentor’s phrase “Physical Geography of the Sea” in the sixth edition of his *Explanations and Sailing Direction*; and in 1855 he published an ambitious oceanographic book under this title. In the introduction, Maury declared “Baron Humboldt is of the opinion that the results already obtained from this system of research are sufficient to give rise to a new department of science, which he has called the PHYSICAL GEOGRAPHY OF THE SEA.”⁵¹

⁴⁹ Humboldt’s priority is noted in Schwarz and Kortum, “Alexander von Humboldt and Matthew Fontaine Maury,” 175.

⁵⁰ Maury to Humboldt, 10 Nov. 1854, in *Alexander von Humboldt und die Vereinigten Staaten von Amerika*, 325. Maury used Humboldt’s name much as Humboldt had once used Forster’s. When a resolution was submitted to the United States Agricultural Society in 1865 recommending to Congress that “the system of meteorological co-operation and research which has done and is doing so much for commerce and navigation at sea” be extended to the land, Maury argued that “Baron Humboldt, among others, has expressed the most earnest desire to see such a concerted plan of observations inaugurated among meteorologists. He would, I am assured, be most happy to assist in maturing it, and stands ready with his counsel and advice to that end.” (As quoted in Frances Leigh Williams, *Matthew Fontaine Maury, Scientist of the Sea* (New Brunswick: Rutgers University Press, 1963), 314-15.)

⁵¹ Matthew Fontaine Maury, *Physical Geography of the Sea* (New York: Harper & Brothers Publishers, 1855), xiii.

What came next was something of a graduation ceremony from the “school of Humboldt,” and a second displacement of private relations into the public sphere of international science. At Humboldt’s behest, the Prussian Crown awarded Maury the Kingdom’s highest scientific honors, the “Große Preismedaille für Wissenschaft” and the “Kosmos-Medaille,” named after Humboldt’s five-volume “physical description of the universe,” *Kosmos*. Humboldt’s personal letter to Maury in February of 1855, informing him of the awards, is telling of their exchange of patronage and loyalty—or as Humboldt wrote, “affection.” “Sensible also of the affection with which you have honoured me for so long a period,” Humboldt wrote, “the King has deemed that he would be doing you a further pleasure by adding another medal—that which his Majesty had struck for me upon the publication of my ‘Cosmos.’”⁵² The legacy of the master was bestowed upon, and secured through, that of the student. Maury responded by assuring Humboldt that “communication from such a source conveyed in such terms & expressed by such tokens & symbols, is for the man of science a quiver full.” Acknowledging the role of charisma in his own endeavors, Maury described to Humboldt in masculine, chivalric tones how the man of science, like the knight, “feels strong for renewed labours & buckling up his armour, he finds his hands strengthened.”⁵³

A month before his death in 1859, the ninety-year-old Humboldt wrote Maury one final time to congratulate him not on his science per se, nor on the new fields of inquiry he had opened up, but on his professional development. In his own words, Humboldt wrote “to congratulate my illustrious friend on the career which he has so gloriously opened to the exertions of your contemporaries.” Coming from a man who considered himself the “father of all German

⁵² Humboldt to Maury, 3 Feb. 1855, in *Alexander von Humboldt und die Vereinigten Staaten von Amerika*, 341.

⁵³ Maury to Humboldt, 12 Apr. 1855, in *Alexander von Humboldt und die Vereinigten Staaten von Amerika*, 344.

authors,” Humboldt’s postscript is ironically humble: “Excuse the mistakes of my terrible writing,” were his final words to Maury.⁵⁴ Maury’s response, penned on 5 May 1859, may be read as a recapitulation of this section: it indicates the charisma and research reputation of the research school leader, the loyalty and affection of the student, and the institutional benefits made possible by this dynamic. Maury, for the third time, told Humboldt he has “strengthened my hands for good” and assured him once more that his “commendation of my poor labors will encourage them with the Government and people of America.”⁵⁵ Humboldt died the following day, and so never got to read this final letter from the man who considered himself his “student.” The public statement Maury made after Humboldt’s death reveals the unique epistolary character of the “school of Humboldt,” conducted as it was from his home in Berlin. “By *a word* from him new fields of scientific research were opened,” Maury told his colleagues at the American Geographical and Statistical Society in New York, concluding that “the last letter that Baron HUMBOLDT wrote was to help on a good work with *a good word*.”⁵⁶

