

## Alexander von Humboldt and Matthew Fontaine Maury – two pioneers of marine sciences

Gerhard Kortum and Ingo Schwarz<sup>1</sup>

The United States oceanographer Matthew Fontaine Maury (1806-1873) was one of the important correspondents of the Prussian naturalist Alexander von Humboldt (1769-1859). As both are regarded as pioneers of marine sciences by the oceanography community, it is worth having a closer look at their interaction. It is not widely known that Maury visited Humboldt in Berlin in 1853 after attending the „International Maritime Meteorological Conference“ in Brussels. Humboldt had been very interested in all marine matters ever since his expedition to America (1799-1804). In his „Personal narrative“ and in later works, Humboldt covered oceanographic questions in some detail, partly using his own series of regular observations at sea that included surface temperatures, currents and other matters. Maury, a navy officer, had a very different, non-academic background. As head of the Naval Observatory in Washington, he issued wind and current charts based on abstract logs sent to him both by navy and merchant vessels. Eventually Maury's explanations grew into a book: this material formed the nucleus of his famous „Physical Geography of the Sea“. This book was edited and reprinted again and again and translated into many languages. It was regarded as a basic textbook of oceanography until the British „Challenger“-Expedition (1872-1876) inaugurated a new era in marine sciences. Apparently, it was Humboldt who suggested the title of Maury's main work, perhaps during their meeting in Berlin.

Our paper focuses on the correspondence between Humboldt and Maury at a time when the latter had to struggle for his scientific reputation in his own country. Maury had many admirers all over the world. However, his highly speculative and unscientific approaches and religious arguments in „Physical Geography of the Sea“ were also widely criticised. Thus, Maury was interested in receiving advice and support from Humboldt, who was regarded as the leading European natural scientist of that time.

Maury's main contributions came too late for Humboldt to incorporate them into „Cosmos“. Nevertheless Humboldt expressed a vivid interest in Maury's investigations into currents and deep sea morphology in connection with the first Atlantic telegraph cable project. This project was a technical and scientific highlight of the mid 19<sup>th</sup> century and is also a matter of discussion in their correspondence.

**Alexander von Humboldt und Matthew Fontaine Maury – zwei Pioniere der marinen Wissenschaften.** Der nordamerikanische Ozeanograph Matthew Fontaine Maury (1806-1873) gehört zu den wichtigen Briefpartnern des preußischen Naturforschers Alexander von Humboldt (1769-1859).

---

<sup>1</sup> Text editor: Jason H. Lindquist, Indiana University, Bloomington.

Da beide als Pioniere der Meereskunde angesehen werden, erscheint es angemessen, ihr gemeinsames Wirken näher zu untersuchen. Nicht allgemein bekannt ist die Tatsache, daß sich Humboldt und Maury 1853 in Berlin persönlich begegnet sind, nachdem letzterer an der von ihm im wesentlichen organisierten ersten „Internationalen Konferenz für Maritime Meteorologie“ in Brüssel teilgenommen hatte. Humboldt war bereits während seiner amerikanischen Expedition (1799-1804) an meereskundlichen Fragen hoch interessiert. In seiner Reisebeschreibung „Relation historique du voyage aux régions équinoxiales du Nouveau Continent“ und in späteren Werken behandelte Humboldt meereskundliche Fragen und nutzte dabei eigene Beobachtungen und Messungen, etwa zur Oberflächentemperatur und zu Strömungen.

Maury hatte als Marineoffizier einen nichtakademischen beruflichen Hintergrund. Als Direktor des Marineobservatoriums in Washington publizierte er Wind- und Strömungskarten, die auf Berichten beruhten, die ihm Kapitäne sowohl von Kriegs- als auch Handelsschiffen sandten. Die den Karten beigefügten Erläuterungen wuchsen bald zu einem Buch an. Auf diesem Material beruhte dann auch Maurys berühmtes Buch „Physical Geography of the Sea“. Dieses Werk erschien in vielen Auflagen und wurde in zahlreiche Sprachen übersetzt. Es galt als Standardwerk der Meereskunde, bis die Britische „Challenger“-Expedition (1872-1876) ein neues Zeitalter der Meereskunde einleitete. Augenscheinlich hatte Humboldt den Titel für Maurys Hauptwerk vorgeschlagen, wohl während der Berliner Begegnung.

Der vorliegende Aufsatz beschäftigt sich in erster Linie mit der Korrespondenz zwischen Humboldt und Maury zu einer Zeit, als der amerikanische Marineoffizier um sein wissenschaftliches Ansehen in den USA kämpfen mußte. Maury besaß in aller Welt viele Bewunderer, was jedoch nicht bedeutete, daß seine spekulativen und unwissenschaftlichen Ansätze und religiösen Deutungen in „Physical Geography of the Sea“ nicht auch stark kritisiert wurden. Somit war Maury an Ratschlägen und vor allem an moralischer Unterstützung durch Humboldt interessiert, der als der führende Naturforscher seiner Zeit galt.

Maurys wesentliche Beiträge zur Meereskunde kamen zu spät, um noch in Humboldts „Kosmos“ ihren Niederschlag zu finden. Nichtsdestoweniger drückte Humboldt sein lebhaftes Interesse an Maurys Untersuchungen über Meeresströmungen und an der Erkundung der submarinen Morphologie aus, die die Verlegung des ersten transatlantischen Telegraphenkabels vorbereitete. Dieses Projekt wurde als technische und wissenschaftliche Höchstleistung in der Mitte des 19. Jahrhunderts auch in der Korrespondenz zwischen Humboldt und Maury berührt.

### 1. Introduction: Two pioneers of marine sciences

At the VII<sup>th</sup> International Congress on the History of Oceanography in Kaliningrad/Königsberg (September 8<sup>th</sup> to 14<sup>th</sup>, 2003), a special symposium was held to commemorate the first „International Maritime Meteorological Conference“ in Brussels in 1853. This conference had been organized by the American oceanographer and navy officer Matthew Fontaine Maury, who visited Alexander von Humboldt in Berlin soon after the conference. Because Humboldt had also been interested in marine sciences ever since crossing the Atlantic Ocean from Spain to Venezuela in 1799, the history of oceanography may benefit from a more detailed study of the communication between these outstanding men. Both are regarded as pioneers of marine sciences, but their background, their careers and characters were quite different, as were their approaches to the study of the sea. Their interactions include letters and other personal communications, as well as references to each other in major works.

The scientific relations between Humboldt and Maury were first analysed by Kortum (1985), who presented some details of their Berlin meeting on September 14<sup>th</sup>, 1853, and referred to some of their letters. A systematic documentation of their correspondence is included in Schwarz (2004), an edition of Humboldt's correspondence related to the United States. Humboldt liked to call himself „half an American“, in part because two hundred years ago, from May 20<sup>th</sup> to June 30<sup>th</sup>, 1804, he paid a short visit to the United States on his way back to Europe. Humboldt's visit to the U.S. has been very well documented by Herman R. Friis (1959). Thus we know exactly which places he visited and who he met (cp. Schwarz, 2001). It seems that Humboldt had not planned his trip to the United States long in advance. It was the American consul in Havana who had convinced Humboldt that, with his experiences, he would be very welcome in the new Republic. Humboldt enjoyed his stay during which he met the scientific elite in Philadelphia, as well as members of the administration and the president himself in Washington. Humboldt saw President Jefferson several times in the White House. Their correspondence between 1804 and 1825 was certainly more substantial and became more widely known than the letters which Humboldt exchanged with Maury some decades later.

Humboldt's stay in the United States was short but it became the basis of a deep interest in the scientific and political developments in the young Republic on the part of the Prussian explorer. He was always eager to get new information through letters and visitors, and Maury was only one of them. Among Humboldt's American correspondents we find statesmen Albert Gallatin and James Madison, explorer John C. Frémont, historian William H. Prescott, painter George Catlin, astronomer Benjamin A. Gould, and naturalists Louis Agassiz, Alexander Dallas Bache and Benjamin Silliman, Sr.

Today, two hundred years after his return to Europe, Humboldt's world view and his achievements as explorer, statesman and author are beginning to receive new attention in both the Old and the New World.

From Humboldt's perspective, the United States – and particularly its scientists – always played a special role. This paper investigates his relations to one of these outstanding U.S. citizens.

## 2. Humboldt and oceanography

Humboldt visited Königsberg several times. In April and December 1829 he and his companions passed the city on their way to and from Russia. Five years later Humboldt went there again as part of the King's suite, taking a Russian steam boat from Swinemünde/Swinoujście. In Königsberg he met the famous astronomer Friedrich Wilhelm Bessel on August 29<sup>th</sup>, 1834. On his way back he realized in Danzig/Gdansk that he had forgotten his thermometer and so he asked Bessel to send it to Berlin (cf. Felber 1994, p. 91). While on board, he measured the surface temperature of the Baltic Sea and was able to describe an upwelling event off the Pommerania coast, which occurs there frequently under certain meteorological

conditions (cp. Kortum/Lehmann 1997). This episode indicates Humboldt's strong inclination towards marine research. He was a cosmopolitan genius with a multi-, or better said, a *trans*-disciplinary approach to nature and the world as a whole. This is one reason why he is still an important source of inspiration for any modern scientist with a background in ecology. His long life and the multitude of subjects and ideas covered in his publications and letters will also be studied by coming generations. Unity in diversity, as expressed in his „Cosmos“, is only one influential topos. Humboldt did not use the term „geography“ very often, and when he did, it was mostly in the context of plant ecology. And yet, he can certainly be regarded as one prominent founder of this modern discipline. All Humboldt biographies – and there are many – list his contributions to other arts and sciences, such as painting, literature, ethnography, cartography, astronomy, botany, medicine, mining and geology, meteorology and others.