III. “From the top of Chimborazo to the bottom of the Atlantic”: Geographical Techniques

“A good word” was not the only thing Humboldt impressed upon Maury, for he also influenced Maury’s cartographic approach to oceanography. One of the visual technologies central to Humboldt’s physical geography was the vertical profile map, which Humboldt adapted from mining, having trained and served as a miner in Germany and, during his American journey (1799-1804), continued to work alongside cartographers trained at the Mining Academy in

⁵⁴ Humboldt to Maury, 11 Apr. 1859, in *Alexander von Humboldt und die Vereinigten Staaten von Amerika*, 476-77.

⁵⁵ Maury to Humboldt, 5 May 1859, in *Alexander von Humboldt und die Vereinigten Staaten von Amerika*, 479.

⁵⁶ Maury to Lefferts, 26 May 1859, in *Alexander von Humboldt und die Vereinigten Staaten von Amerika*, Dokument 45, emphasis added.

Mexico City. Just as historian J. B. Morrell has argued that a fundamental feature of Liebig's research school were the "simple, quick and reliable experimental techniques" he bestowed upon students, so I argue that Maury, as a student in the school of Humboldt, inherited the geographical technique of the vertical profile map.⁵⁷ Like Humboldt before him, Maury utilized government institutions and state-operated sites of knowledge production to generate novel cartographic depictions of the natural world.⁵⁸ In this respect, the Depot of Charts and Instruments was for Maury what the mining institutions of central Europe and New Spain had been for Humboldt. Furthermore, this section shows how Maury promoted a lineage between Humboldt and himself in the way he constructed and described his "Vertical Section [of the] North Atlantic" published in *Physical Geography of the Sea*.

To be sure, Maury was not the first to apply vertical cartography to the ocean's depths, and Humboldt was not the only source of inspiration. Dutch cartographers had depicted coastlines in profile since at least the beginning of the seventeenth century (fig. 1); and by the end of that century, the Englishman Thomas Burnet included in his *Telluris Theoria Sacra, or Sacred Theory of the Earth* a profile of the ocean floor (fig. 2), not entirely unlike the profile Maury drew up two centuries hence.⁵⁹ Vertical thinking about the ocean's depths has a deep history of its own. As the Italian mathematician Guglielmo Libri reminded Humboldt in 1825, it was in Classical antiquity that the Greek geometer Xenagoras suggested the deepest point in the

⁵⁷ Morrell, "The Chemist Breeders," 5.

⁵⁸ This point is made with respect to Maury's utilization of the Depot of Charts and Instruments in Hardy, "Every Ship a Floating Observatory," 19.

⁵⁹ Svetlana Alpers, *The Art of Describing: Dutch Art in the Seventeenth Century* (Chicago: The University of Chicago Press, 1983), 142-43; Stephen Jay Gould, *Time's Arrow, Time's Cycle: Myth and Metaphor in the Discovery of Geological Time* (Cambridge, Mass. Harvard University Press, 2001 [1987]), 30-31.

ocean must be equal to the highest point on land, and no more than ten stadia (roughly 6,096 feet).⁶⁰

But it was Humboldt who, at the turn of the nineteenth century, infused geography with the rich visual culture of mining, having “seized upon the idea to represent whole lands as a mine” while traveling through Latin America in 1803.⁶¹ This meant viewing nature in all its verticality, representing mountains, volcanoes, and indeed entire continents in profile. Thus, when Maury unveiled the “Vertical Section [of the] North Atlantic” in his *Physical Geography of the Sea*, he began with a telling nod to Mt. Chimborazo, a volcano in modern-day Ecuador that had become the icon of Humboldt’s science, immortalized in his “Tableau physique des Andes” (first published in 1805) and a plethora of paintings and prints made subsequently (see figures 3 and 4). Maury called this section of the book “Height of Chimborazo above the Bottom of the Sea,” recording a distance of nine mines “in a vertical line” “[f]rom the top of Chimborazo to the bottom of the Atlantic.”⁶² By extending into the ocean cartographic methods that Humboldt had raised from mines to mountains, by linking mountain heights and ocean depths, Maury made himself into a modern Xenagoras.

A second pass through the Humboldt-Maury correspondence reveals that Maury was not only interested in enlisting Humboldt’s patronage (his “good word”), but also in showing off the vertical science he practiced in Humboldtian fashion. While the vestiges of their correspondence

⁶⁰ SBB-PK IIIA Nachl. Alexander von Humboldt, gr. Kasten 11, Nr. 22. Libri pointed Humboldt to “une citation d’un passage de Plutarque dont je vous avois . . . sur la relation qui existe entre la hauteur des montagnes, et la profondeur de la mer,” which in Plutarch’s *Lives of the Noble Greeks and Romans* reads as follows: “And yet the geometricians say that no mountain has a height, and no sea a depth, of more than ten furlongs. It would seem, however, that Xenagoras took his measurement, not carelessly, but according to rule and with instruments.” Notably, Humboldt cited Plutarch in both *Asie Central* and *Kosmos*, comparing the measurements of Xenagoras to those of Laplace and ultimately replacing them with his own estimations.

⁶¹ As quoted in Sandra Rebok, *Alexander von Humboldt und Spanien im 19. Jahrhundert: Analyse eines wechselseitigen Wahrnehmungsprozesses* (Frankfurt am Main: Vervuert Verlag, 2006), p. 167.

⁶² Maury, *Physical Geography of the Sea*, 208.

do not suggest that Humboldt personally tutored Maury in this craft, it is evident that Maury sought praise and approval. As Maury himself told Humboldt: “I am proud of your praises, and like the child that brings its caps full of pebbles gathered on the sea shore to its protector, so I would often fain have laid the results of my investigations at your feet.”⁶³ Among the pebbles laid at Humboldt’s feet were profile maps, like the “Profile of the ocean depths in the Atlantic” that Maury send via Friedrich von Gerolt in November 1853 (most likely a proto-type of figure 7).⁶⁴ Two years earlier, while assuring Humboldt that his publicly printed letter had effectively swayed the U.S. policy and science, Maury described to him newly developed methods of sounding and included a number of reports from the oceanic field (for example: “Lati[itude] 24°.05’ N. Long[ititude] 79.° 48’ W. from Greenwich 470 fath[om]s—time of running out 6 m[inutes]”).

Here Maury laid out an ambitious cartographic vision, one that spanned an entire ocean bed from continent to continent, just as Humboldt had once mapped the entirety of New Spain (now Mexico) from coast to coast. “The ‘Ino Adams’ on her way from the Capes of Virginia to the Coast of Africa,” Maury wrote, “will I hope, give us a line of deep sea soundings entirely across the Atlantic, and so enable us to present a vertical section of the Atlantic basin and compare it with a vertical section of this continent between the same parallels.”⁶⁵ The deep-sea

⁶³ Maury to Humboldt, 5 May 1859, in *Alexander von Humboldt und die Vereinigten Staaten von Amerika*, 479.

⁶⁴ Gerolt to Humboldt, 28 Nov. 1853, in *Alexander von Humboldt und die Vereinigten Staaten von Amerika*, 327. The vertical profile sent by Maury via Gerolt is likely to be the profile he published that year in the sixth edition of his book *Explanations and Sailing Directions*, which might be fairly regarded as a proto-type of his later 1855 profile (figure 7). According to Michael Reidy and Helen Rozwadowski, the sixth edition of *Explanations and Sailing Directions* “contains a vertical section comparing the elevation of the Rocky Mountains to the depth of the Atlantic seafloor across the Azores and Europe.” (Michael S. Reidy and Helen M. Rozwadowski, “The Spaces in Between: Science, Ocean, Empire,” *Isis* 105, no. 2 (2014): 346.)