Oceanography is part of this wide spectrum. Humboldt had an emotional relation to the ocean, as he confessed in the final paragraph of his somewhat short, but concise marine-sciences section of his „Cosmos“. Summarizing his own experience and knowledge around 1845, Humboldt wrote: „A peculiar predilection for the sea [in the German original: „eigenthümliche Vorliebe für das Meer“], and a grateful remembrance of the impression which it has excited in my mind, when I have seen it in the tropics in the calm nocturnal rest, or in the fury of the tempest, have alone induced me to speak of the individual enjoyment afforded by its aspect before I entered upon the consideration of the favorable influence which the proximity of the ocean has incontrovertibly exercised on the cultivation of the intellect and character of many nations, by the multiplication of those bands which ought to encircle the whole of humanity [...]“ (Humboldt 1997, vol. 1: 310). Early in his „Personal Narrative“, Humboldt records a similar sentiment: „From my earliest youth I had felt an ardent desire to travel into distant regions, which Europeans had seldom visited [...]. Educated in a country which has no direct communication with the colonies of either India, living amidst mountains, remote from the coasts, and celebrated for their numerous mines, I felt an increasing passion for the sea, and distant expeditions. [...] The taste for herborisation, the study of geology, rapid excursions to Holland, England, and France, with the celebrated Mr. George Forster, who had the happiness to accompany Captain Cook in his second expedition round the globe, contributed to give a determined direction to the plan of travels which I had formed at eighteen years of age.“ (Humboldt/Bonpland 1972, vol. 1: 3-4.) Some pages later he added: „[...] from the nature of my constitution I never was subject to sea-sickness, and feel an extreme ardour for study during the whole time I am at sea.“ (Humboldt/Bonpland 1972, vol. 1: 44.) The first volume of his narrative reads like a log book and is a classic document in the history of oceanography containing long passages on ocean currents, sea weed and other matters. At sea, Humboldt used his excellent marine chronometer and astronomical instruments as well as his thermometer whenever possible. As a result, his Atlantic crossing from the port of La Corunna in Spain to Cumana in Venezuela (June 5<sup>th</sup> to July 16<sup>th</sup>, 1799 via Tenerife) became a research cruise. Furthermore, Humboldt crossed the Caribbean several times. His observations there



Fig. 1: A. v. Humboldt in 1857 (Lithograph after a photograph by Vinzenz Katzler).

are less known, as they were not included in the popular German edition of the „Personal Narrative“ (Humboldt 1859/1860). It took him 42 days at sea to get from Callao in Peru to Acapulco in Mexico (with a stopover in Guayaquil, between January 4<sup>th</sup> and February 17<sup>th</sup>, 1803). His Pacific experience was also of some consequence, as the cold water current off the Peruvian coast was later named the „Humboldt Current“ (Humboldt-Strom) in German literature. At the beginning, Humboldt did not like this name, but he later felt flattered.



Fig. 2: A. v. Humboldt in his apartment in Berlin, Oranienburger Strasse 67, where he met M. F. Maury in his library room on September 13th, 1853 (after a watercolour painting by Eduard Hildebrandt, 1856).

Including his journey back to Europe (from Veracruz to Havana, March 7<sup>th</sup> to 19<sup>th</sup>, 1804; from Havana to Philadelphia, April 29<sup>th</sup> to May 20<sup>th</sup>, 1804; from Philadelphia to Bordeaux, June 30<sup>th</sup> to August 1<sup>st</sup>, 1800) ten percent of Humboldt's expedition to America was spent on board different vessels. With more than 208 total days at sea, the explorer had more ocean experience than some modern oceanographers. Details of his marine investigations are scattered throughout his works and need further study. To give only an example, it was Humboldt who first suggested a multi-ship survey of the Gulf Stream area, equipped with state-of-the-art-equipment – an innovative idea indeed.

In Germany, the oceanographic community is aware of Humboldt's pioneering role in the development of marine sciences, and a middle-sized research vessel was named after him (retired from service in August 2004). Geographers and oceanographers, especially from Kiel University, have preserved Humboldt's marine legacy over the decades (Krümmel 1907/1911, Wüst 1959, Dietrich 1970, Kortum 1985 – Kortum 2003, cp. Kohl 1966, Defant 1960 and Engelmann 1969 a).

Apart from his „Personal Narrative,“ we find extensive marine passages in Humboldt's „Views of Nature“ (Humboldt 1849 a, Engl. translations: Humboldt 1849 b, Humboldt 1850) and in his monumental „Cosmos“ (Humboldt 1845-1862, Engl. translations: Humboldt 1846-1858; Humboldt 1997).

His marine texts cover physical oceanography (mainly temperature regime and ocean currents, maritime meteorology, marine biology and marine geology, about which very little was known around 1850). Some details of Humboldt's views will be discussed below. It is important to note that Maury's correspondence with Humboldt did not start until 1849 – after the completion of the first edition of the „Wind and Current Charts“. There are, therefore, no references to Maury in Humboldt's publications before that date. Humboldt quotes other authorities in the marine context, especially „An Investigation of the Currents of the Atlantic Ocean“ by the British hydrographer J. Rennell (Rennell 1832). He visited Rennell in London in 1829 in order to obtain his sea surface temperature data. Rennell's theories on Atlantic circulation (first impulse from the Agulhas Current around the Cape of Good Hope) influenced Humboldt and Maury alike. In his own publications, Humboldt reflects an early stage in the development of oceanography – the observational phase of the era of circumnavigations. Thus, the passages on oceanography in the „Personal Narrative“ were outdated by the time the German edition by Hermann Hauff appeared. However, the author declined to revise and update the text which he had written decades before in French. The extensive marine footnotes in the third edition of „Views of Nature“ appear to be more „modern“.

Maury's approach fascinated Humboldt, who, like Benjamin Franklin and other Americans, felt that the knowledge of the ocean current system and its variability would make navigation faster and safer. Today, in an era when scholars are rediscovering Humboldt's merits in general and his contributions to the sciences in particular, we admire his fresh spirit and inspiration in addressing oceanographic matters. Humboldt made his own observations and experiments whenever he was on board a vessel. Even before his departure for America he used the time aboard the „Pizarro“ for an important experiment that is described in his „Personal Narrative“:

„Crossing from Corunna to Ferrol in shallow water, near the White Signal, in the bay, which according to d'Anville is the Portus Magnus of the Ancients, we made several experiments by means of a valved thermometrical sounding lead, on the temperature of the ocean, and on the decrement of calorie in the successive strata of water. The thermometer on the bank, and near the surface, was from 12.5° to 13.3° centigrades, while in deep water it constantly marked 15° or 15.3°, the air being at 12.8°. The celebrated Franklin, and Mr. Jonathan Williams, author of the work which appeared at Philadelphia under the title Thermometrical Navigation, were the first to invite the attention of the naturalists to the phenomena of the temperature of the ocean over shoals, and in that zone of tepid flowing waters, which runs from the Gulf of Mexico to the banks of Newfoundland, and the northern coasts of Europe. The observation, that the proximity of a sand-bank is indicated by a rapid descent of the temperature of the sea at it's surface, is not on-

ly interesting to the naturalist, but may become also very important for the safety of navigators." (Humboldt, 1972, vol. 1: 29-30).

Thus, „Humboldt the Navigator“ (cf. Kortum, 2001 a; Kortum, 2001 b) used U.S. sources for his ocean studies dating from the time of his visits to Philadelphia and Washington in 1804. About half a century later, the Prussian scientist became aware of Maury's important researches.

### 3. M. F. Maury, pathfinder of the sea

Most contemporary textbooks on oceanography include an introductory chapter on history, and Maury is mentioned at some length in all of them. Looking at the few monographs on the history of oceanography (Herdman 1923, Schlee 1973, Deacon 1997), we find that Humboldt's contributions are either not considered at all or are reduced to footnotes. This is due to different receptions of national legacies. In Paffen/Kortum (1984) the German tradition was covered in detail, including an appreciation of Humboldt's influence on marine science. Most sources are unaware of the fact that Maury had met Humboldt and that they exchanged letters. Hopefully, a new era of global networking will correct the limited scope of current scholarship about these pioneers in both Germany and the Anglo-Saxon world. Biographies of Maury by Caskie (1928), Leighly (Introduction to Maury 1963), Maury Corbin (1888), Lewis (1927), Wayland (1930), Williams (1963), as well as shorter reviews of his life and career (Schumacher 1953, Whipple 1963 and others), concentrate on four major issues: Maury's „Wind and current charts with explanations to accompany them“, his „The Physical Geography of the Sea and its Meteorology“, the Brussels Conference which Maury had organized, and the transatlantic submarine telegraph line. In fact, all these main aspects of his work are referred to in the correspondence with Humboldt.

For Humboldt, the ocean was just one object of research among many others, though it was certainly of great importance to him. For Maury, as a navy man, the sea was his life. When Maury was born on January 14<sup>th</sup>, 1806 in Fredericksburg, Virginia, Humboldt was already a famous scientist working together with specialists on the publication of his findings and observations from his American expedition. Two days after Maury's birth, Humboldt lectured in Berlin on the indigenous peoples of America and their monuments (cf. Biermann/Jahn/Lange 1983: 37). Humboldt was many years older than Maury, and their personalities and careers differed greatly. Nevertheless, they would later develop a deep appreciation for each other's works.