⁶⁵ Humboldt to Maury, 11 Apr. 1859, in *Alexander von Humboldt und die Vereinigten Staaten von Amerika*, 476-77.

sounding enterprise explained here by Maury was central to the Anglo-American endeavor to lay a telegraphic cable across the Atlantic. Later, in 1856, Humboldt read from his home in Berlin a copy of Washington's *National Intelligencer* the hailed Maury's "discovery" of a "telegraphic plateau," "found of down-like softness" over which "our beautiful ocean river glides along . . . as gently as the current of time"—an ideal place, Maury argued, for a submarine cable connecting New and Old Worlds.⁶⁶ But as Helen Rozwadowski has argued, if telegraphy provided the strongest economic motive, "physical geography provided the strongest intellectual motive for [Maury's] experimental deep-sea soundings." And according to Rozwadowski, "Maury had in mind Alexander von Humboldt's scientific program as he arranged for naval vessels on routine patrolling missions to carry out deep-sea sounding gear."⁶⁷ Indeed, the comparative cartographic approach described by Maury in 1851 is strikingly similar to a vision Humboldt outlined in a paper read before the *Königliche Akademie der Wissenschaften* in Berlin in 1853. Notably, Humboldt drafted this paper after receiving Maury's Atlantic profile along with news from Edward Sabine of depth soundings that suggested the ocean's deepest point actually eclipsed the highest point on land by "17,000 Paris feet [about 18,118 English feet]"—a revelation that Maury found equally enthralling.⁶⁸ "Only once we view the earth like the moon, without its liquid shroud [*flüssige Umhüllung*]," Humboldt declared, "will the mountain-masses and peaks, indeed the entire surface of the earth, appear in their true form" (see figures 5 and 6).⁶⁹ We cannot be sure, but one might well suppose that Humboldt had Maury's Atlantic profile in mind

⁶⁶ Humboldt's personal copy of the *National Intelligencer* article "Sub-Oceanic Geography, Deep-Sea Soundings, Temperatures, Submarine Telegraphic Plateau" can be found in at the Staatsbibliothek zu Berlin: SBB-PK IIIA Nachl. Alexander von Humboldt, gr. Kasten 11, Nr. 70, Blatt 3r.

⁶⁷ Helen M. Rozwadowski, *Fathoming the Ocean: the Discovery and Exploration of the Deep Sea* (Cambridge, Massachusetts: Belknap Press, 2005), 79.

⁶⁸ SBB-PK IIIA Nachl. Alexander von Humboldt, gr. Kasten 11, Nr. 72, Blatt 72r and 61a, Blatt 36r; Rozwadowski, *Fathoming the Ocean*, 79.

⁶⁹ SBB-PK IIIA Nachl. Alexander von Humboldt, gr. Kasten 11, Nr. 72, Blatt 72r and 61a, Blatt 36r.

when he imagined the earth as a lunar landscape. What is more certain is that in 1853 Humboldt and Maury shared an approach to physical geography that was amphibious in essence. They visualized the earth, in their minds and on their maps, above and below the surface of the sea.

Maury's "Vertical Section [of the] North Atlantic" (figure 7) gave a visual reality to Humboldt's conceptualization of islands as submarine mountains; and Humboldt in turn extrapolated this way of thinking in his globe-spanning vision of the earth "without its liquid shroud." What is more, by placing Maury's Atlantic profile alongside Humboldt's eastern-most profile of New Spain, the "Tableau physique . . . de la Nouvelle Espagne" (figure 8), we find that the two cartographic projects might well be seen as a single endeavor. One could even say that Humboldt's ends where Maury's begins: the Gulf of Mexico—the "sea shore," perhaps, where Maury metaphorically laid pebbles before Humboldt's feet. Indeed, it is only by pairing Maury's "Vertical Section" with Humboldt's "Tableau physique" (figures 7 and 8) that one can compare a vertical section of the ocean with one of the continent, just as Maury had envisioned in a letter to Humboldt in 1851.

Through cartography, Maury colonized a field of research, visually and semantically planting the Humboldtian flag in the ocean frontier. Maury took himself to be extending a tried and true land-based geographical approach downwards, into the depths of the oceans.⁷⁰ "To measure the elevation of the mountain-top above the sea, and to lay down upon our maps the mountain ranges of the earth, is regarded in geography as an important thing, and rightly so."⁷¹

With these words Maury introduced the section "Height of Chimborazo above the Bottom of the

⁷⁰ This argument has been convincingly made with respect to oceans in general in Reidy and Rozwadowski, "The Spaces in Between: Science, Ocean, Empire," 341. "The earth's oceans were in many respects better suited to a Humboldtian approach than its landmasses," Reidy and Rozwadowski wrote, "where mountain ranges and national borders hampered the study of meteorology and magnetism across large geographical areas." This section of my article is intended, in part, to illuminate a specific aspect of Maury's Humboldtian approach.