In 1810 Maury's father, a poor farmer, moved westward and settled near Franklin, Tennessee. Today this county is adjacent to the Maury and Humboldt counties; thus Franklin is „geographically“ honoured by both of them. Maury spent his youth and school time near Franklin. He entered the U.S. Navy as a midshipman in 1825 and spent most of the next nine years at sea, crossing the Atlantic several times, sailing around South America, and going westward around the

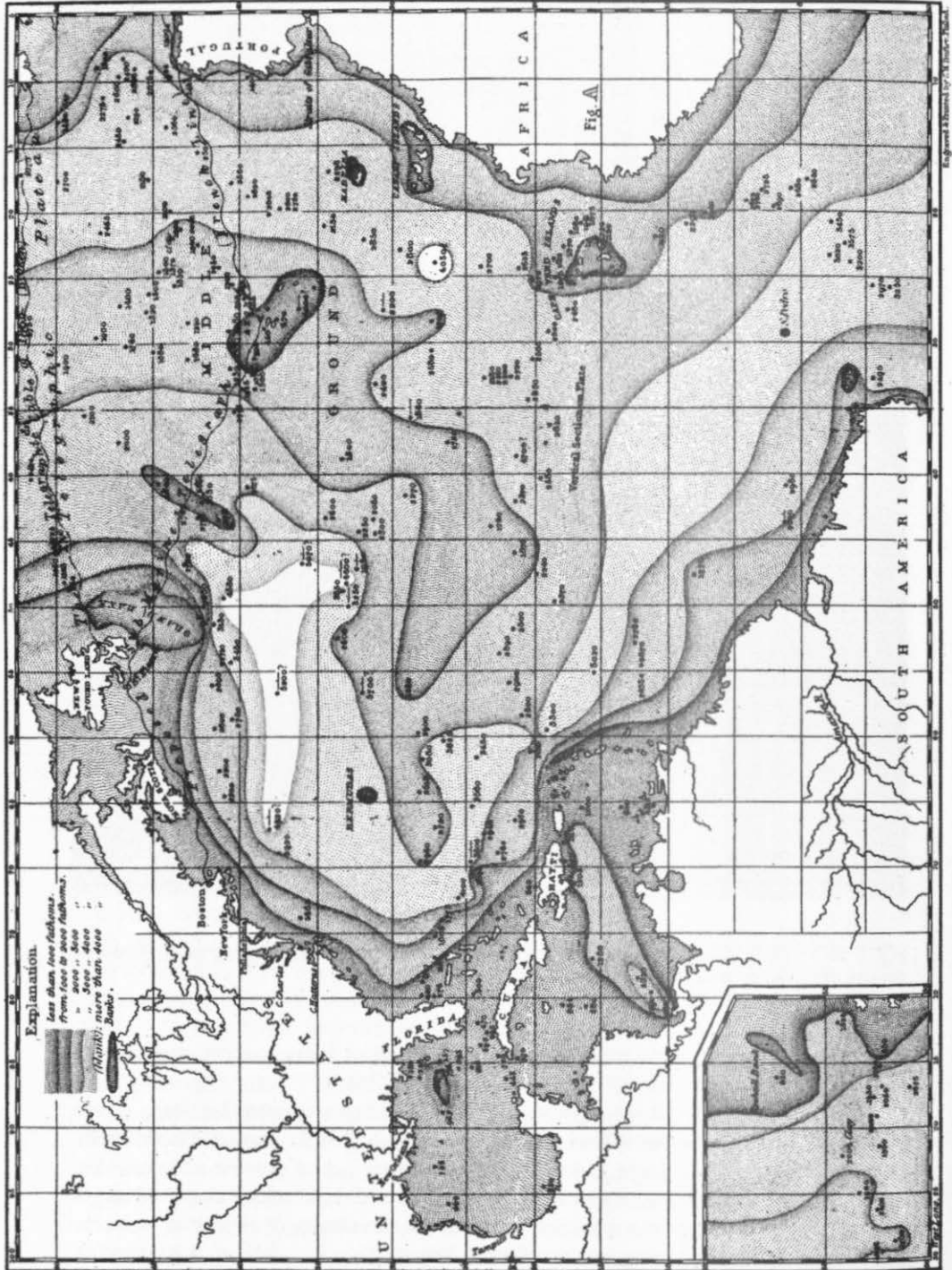




Fig. 3: M. F. Maury about the time he left for the Brussels conference in 1853 (Photograph by Bendann, Library of Congress, Williams 1963: 291).

globe. After this circumnavigation, he took a longer leave and started writing about navigation and nautical astronomy (Maury 1836).

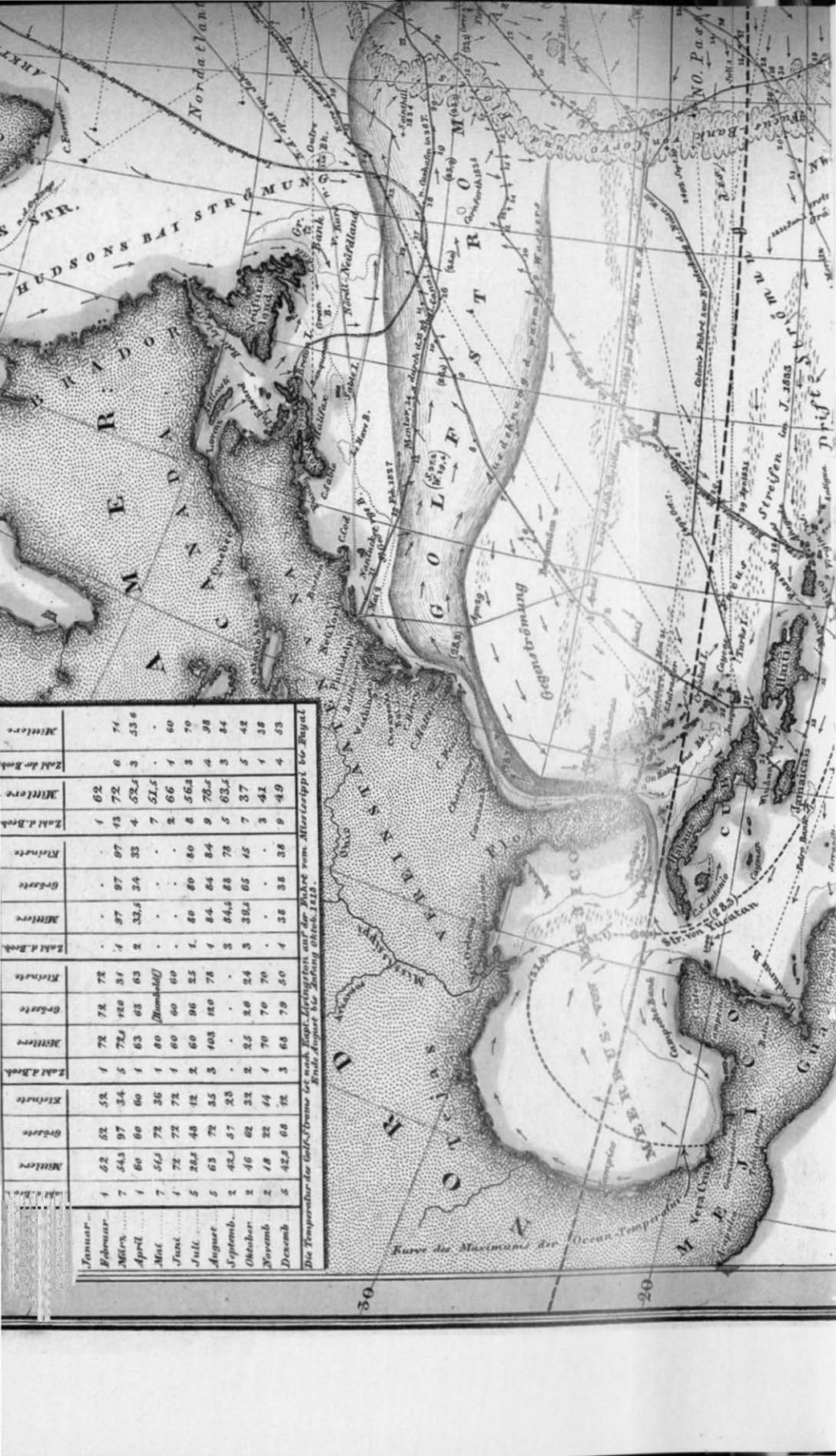
In October 1839 his right leg was severely injured when his stage coach overturned *en route* to New York, where he was to report for duty. He never fully recovered from this accident and was no longer fit for active duty on a vessel. One of his biographers remarked sarcastically that this accident, which ended Maury's career with the navy, was a stroke of luck for the development of marine science; eventually, however, Maury was recalled to duty on July 1<sup>st</sup>, 1842 after a period of