⁷¹ Maury, *Physical Geography of the Sea*, 208.

Sea.” He went on to position himself as the submarine torchbearer of this terrestrial project: “Equally important is it, in bringing the physical geography of the sea regularly within the domains of science, to present its orography by mapping out the bottom of the ocean so as to show the depressions of the solid parts of the earth’s crust there below the sea-level.”⁷² In 1853, Humboldt had concluded his “liquid shroud” paper with the observation that “comparisons of positive and negative heights had already been undertaken by the Alexandrian philosophers,” noting Xenagoras’s claim that “there is no mountain higher and no sea deeper than 10 Stadia.”⁷³ Ever the historian of science, Humboldt implied a lineage from Xenagoras and his chronicler Plutarch to Laplace and himself. In his own act of self-fashioning, Maury made it possible for readers to regard the “vertical line” “[f]rom the top of Chimborazo to the bottom of the Atlantic” as that which existed between Humboldt and himself.⁷⁴ The vertical profile map—a quintessential geographic technique in the school of Humboldt—rendered this lineage visible.

The Case for Non-Institutional Research Schools: Conclusion

The non-institutional—or more accurately, epistolary—research school of Humboldt operated through carefully placed words: the personal encouragement of private letters, the public acclaim of praise in print, the development of the master’s phrase (“the physical geography of the sea”) into the student’s title, and the ultimate recognition of Humboldtian heritage, the Cosmos Medallion. The school of Humboldt was also manifest in cartography, particularly (though not exclusively) in the geographical technique of the vertical profile map—an element of physical geography that Maury extended below the surface of the sea. Prior to

⁷² Maury, *Physical Geography of the Sea*, 208.

⁷³ SBB-PK IIIA Nachl. Alexander von Humboldt, gr. Kasten 11, Nr. 61a, Blatt 36r.

⁷⁴ Maury, *Physical Geography of the Sea*, 208.

receiving the Cosmos Medallion in 1855—a sort of degree from the school of Humboldt, as I have suggested—Maury was able to fashion himself as being of the Humboldtian stamp with references to Chimborazo and a “Vertical Section [of the] North Atlantic” that said as much to those familiar with Humboldt’s “Tableau physique . . . de la Nouvelle Espagne.” Perhaps this is what Maury had in mind when he wrote that his profile and bathymetric maps of the Atlantic “speak for themselves.”⁷⁵

Scholars have written a great deal about the Science that Susan Faye Cannon dubbed “Humboldtian” in 1978.⁷⁶ “Humboldtian Science,” Cannon argued, is a study of nature combining instrumentation and quantification with a geographical sensibility. But the vague breadth and alleged pervasiveness of “Humboldtian Science” has rendered it difficult to pin down in concrete terms. While I have tried to bring greater specificity to an element of Humboldt’s science taken up by Maury in the vertical profile map, I have also suggested Humboldt’s “presence everywhere” did not in fact mean that he left “behind no field or school to bear his name.”⁷⁷ Not only did contemporaries like Roderick Murchison write of the “school of Humboldt,” but followers like Maury readily identified themselves as students. The figure Murchison had in mind while writing of this “school” was Robert Herman Schomburgk, the German-born geographer who styled his approach to surveying after Humboldt’s notion of “fixed points” based on natural monuments (*Naturdenkmäler*).⁷⁸ And as Suzanne Marchand has

⁷⁵ Maury, *Physical Geography of the Sea*, xxiv.

⁷⁶ Cannon, *Science in Culture*, 75.

⁷⁷ Walls, “‘Hero of knowledge, be our tribute thine:,’ 128-129.

⁷⁸ Burnett, *Masters of All They Surveyed*. On *Naturdenkmäler*, a concept not analyzed in Burnett’s study, see Thomas M. Lekan, *Imagining the Nation in Nature: Landscape preservation and German Identity, 1885-1945* (Cambridge, MA: Harvard University Press, 2004), 21, 39, 50.

shown in the case of Orientalist scholars, Schomburgk was one of many in his generation to seek Humboldt's advice and patronage.⁷⁹

Maury's case is unique when compared to orientalists and geographers who lived in or frequented Berlin. With the exception of a single meeting in 1853, the program of mentorship and patronage Humboldt offered Maury was conveyed across an ocean, carried out in letters, mailed materials, and awards. But even without a physical site in which to gather acolytes—a university or a laboratory, as in the case of Liebig in Gießen, Neumann in Königsberg, or Sommerfeld in Munich—Maury was fully confident that Humboldt provided him the charisma, institutional benefits, and scientific techniques that historians have tended to associate with fixed, localized pedagogical programs.⁸⁰ The research school as a unit of analysis may be more broadly applicable, and thus more illuminating, than we thought.

⁷⁹ Marchand, *German Orientalism*, 159, 95, 116, 96.

⁸⁰ Morrell, "The Chemist Breeders"; Olesko, *Physics as a Calling*; Seth, *Crafting the Quantum*.

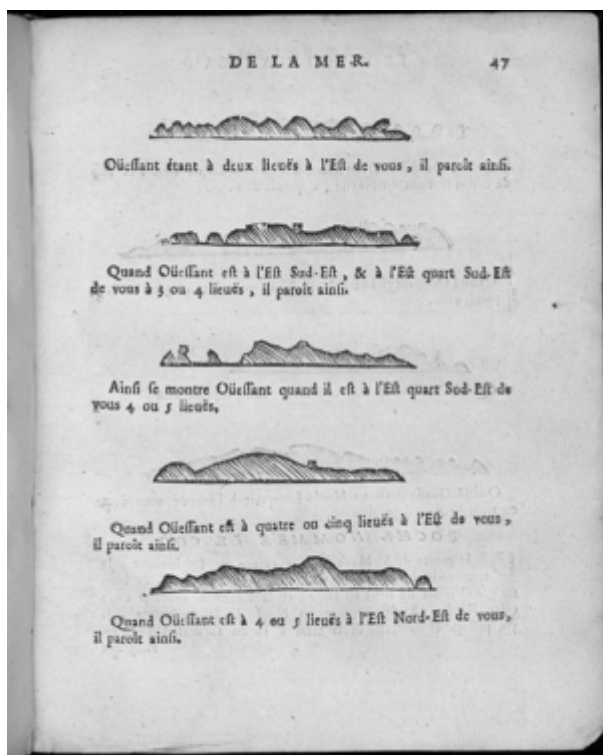


Figure 1. Coastal profile from Willem Jansz Blaeu's *Le flambeau de la navigation*, published in Amsterdam in 1625. Image source: Renaud Morieux, *The Channel: England, France and the Construction of a Maritime Border in the Eighteenth Century* (Cambridge, UK: Cambridge University Press, 2016).