Copyright © 1914 by G. Kortum and I. Schwarz

idleness, and he served as superintendent of the Navy's Depot of Charts and Instruments. This shore-based agency was later reorganized and renamed the Naval Observatory (after 1866 it was called the Hydrographic Office). As superintendent, Maury was now in the position to combine his nautical astronomy interests with compilations of statistical data from log books sent to the Observatory. In summary, as Leighly put it in 1963, he turned his attention from the heavens to the sea and the atmosphere. Maury introduced special reporting forms (abstract logs) for masters of all U.S. vessels; these logs had to be sent for centralized processing to Washington. This approach was unique and very helpful in producing wind and current charts for different parts of the oceans. The first set of sheets appeared in 1847 and was distributed free of charge to all participants in the project. Over the years, Maury and his staff received more and more logs which were carefully reviewed. In 1851, the publication of „Explanations and Sailing Directions to accompany the Wind and Current Charts“ began. The 8<sup>th</sup> edition of this work, enlarged and improved, was published in two volumes 1858. Obviously, the masters and officers liked Maury's form of presentation. The information he provided was necessary for finding a fast and safe way across the seas. In the introduction to the first edition of his „Physical Geography of the Sea“, Maury stated: „The primary object of 'Wind and Current Charts,' out of which has grown this Treatise on the Physical Geography of the Sea, was to collect the experience of every navigator as to the winds and currents of the ocean, to discuss his observations upon them, and then to present the world with the results on charts for the improvement of commerce and navigation.“ (Maury 1855: III.) Furthermore, Maury outlined the background and results of the International Maritime Congress in Brussels 1853, which he had organized and at which he had presided. This was certainly the culmination of Maury's career. He records: „Therefore, all who use the sea were equally interested in the undertaking. The government of the United States, so considering the matter, proposed a uniform system of observations at sea, and invited all the maritime states of Christendom to a conference on the subject. [...] This conference, consisting of representatives from France, England and Russia, from Sweden and Norway, Holland, Denmark, Belgium, Portugal, and the United States, met in Brussels, August 23, 1853, and recommended a plan of observations which should be followed on board the vessels of all friendly nations, and especially of those there present in the persons of their representatives. [...] Prussia, Spain, the free city of Hamburg, the republics of Bremen and Chili, and the empires of Austria and Brazil, have since offered their co-operation also in the same plan“ (Maury 1855: XII-XIII). And Maury continued: „Thus the sea has been brought regularly within the domains of philosophical research, and crowded with observers. [...] Baron Humboldt is of 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.“ (Maury 1855: XIII.) We agree with

Fig. 4 (left): Maury's bathymetric chart of the North Atlantic Ocean (The Physical Geography of the Sea, 8th edition, 1861, Schlee 1974: 46-47).



Die Temperatur der Luft-Temperatur ist nach Regel-Lingenen auf der Höhe vom Meeresspiegel bei Regal  
 und die Temperatur der Luft-Temperatur ist nach Regel-Lingenen auf der Höhe vom Meeresspiegel bei Regal

Monat	Mittlere	Grösste	Kleinste	Zahl d. Beob.	Mittlere	Grösste	Kleinste	Zahl d. Beob.	Mittlere	Grösste	Kleinste	Zahl d. Beob.
Januar	1	62	52	1	72	78	72	1	72	78	72	1
Februar	7	54,5	37	5	72,5	78	51	1	87	97	67	4
März	1	60	60	1	63	63	63	2	32,5	34	33	4
April	1	66	66	1	60	60	60	1	66	66	66	1
Mai	7	66,5	72	36	1	60	60	1	66	66	66	1
Juni	1	72	72	1	60	60	60	1	66	66	66	1
Juli	5	24,5	48	42	2	60	66	5,5	40	60	60	8
August	5	63	72	3,5	103	150	78	1	84	84	84	9
September	2	45,5	57	3,5	1	3	84,5	88	78	5	63,5	3
Oktober	2	46	62	3,2	2	2,5	2,6	2,4	3	32,5	65	45
November	2	18	22	4,4	1	70	70	70	3	41	3	41
December	5	42,5	68	12	3	68	79	50	4	38	38	9

Kurve der Maximumen der Ocean-Temperatur

Leighly (1963) and Williams (1963) that the title of Maury's main book, which is based, in principle, on the „Explanations and Sailing Directions“ (many parts are identical), was suggested by Humboldt to Maury, probably during their meeting in Berlin. Maury first used this term in the 6<sup>th</sup> edition of his 1854 „Explanations“ as a heading for the section on the investigations of the Atlantic Ocean made under his direction.

Maury's work was reprinted many times and appeared in several foreign translations. Its obvious success, however, did not prevent scientists from severely criticising it. As one scholar noted, „In spite of its popularity the book had some serious shortcomings, and these did not go unnoticed. What bothered scientists about Maury's work was the oversimplified and often contradictory explanation which he insisted upon advancing for all the data that fell into Maury's hands [...]. While energy and ambition went a long way towards making up for his lack of formal education, these admirable qualities were not enough to initiate Maury into the intricacies of geophysics and fluid dynamics. Yet these were the areas which fascinated him, and he formulated theories concerning the most complex systems of the sea and supported his contentions with a few observations, a vast number of assumptions, and quotations from the Bible.“ (Schlee 1973: 58-59). It may be true that Maury had an „amateurish approach to science“, a tendency which infuriated A. D. Bache, L. Agassiz, Joseph Henry and other contemporaries in the United States who were also interested in marine science. The German geographer Johann Georg Kohl, who had emigrated to the U.S. and was working for Bache during the years 1854 to 1857, compiled an account of the history of Gulf Stream research for the United States Coast Survey, which he published in German after returning home (Kohl 1966). In his book we find a more detailed discussion of the competition between the various agencies in America and the difficulties Maury had to face as a result. It should be mentioned that Kohl was one of the first scientists who began to appreciate Humboldt's contribution to oceanography; he knew, for instance, that Humboldt was working on a longer text about ocean currents and that he had prepared a chart of the North Atlantic (Kohl 1966: 125). Unfortunately this 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“ (Berghaus 2004: 32/33).

Maury was a Southerner and had no New England academic background. On April 20<sup>th</sup>, 1861 he chose to resign from the United States Navy and leave the Naval Observatory. He was commissioned in the Confederate States Navy and went to England on a secret mission to acquire vessels. After the war, Maury's wind and current project was not continued, and he decided to go to Mexico. Later, he went to England in order to promote a military torpedo project. In 1868, he accepted a chair at the Virginia Military Institute and started to write a popular manual of geography for schools. In addition to these activities, he lectured on diverse

matters in many cities. Matthew F. Maury died in Lexington, Virginia on February 1<sup>st</sup>, 1873. In September of that year, his body was taken to its final resting place in Richmond. A monument to him was unveiled there in 1929 (the sculptor was F. W. Sievers). In 1915 a hall had been dedicated to Maury at the United States Naval Academy in Annapolis, Maryland. His bust stands in The Hall of Fame for Great Americans at New York University (see photos in Williams 1963: 290-291).

It is not possible here to analyse Maury's works in detail or to discuss the arguments of his critics concerning the arrangement and style of his books or the physical misconceptions and religious connotations which crept into his work. Maury was a practically minded man, and Humboldt appreciated his efforts, the merits and fame of which have survived more than a century. Today the history science community in the United States with interest in marine subjects organizes a Maury-Conference every other year to honour this „pathfinder of the seas“.

#### 4. The relationship between Humboldt and Maury

On May 26<sup>th</sup>, 1859, Maury sent the following lines to the American Geographical and Statistical Society of New York, which was preparing a commemorative meeting for Humboldt:

„As great, important and valuable as are the contributions which Humboldt made directly to the general stock of human knowledge, it may well be questioned whether those which, simply by his influence, he induced, assisted and enabled others to procure or to make, are not manifold greater. With unerring judgement he knew how to encourage, and when to commend. Often in the loneliness of his calling, has the 'well done' of this great man cheered and encouraged the student with his speciality, the philosopher with his researches“.  
(Schwarz 2004: 575.)

These remarks precisely outline the relationship between Maury and Humboldt and corroborate all we know about Humboldt's contacts with other researchers, authors, artists etc. whom he helped in one way or another, especially when in Berlin. Often it was enough help to write some lines in a letter of recommendation or to advise the King of Prussia to sponsor a specific project. The Humboldt biographies give many examples of such interventions. For Humboldt it was a form of indirect influence and networking – and it is certainly a charming part of his character. Obviously, Maury tried to profit from the relationship as well, in part because he had problems at home: this may be one more reason that he approached Humboldt. Their correspondence consists of ten letters they exchanged between 1849 and 1859. However, the numerous references to Maury in letters from Humboldt to other persons in America and Europe are important, too. In particular, the American Consul in Leipzig, Johann Gottfried Flügel, received a lot of information from Humboldt, and whenever he read some favourable judgement of

American scientists, he copied and sent the quotations to those who were praised.

Humboldt particularly admired Maury's tremendous efforts in making ocean navigation safer and faster, and he supported Maury in his exploration of the Grand Circle line from Newfoundland to Ireland as a preparation for the first submarine Atlantic telegraph.

#### 4.1. Humboldt and Maury's „Wind and Current Charts“

„Lieut. Maury presents his compliments to Baron Alexander De Humboldt and begs that the Baron will do the Lieut. the favour to accept a set of 'Wind & Current Charts' which the Lieut. has the honour of sending thro' his friend, Professor Rümker of Hamburg.“ (Schwarz 2004: 257.)

This is the beginning of the first letter which Maury sent to Humboldt. It is dated September 5<sup>th</sup>, 1849. Maury was at that time forty-three years old, Humboldt just shy of eighty. Humboldt's famous travels in South and Central America had started fifty years before; his expedition to Russia had taken place in 1829. And still, the world famous traveller and scientist had ten years ahead of him. Those were years of hard labor on his „Cosmos“, years of service at the Prussian court, and years of promoting young, gifted scientists.

In 1844, Maury had been appointed head of the newly built Naval Observatory in Washington, DC. This had happened against the opposition of his predecessor in this position, the astronomer James Melville Gilliss. Gilliss was close to a group of influential men who controlled important scientific institutions in the United States. Since 1843 the Coast Survey had been directed by A. D. Bache, a great-grandson of Benjamin Franklin. Bache's friend J. Henry taught physics at Princeton, and, in 1846, became the founding secretary of the Smithsonian Institution. Both Bache and Henry had been against Maury's appointment as superintendent of the Naval Observatory.

Maury was not a trained astronomer, and, what is more, his main interests were in improving practical navigation. The results of his efforts were the famous „Wind and Current Charts“ some of which he sent to Humboldt in September 1849.

Humboldt did not answer Maury's letter either immediately or directly. Instead, he wrote to Johann Gottfried Flügel, United States consul in Leipzig. The passage related to Maury in Humboldt's letter to Flügel, dated Berlin, June 19<sup>th</sup>, 1850, reads as follows: „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.“ (Schwarz 2004: 269-270.)

Humboldt's opinion about Maury's works was not only copied and sent to the author; it also appeared in the newspaper „Daily Advertiser“ and was reprinted many times. Maury found it so important that he quoted it in his „Explanations and Sailing Directions to accompany the Wind and Current Charts“ (Maury 1851: 3).

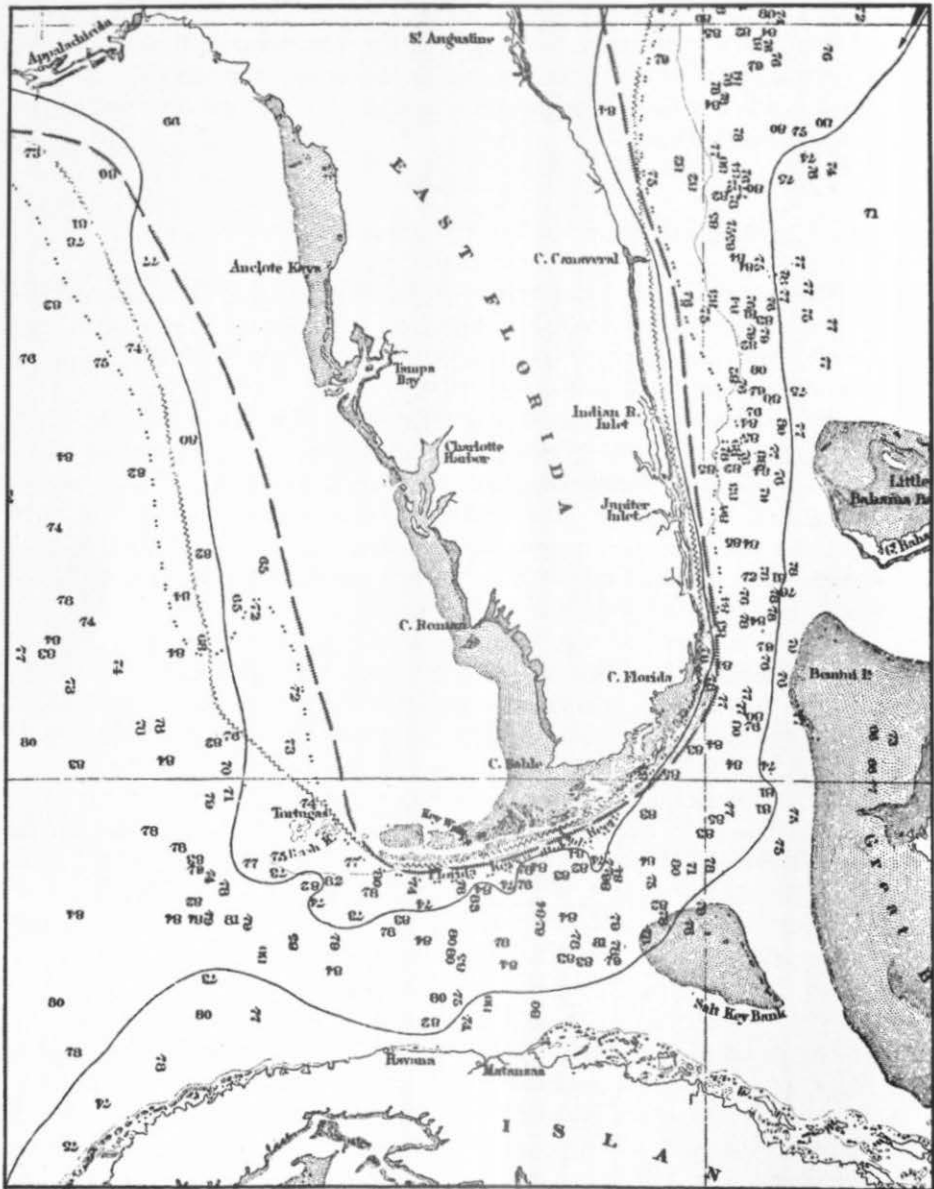
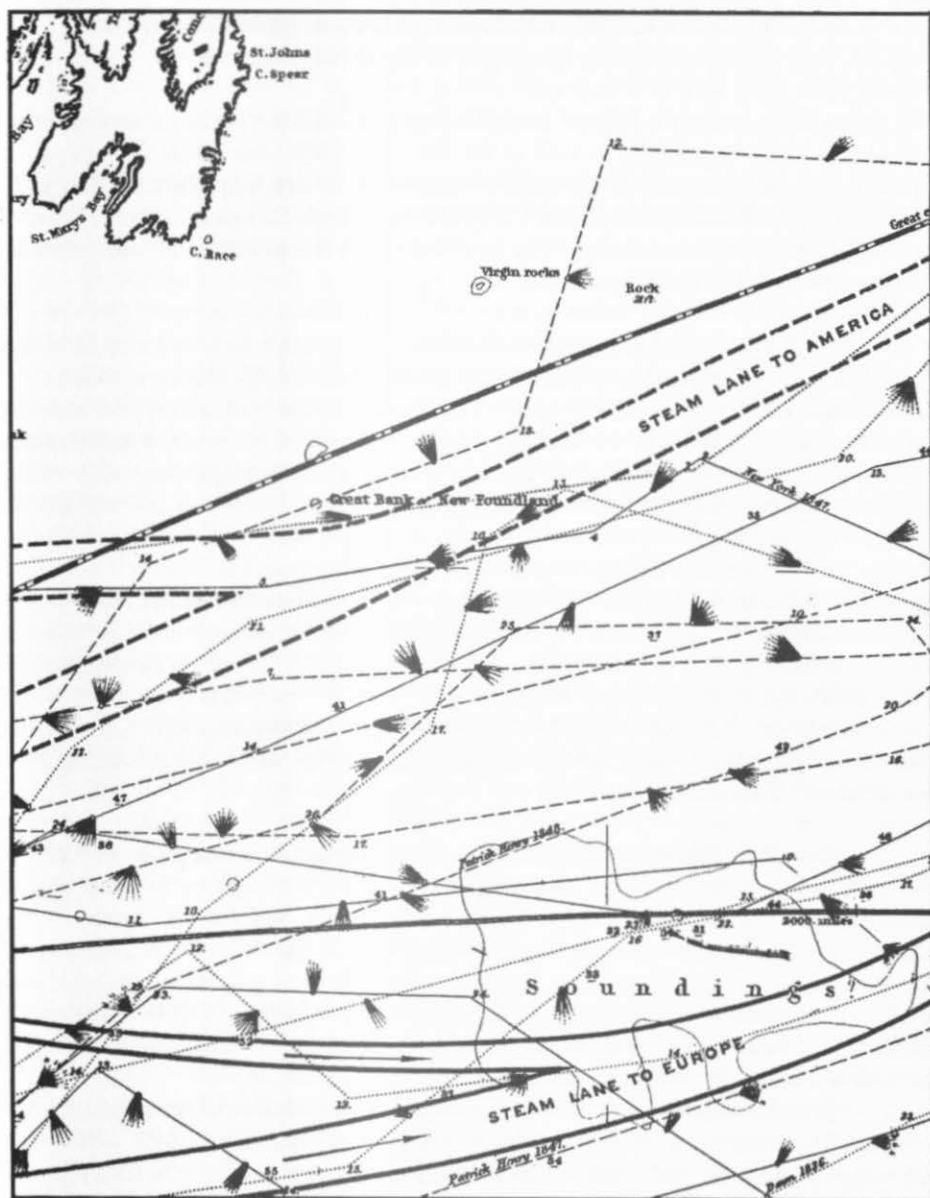


Fig. 6: Section of Maury's Wind and Current Chart of the North Atlantic, Thermal Sheet No. 1, Series D, 1852 (Temperatures in Fahrenheit, Williams 1963: 150).

Fig. 7 (right): Section of Maury's Wind and Current Chart No. 6, Series A (3rd ed. 1855) showing steamer lanes across the Atlantic south of Newfoundland (Williams 1963: 148).





But Humboldt did not deal solely with Maury's achievements in his letter. He used the opportunity to express his opposition to slavery and – this is particularly important in our context – he praises Gilliss as well. We can assume that Humboldt was aware of the friction between Maury on the one hand, and Gilliss and his friends on the other.

#### 4.2. The first „International Maritime Meteorological Conference“ and Maury's meeting with Humboldt in Berlin

When, in 1851, Maury's idea of „establishing a universal System of meteorological observations for the sea as well as for the land“ (Williams 1963: 208) began to materialize, he approached Humboldt in December of that year through the Prussian Minister in Washington, Baron Friedrich von Gerolt (Williams 1963: 542, note 64). It is very likely that Gerolt informed Humboldt immediately, but unfortunately this letter has not been found yet.