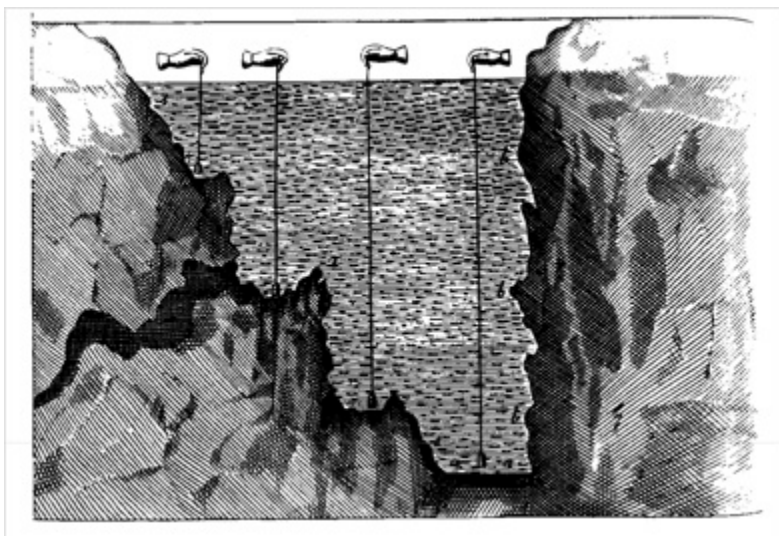


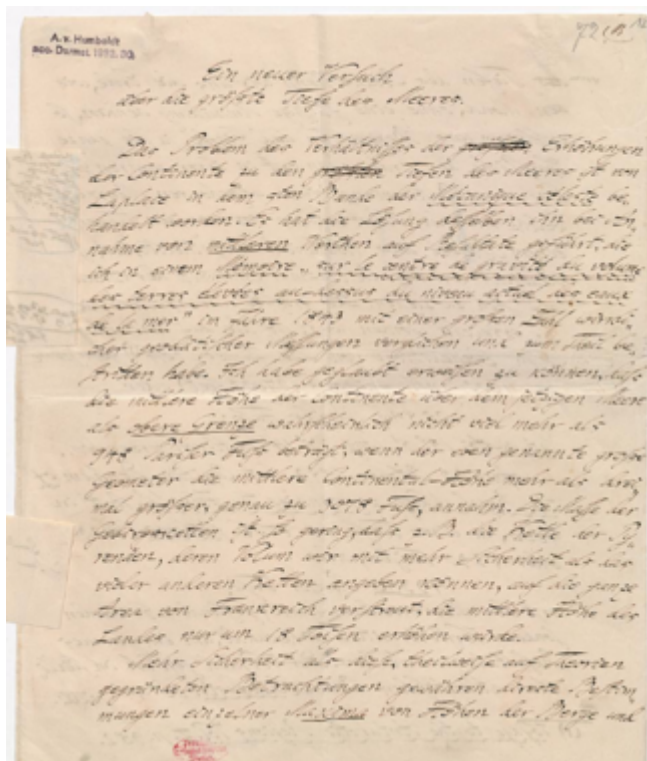
Figure 2. Vertical profile of the ocean's depths from the first edition of Thomas Burnet's *Telluris Theoria Sacra, or Sacred Theory of the Earth*, published in Latin in 1681 then in English in 1684. The four hands and sounding lines indicate the method used then as in Maury's time (though with some change) for measuring depth. Image source: Stephen Jay Gould, *Time's Arrow, Time's Cycle: Myth and Metaphor in the Discovery of Geological Time* (Cambridge, Mass. Harvard University Press, 2001 [1987]), 31.



Figure 3. Humboldt’s “Tableau physique des Andes et pays voisins,” called the “Naturgemälde der Anden” in this 1807 German edition. The “Tableau,” based on Mt. Chimborazo, was originally published in Paris in 1805 with the *Essai sur la géographie des plantes*. Wikimedia Commons.



Figure 4. Julius Schrader, *Baron Alexander von Humboldt*, 1859, oil on canvas, 158.8 x 138.1 cm. Metropolitan Museum of Art, New York. As in so many heroic depictions of Humboldt, young and old, Mt. Chimborazo looms in the background. Wikimedia Commons.



Figures 5 and 6. Humboldt’s “liquid shroud” paper delivered at the *Königliche Akademie der Wissenschaften* in Berlin, titled “A new attempt at the greatest depth of the sea,” can be found today in the Staatsbibliothek zu Berlin. Part of the manuscript survives in its draft form (left), written down by Humboldt’s assistant Johann Buschmann. The other part survives in its printed form (right), published after being read at the *Akademie*. SBB-PK IIIA Nachl. Alexander von Humboldt, gr. Kasten 11, Nr. 72, Blatt 72r and 61a, Blatt 36r.