In April 1851, Maury had written a lengthy letter to Humboldt in which he thanked him for the praise included in the letter to Flügel. Maury explained his charts and pointed out another aspect of his research: „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.“ (Schwarz 2004: 284.) Here, for the first time, the deep-sea sounding program is mentioned in the correspondence between Humboldt and Maury. It is interesting to note how Maury views Humboldt's role for himself and his labors in the same letter: „Your approval of such an undertaking [Maury's investigations] strengthens mightily my hands for good & facilitates more than I can express, the task before me; it removes difficulties, breaks down obstacles, makes friends for the work, and enlists many labourers for the field, who were before looking on it in idleness.“ (Schwarz 2004: 284.)

The first „International Maritime Meteorological Conference“ of 1853 in Brussels was a great personal triumph for Maury, even though he was not able to combine the meteorological observations for the sea and for the land. As the American historian of science Nathan Reingold has put it: „When [Maury] attempted to extend his system to the land, using farmers instead of sea captains, [he] was blocked by the existence of Henry's Smithsonian network.“ (Reingold 1964: 146.) The Naval Observatory and the Smithsonian Institution were not able to cooperate, mainly for personal reasons.

On Maury's way home from Brussels, he met Alexander von Humboldt in Berlin. We know of a letter from Humboldt to his American guest, written on Monday, September 12<sup>th</sup>, 1853: „As it is my strong wish to have before long the opportunity to meet Lieutenant Maury and to tell him how much I admire his great works on Nautical Astronomy, Meteorology and Terrestrial Physics, I dare to be as immodest as to ask him if he would have the time to honour me with his visit tomorrow, Tuesday between 1 and 2 p.m.“ (cf. Schwarz 2004: 325, transl. from the French).

Humboldt's politeness can certainly be seen as an indication of his respect and admiration for Maury. The two men met on Tuesday, September 13<sup>th</sup>, 1853 in Humboldt's apartment in Berlin, Oranienburger Strasse No. 67.

Maury had come to Berlin to see some other scientists as well, among them naturalist Christian Gottfried Ehrenberg and perhaps meteorologist Heinrich Wilhelm Dove. The list of scientists whom Maury met in Germany compiled by Maury Corbin (1888: 156) is incomplete and not correct.

It is likely that Humboldt suggested the title for Maury's „Physical Geography of the Sea“ when both men met in the Prussian capital. (Maury 1963: XIII. See also Kortum 1985: 3.) F. Williams has described the meeting in the following way: „In giving Humboldt a full report on the Brussels Conference, Maury mentioned that his original proposal had been for a universal system of observations for both land and sea. Baron von Humboldt encouraged him to work for just such an over-all consideration of meteorology and later repeated this in a letter.“ (William 1963: 220.) It is true that Maury, in his letter to Humboldt of November 10<sup>th</sup>, 1853, referred to the topic of meteorological observations on land and sea: „Pray will you not lend me the powerful aid which a word from you would have in favour of a Main General Meteorological Conference of one that should take cognicion [sic] of the land as well as the sea - and aim at the establishment of a universal system of observations. I should be most happy to hear your views upon the subject.“ (Schwarz 2004: 326.) However, for such a clear statement Maury would wait in vain. In his following letter, written in August of 1854, Humboldt praised Maury's work only in general terms. There is not a single word about a General – land *and* sea – Meteorological Conference. (Cf. Schwarz 2004: 336-338.) What might have been the reason? Apparently Humboldt did not want to get involved in the quarrels among scientists, all of whom he respected. He certainly feared that, if he took one side, he would lose his general influence. If Humboldt was aware of the friction between Maury and his colleagues, he certainly regretted it, because it prevented a more efficient organization of scientific research.

#### 4. 3. Maury, Humboldt, and the Transatlantic Cable

Maury kept Humboldt informed about the deep-sea sounding program, which was focused on finding the best area in the ocean where a transatlantic cable could be placed. It is surprising that Humboldt did not refer to it in his letters to Maury. However, in a note to Carl Böttger, who translated the „Physical Geography of the Sea“ into German, Humboldt wrote in October 1856 that the results of deep-sea soundings, organized by Maury, had been confirmed by the soundings carried out by Otway Henry Berryman for the telegraphic wire between Newfoundland and Ireland. (Cf. Schwarz 2004: 409.)

In 1857 a mutual American friend, Francis Lieber, sent Humboldt a piece of the cable. He asked the physicist Gustav Magnus to show it to the members of the Royal Prussian Academy at Berlin. Humboldt remarked in a letter to Physiologist Emil du Bois-Reymond that this piece of wire had impressed the academy members because of the daring project of connecting the two hemispheres. (Cf. Schwarz/Wenig 1997: 154-155.)

### 5. References to each other in publications

A final task is to check the references to Maury in Humboldt's writings against those to Humboldt found in Maury's works. As far as Maury is concerned, he quotes Humboldt in the 8<sup>th</sup> edition of the „Explanations and Sailing Directions to accompany the Wind and Current Charts“: „In the present condition of the surface of our planet,‘ says Baron Humboldt, the most celebrated philosopher of the age, ‘the area of the solid is to that of the fluid parts as 1 to 2 4/5 [...].’“ This introductory statement is followed by 19 more lines from „Cosmos“. The reference is in a very prominent position and almost reads as a dedication. Maury then quotes the letter from Humboldt to Johann Gottfried Flügel of June 20<sup>th</sup>, 1850: „I beg you to express to Lieut. Maury, the author of the beautiful Charts of the Wind and Currents, prepared with so much care and profound learning, my hearty gratitude and esteem.“ (Maury 1858, vol. 1: 1.) A longer passage of Humboldt's „Aspects of Nature“ regarding the whirlwinds of the Upper Orinoco forms part of the chapter on Red Fogs and Sea Dust (Maury 1858, vol. 1: 32-33). Again from „Cosmos“ Maury quotes some lines in the introduction to chapter XI on the „Depth of the Ocean“: „Philosophers have greatly desired to ascertain the mean depression of the bed of the ocean *below*, as well as the mean elevation of the continental masses *above*, the sea level.“ (Maury 1858, vol. 1: 113.) Very interesting is a letter of Christian Gottfried Ehrenberg to Maury, dated October 1857 concerning the deep-sea sediments obtained in the Atlantic with John Mercer Brooke's apparatus: „Of the deep soundings in the line of the projected Atlantic telegraph, which are 29 in number, I know only 5, the same which Mr. Morse sent to Mr. Humboldt, and which are not among the deepest. I know that they have reached soundings of 2,000 to 2,070 fathoms.“ (Maury 1858, vol. 1: 175.)

There are also numerous cross-references in the „Physical Geography of the Sea“: § 326 (Humboldt's description of the dust-whirlwinds of the Orinoco) is, in effect a page-long passage taken verbatim from Humboldt's „Aspects of Nature“ (Humboldt 1849 b: 36-39; see Maury 1963: 142-143). § 752 (Humboldt's description of rip-tides) was taken in part from the „Personal Narrative of Travels to the Equinoctial Regions of America“ (Humboldt/Bonpland 1852/1853, vol. I: 25-26). Furthermore, there are six references to Humboldt's Current.

Of course, Maury possessed some of Humboldt's works and should have known them in detail. The few references spotted in his books are disappointing and do not include references to fundamental propositions Humboldt had advanced for ocean circulation and maritime meteorology.

Screening Humboldt's work is somewhat easier, as we need only look at his texts written later than 1849 – after he had received Maury's „Explanations and Sailing Directions“. The third edition of his „Ansichten der Natur“ (Humboldt 1849 a) appeared in this year. It includes many classical passages on marine sciences, especially in the extensive notes. The most recent book from which Humboldt quotes is a physical geography of Iceland by Sartorius von Waltershausen (Sartorius von Waltershausen 1847; see Humboldt 1849 a: vol. 1: 91, 201). His „scientific illustration“ for the essay on „Steppes and Deserts,“ which described

the Gulf Stream and North Atlantic circulation in general („The consequence of the great rotatory movements of water“, cf. Humboldt 1849 a, vol. 1: 193-201), would have been the place to add some of Maury's results. A great deal of oceanography can be extracted from this book, which Humboldt regarded as his favourite publication.

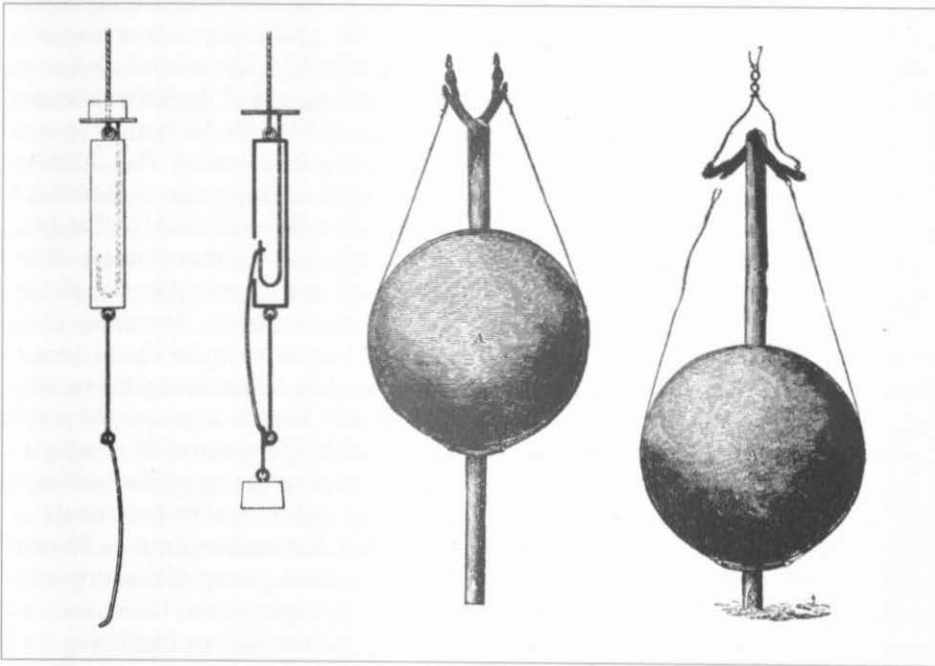


Fig. 8: Brooke's Deep Sea Sounding Apparatus (Maury 1855: 207).

In Humboldt's „Cosmos,“ Maury is not mentioned. The works of the American oceanographer came to Humboldt's attention too late to influence his marine notions as expressed in this work.

However, it is evident that Humboldt took notice of Maury and his work even before they met in Berlin. For instance, one of his many American visitors, Benjamin Silliman, in his account „A Visit to Europe in 1851,“ reported that Humboldt praised the work of Colonel Frémont in the Far West of North America, of Prof. Bache in surveying the coasts, and of Lieutenant Maury for improving the safety of navigation (see Beck 1959: 304).

It may be assumed that in his last years, Humboldt became more and more aware of the fact that the world around him was quickly changing. In oceanography the cable project had opened a new era of deep-sea research. He

was no longer sure that he would be able to incorporate the multitude of new facts emerging in all disciplines into his system. „Cosmos“ remained unfinished; he never found the time to complete his „Personal Narrative“, and the planned second volume of „Kleinere Schriften“ (Humboldt 1853) was never published.

In 1857, a great opportunity passed by without much consequence. On December 12<sup>th</sup>, 1856, the Archduke Ferdinand Maximilian, Commander-in-Chief of the Austrian Navy, had asked Humboldt to write a scientific cruise instruction for the frigate „Novara“ preparing to sail around the globe and then at anchor in Triest harbour. This was a great honour for Humboldt who had contributed to the French circumnavigations (together with François Arago) and the British Antarctic expedition of Sir James Ross. It is well-known that Humboldt himself wanted to join the Baudin circumnavigation while travelling in America. The „Novara“ episode has not been mentioned elsewhere until now, although the instruction is included as an appendix to the „Novara“ report (see Scherzer 1861). Humboldt sent his twenty-eight pages of suggestions regarding the Austrian cruise to Triest on April 7<sup>th</sup>, 1857. He recommended following the lanes suggested in the „Sailing Directions“ according to Maury's instructions („nach meines Freundes Lieut. Maury (in Washington) heilsamen Vorschriften“). Furthermore, he discussed other, more recent American expeditions, such as the cruise of the „Dolphin“ in 1854. But most of the text dealt with other matters, not with marine sciences and proper instrumentation. Humboldt presents no general research perspective from which to study currents or the sea bed. He urged the commander to keep an abstract log in the form agreed upon at the Brussels Conference, and we know that Maury received just such a diary on June 6<sup>th</sup>, 1860. However, the well-organized „Novara“ cruise of 1857-1859 did not contribute much to the development of oceanography. There was a scientific staff on board, but no one was specialized in marine matters. Humboldt was old and alone in his network. Neither he nor Ehrenberg were able to name a younger scientist to go with the „Novara“.

Finally, there is the never-ending story of Humboldt's intention to write a monograph on ocean currents to be included in the second volume of „Kleinere Schriften“. The story of his work on the manuscript up until his death has been told by Engelmann (1969 a) and Kortum (1990), who summarize the main sources and results of the proofs that have survived. At the end of 1854, Humboldt had revised earlier manuscript versions and sent a clean copy to his publisher Cotta, who returned the proofs of the first part of the ocean text (pages 31-145, following a paper on climatology). This document stops in the middle of a sentence dealing with cold water bodies in Baffin Bay off Labrador and in the Norwegian and Barents Sea, which are known today to initiate convection processes in the subpolar Atlantic that start the Global Conveyor Belt of the world's oceans. The title of the text is „Über Meeresströmungen im allgemeinen und über die kalte peruanische Strömung in der Südsee im Gegensatz zu dem warmen Golf- oder Florida-Strome“ (On Ocean Currents in General and on the cold Peruvian Current in Contrast to the warm Gulf or Florida Current“). The text of the proofs is currently being prepared for publication and will add many new facts to what we know now about Humboldt's oceanographic ideas. Surprisingly most of the pages deal with

the Gulf Stream and North Atlantic circulation, which is now a topic of modern German oceanographic research (for details cf. Kortum 1990). It is striking that Humboldt re-assessed his own temperature observations in that area, which he had made fifty years earlier, to a great extent. He referred to Maury's „Sailing Directions“ and the „Physical Geography of the Sea“ nine times, which is not very often if we take into account how many new results the American scientist had compiled. The longest and most interesting reference is about cold counter-currents observed in the Gulf Stream. In a footnote (proof page 140), Humboldt mentioned the cruise of the brig „Dolphin“ (cf. Lee 1854), and Walsh's cruise with the schooner „Taney“ in Maury's Sailing Directions for 1853, p. 160-174. On the following page (141), Humboldt discussed the Arctic Current and referred to a report of Alexander D. Bache, Superintendent of the United States Coast Survey, to the Senate. These details show that Humboldt was aware of the most modern investigations and wanted to include them in his text on ocean circulation. We do not know what Humboldt intended to present in the next section of his manuscript. Perhaps he felt that he was no longer able to process the most recent findings coming in from America and elsewhere. Adding a limited number of footnotes would not go very far in covering such a complex matter. Over the years during which he had worked on this subject, he, as had Maury for some time, relied on J. Rennell's theory, which he tried to improve. The result is a great number of longer quotations from Rennell (1832). After all, Humboldt, then eighty-seven years old, was also working hard on his „Cosmos“. For reasons we do not know he stopped work on his favourite subject of ocean currents. It can be assumed that the „Old Man from the Mountain“, as he liked to call himself, realized that he was running out of time. His plan to show how the ocean functions as an integral part of the Cosmos could not be realized.

There are indications, however, that Humboldt made a serious effort to keep informed about recent developments in oceanography. In his introduction to the second German edition of Maury's „Physical Geography of the Sea“, the translator Carl Böttger, quoted from a lengthy letter to him from Humboldt (cf. Kortum 1985: 19-20): „Sie haben eine vortreffliche deutsche Ausgabe des trefflichen, freilich etwas unvollständigen Buches meines Freundes Maury geliefert mit Karten, die die des Originals weit übertreffen. Mein Verkehr mit Maury ist seit vielen Jahren um so lebhafter, als ich ein großes Interesse an Strömungen, Meeres-temperatur und Wirkung der Sandbänke (?) nehme. Eine herrliche Bestätigung der von Maury veranlaßten Sondierungsergebnisse hat jetzt eben die vollendete Sondierung für den *Telegraphic Wire* von St. John in Neu-Fundland bis Valentia-Bay in Irland durch Lieutenant Berryman gegeben. Morse schickt mir eben eine 15 Fuß lange Sondierungskarte und versichert, daß der Telegraph in weniger als einem Jahr zur Verbindung beider Continente brauchbar fertig sein werde. *'There will be a possibility'*, schreibt mir der Telegraphen-Morse (London, 7. Oktober), *'to send you in less than one year a despatch from my home on the Hudson River to Potsdam in less than 5 minutes of time. I look with sanguine hope to this consummation'*. Die Länge der Sondierungslinie von Neu-Fundland bis Irland ist 1640 *nautical miles* [...]. Die größte gefundene Tiefe war 2070 *fathoms* (2 1/3 miles), etwa

833 *miles* westlich von Irland und 807 *miles* östlich von Neu-Fundland. Die größten Strecken hatten 1200 *fathoms* = 7200 Fuß Tiefe. Ich glaube, daß diese Resultate Sie interessiren werden. Morse schickt mir auch für Ehrenberg Proben des Meeresbodens, nirgends Felsen. Ehrenberg hat schon früher lebendige Polythalamien in großen Meerestiefen mikroskopisch aufgefunden..." (Maury 1859: VII-VIII; reprinted in Schwarz 2004: 409). This passage illustrates Humboldt's peculiar interest in oceanographic matters, an interest which remained alive until the end of his long life.

### 6. Concluding remarks

Shortly after Humboldt's death, Maury wrote of Humboldt: „With unerring judgment he knew how to encourage, and when to commend. Often in the loneliness of his calling, has the 'well done' of this great man cheered and encouraged the student with his speciality, the philosopher with his researches.“ We have seen that Humboldt was always willing to praise Maury and to support his efforts publicly. However, even at his old age, Humboldt knew how to avoid getting involved in quarrels among scientists.

Humboldt had made his own observations in the Atlantic and was especially interested in the Gulf Stream system. He returned to this subject several times, although he could never finish his manuscript on ocean currents. The letters which Humboldt exchanged with the American hydrographer M. F. Maury, as well as their meeting in Berlin in 1853, are a highlight in the history of oceanography and mark a turning point towards a new era of studying and understanding the ocean. The geography of the sea – and marine sciences in general – will be forever indebted to the pioneering contributions of Humboldt and Maury. For Humboldtian Studies the communication between these two very different men with their common enthusiasm for ocean research constitutes a specific example in one important discipline of early German–American scientific cooperation.