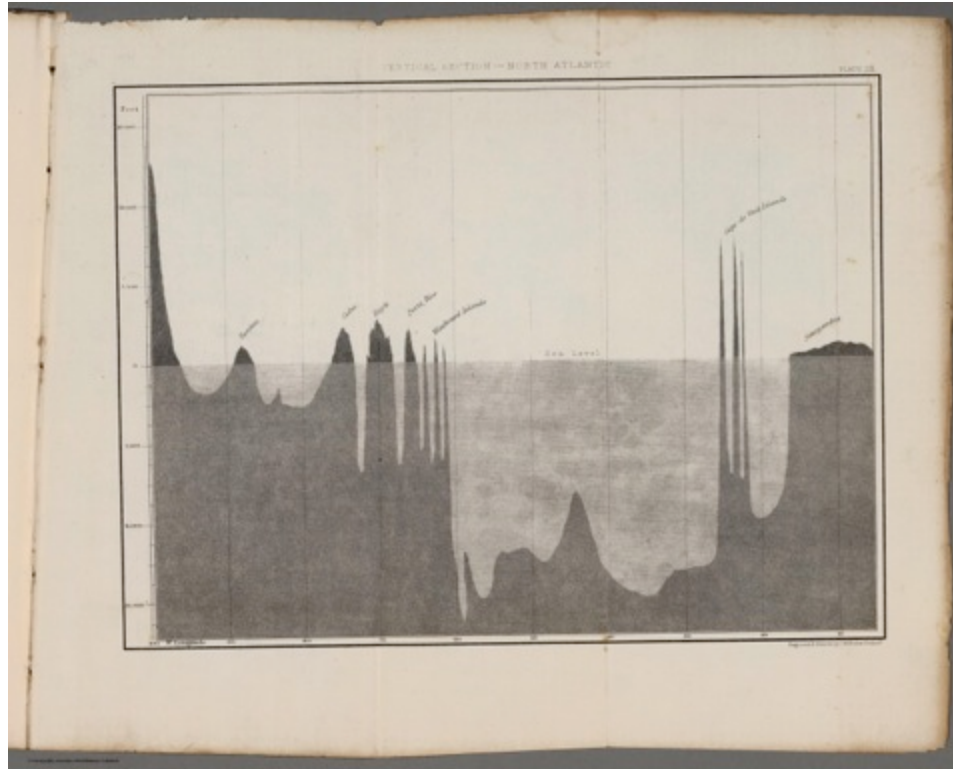


Figure 7. “Vertical Section – North Atlantic” from Matthew Fontaine Maury’s *Physical Geography of the Sea* (1855). Maury depicted islands as submarine mountains, just as Humboldt had understood them. www.davidrumsey.com

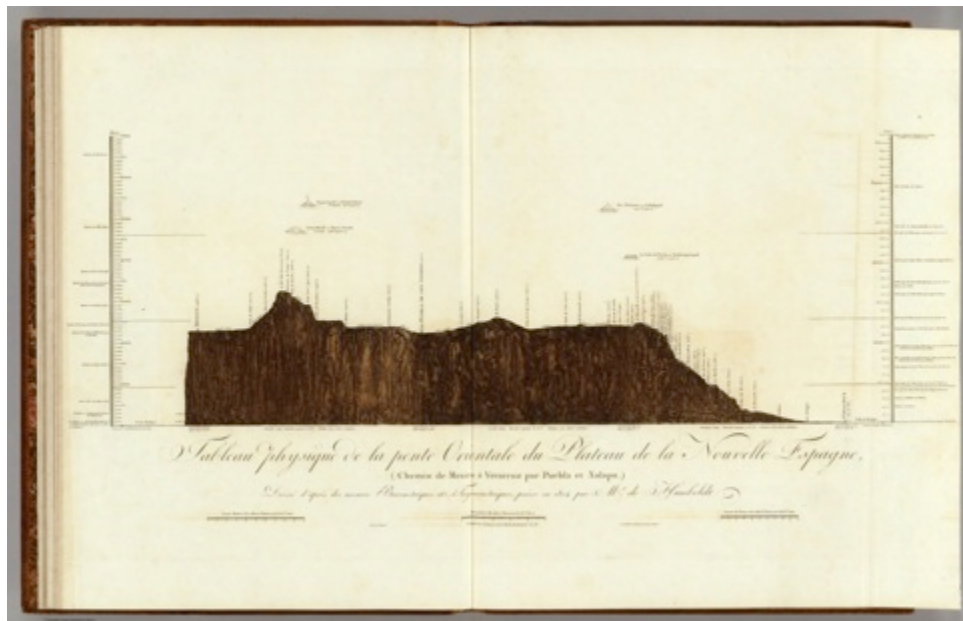


Figure 8. Humboldt’s “Tableau physique de la pente Orientale du Plateau de la Nouvelle Espagne,” drafted in 1804 by Rafael Davalos of the Mining Academy in Mexico City and published in the *Atlas géographique* in 1811. This is the eastern-most section of the three-part series. www.davidrumsey.com