### References / Further Reading

- Beck, H. (Ed.)**, 1959: Gespräche Alexander von Humboldts. Hrsg. im Auftrage der Alexander von Humboldt-Kommission der Deutschen Akademie der Wissenschaften zu Berlin. Akademie-Verlag, Berlin: XXXII, 492 p.
- Beck, H.**, 1959/1961: Alexander von Humboldt. Vol. 1-2. Franz Steiner, Wiesbaden: XI, 303/XII, 439 p.
- Berghaus, H.**, 2004: Physikalischer Atlas oder Sammlung von Karten, auf denen die hauptsächlichsten Erscheinungen der anorganischen und organischen Natur nach ihrer geographischen Verbreitung und Vertheilung bildlich dargestellt sind. Zu Alexander von Humboldt Kosmos. Entwurf einer physischen Weltbeschreibung. Ed. O. Ette and O. Lubrich. Eichborn, Frankfurt/Main 2004: 179 p.
- Biermann, K.-R., Jahn, I. & F. G. Lange**, 1983: Alexander von Humboldt. Chronologische Übersicht über wichtige Daten seines Lebens. 2nd ed. Akademie-Verlag, Berlin (Beiträge zur Alexander-von-Humboldt-Forschung, 1): 96 p.



- Caskie, J. A.**, 1928: *Life and Letters of Matthew Fontaine Maury*. Richmond Press, Richmond, Va.: 191 p.
- Deacon M.**, 1997: *Scientists and the Sea. A Study of Marine Science*. 2<sup>nd</sup> ed. Ashgate, Aldershot: XL, 459 p.
- Defant, A.**, 1960: Die meereskundlichen Interessen Alexander von Humboldts im Lichte der modernen Ozeanographie. In: 32. Deutscher Geographentag 1959 in Hamburg. Tagungs-Berichte u. wiss. Abhandlungen, Wiesbaden: 84-94.
- Dietrich, G.**, 1970: Alexander von Humboldts „Physische Weltbeschreibung“ und die moderne Meeresforschung. In: 37. Deutscher Geographentag 1969 in Kiel. Tagungs-Berichte und wiss. Abhandlungen, Wiesbaden: 105-122.
- Engelmann, G.**, 1969 a: Alexander von Humboldts Abhandlung über die Meeresströmungen. In: *Peterm. Geogr. Mitt.* 113, H. 2: 100-110.
- Engelmann, G.**, 1969 b: Christian Gottfried Ehrenberg: Ein Wegbereiter der Tiefseeforschung. In: *D. Hydr. Z.* 22, H. 4: 145-157.
- Faak, M. (Ed.)**, 1986/1990: Alexander von Humboldt. Reise auf dem Rio Magdalena, durch die Anden und Mexico. Aus seinen Reisetagebüchern zusammengestellt und erläutert, mit einer einleitenden Studie von K.-R. Biermann. Parts 1 and 2. Akademie Verlag, Berlin (Beiträge zur Alexander-von-Humboldt-Forschung, 8/9): 402, 537 p.
- Faak, M. (Ed.)**, 2000: Alexander von Humboldt. Reise durch Venezuela. Auswahl aus den amerikanischen Reisetagebüchern. Akademie Verlag, Berlin (Beiträge zur Alexander-von-Humboldt-Forschung, 12): 667 p.
- Felber, H. J. (Ed.)**, 1994: Briefwechsel zwischen Alexander von Humboldt und Friedrich Wilhelm Bessel. Akademie Verlag, Berlin (Beiträge zur Alexander-von-Humboldt-Forschung, 10): 249 p.
- Friis, H. R.**, 1969: Alexander von Humboldts Besuch in den Vereinigten Staaten von Amerika vom 20. Mai bis zum 30. Juni 1804. In: Schulze, J. H. (Ed.): *Alexander von Humboldt. Studien zu seiner universalen Geisteshaltung*. Walter de Gruyter, Berlin: 142-195.
- Hein, W.-H. (Ed.)**, 1985: *Alexander von Humboldt: Leben und Werk*. C. H. Boehringer Sohn, Ingelheim am Rhein: 334 p.
- Herdman, W. A.**, 1923: *Founders of Oceanography and their Work*. E. Arnold, London: XII, 340 p.
- Humboldt, A. v. & A. Bonpland**, 1814-1825: *Voyage aux régions équinoxiales du Nouveau Continent, fait en 1799, 1800, 1801, 1802, 1803 et 1804*. Première partie: Relation historique. Vol. 1-3. [various publishers] Paris: 643/722/632 p.
- Humboldt, A. v.**, 1808-1810: *Recueil d'observations astronomiques, d'opérations trigonométriques et de mesures barométriques, faites pendant le cours d'une voyage aux régions équinoxiales de Nouveau Continent depuis 1799 jusque'en 1804*. Vol. 1-2. F. Schoell, Paris: LXXVI, 138, 52, 382/629 p.
- Humboldt, A. v.**, 1836-1839: *Examen critique de l'histoire de la géographie du Nouveau Continent et des progrès de l'astronomie nautique au XV<sup>e</sup> et XV<sup>e</sup> siècles*. Vol. 1-5. Gide, Paris: XXVII, 362/373, 407, 336/263 p.
- Humboldt, A.v.**, 1836-1852: *Kritische Untersuchungen über die historische Entwicklung der geographischen Kenntnisse von der Neuen Welt und die Fortschritte der nautischen Astronomie in dem 15ten und 16ten Jahrhundert*. Aus dem Französischen übersetzt von Jul. Ludw. Ideler. Vol. 1-3. Nicolaische Buchhandlung, Berlin: 560/528/316 p.
- Humboldt, A. v.**, 1845-1862: *Kosmos. Entwurf einer physischen Weltbeschreibung*. Vol: 1-5. J. G. Cotta, Stuttgart/Tübingen: 494/544/644/649/1297 p.
- Humboldt, A. v.** 1846-1858: *Cosmos: Sketch of the physical description of the universe*. Transl. un-

- der the superintendence of Lieut.-Col. Edward Sabine. Vol. 1-4. Longman, Brown, Green and Longmans: XXVI, 473/VIII, 359/XV, 457, CLXII/XII, 516, CLXXXIII p.
- Humboldt, A. v.**, 1849 a: Ansichten der Natur, mit wissenschaftlichen Erläuterungen, 3. verbesserte und vermehrte Ausgabe. Vol. 1-2. J. G. Cotta, Stuttgart/Tübingen: XVIII, 362/407 p.
- Humboldt, A. v.**, 1849 b: Aspects of Nature, in different lands and different climates, with scientific Elucidations. Transl. by Mrs. Sabine. Lea and Blanchard, Philadelphia: IX, 474 p.
- Humboldt, A. v.**, 1850: Views of Nature: or contemplations on the sublime phenomena of creation. Transl. from the German by E. C. Otté, and Henry G. Bohn. Henry G. Bohn, London: XXX, 452 p.
- Humboldt, A. v.**, 1853: Kleinere Schriften. Vol. 1. Geognostische und physikalische Erinnerungen. J. G. Cotta, Stuttgart/Tübingen: VIII, 474 p.
- Humboldt, A. v.**, 1859/1860: Reise in die Aequinoctial-Gegenden des neuen Continents. In deutscher Bearbeitung von H. Hauff. Vol. 1-4. J. G. Cotta, Stuttgart: XIII, 403/416/403/444 p.
- Humboldt, A. v.**, 1997: Cosmos. A sketch of the physical description of the universe. Transl. from the German by E. C. Otté. Vol. 1-2. Johns Hopkins University Press, Baltimore/London: XLII, 375/XLVIII, 367 p.
- Humboldt, A. v. & A. Bonpland**, 1852/1853: Personal narrative of travels to the equinoctial regions of America, during the years 1799-1804, translated and edited by Thomasina Ross. Vol. 1-3, Henry G. Bohn, London: XX, II, 505/VI, 521/VI, 442 p.
- Humboldt, A. v. & A. Bonpland**, 1972: Personal narrative of travels to the equinoctial regions of the New continent during the years 1799-1804, translated by Helen Maria Williams. Vol. 1-7, London 1818-1829. Reprint: Da Capo Press, Amsterdam, New York: 294/293/575/502/390/454/482 p.
- Jahn, I. & F. G. Lange (Eds.)**, 1973: Die Jugendbriefe Alexander von Humboldts 1787-1799. Akademie Verlag, Berlin (Beiträge zur Alexander-von-Humboldt-Forschung, 2): XLVIII, 838 p.
- Kohl, J. G.**, 1966: Geschichte des Golfstroms und seiner Erforschung von der ältesten Zeit bis auf den grossen amerikanischen Bürgerkrieg. Bremen 1868. Reprint: Meridian Publ., Amsterdam: XV, 224 p.
- Kortum, G.**, 1985: M. F. Maury (1806-1873), A. v. Humboldt (1769-1859) und der Mythos des Telegraphen-Plateaus im Nordatlantischen Ozean. In: Hofmeister, B., Voss, F. (Eds.): Geographie der Küsten und Meere. Beiträge zum Küstensymposium im Mainz, 14.-18. Oktober 1984. Berliner Geograph. Studien, 16: 1-23.
- Kortum, G.**, 1990: An unpublished manuscript of Alexander von Humboldt on the Gulf Stream. In: W. Lenz and M. Deacon (Eds.): Ocean Sciences. Their History and Relation to Man. Proceed. 4<sup>th</sup> Intern. Congress on the History of Oceanography, Hamburg: Deutsche Hydrograph. Zeitschr., Erg. Hefte, Reihe B, 22: 122-129.
- Kortum, G.**, 1993: Überfahrten in die Neue Welt. Die Atlantikquerungen von Kolumbus (1492) und Humboldt (1799) im ozeanographiegeschichtlichen Vergleich. In: Zeitschr. f. Geolog. Wiss. 21: 605-616.
- Kortum, G.**, 1994 a: Alexander von Humboldts Forschungsfahrt auf dem Kaspischen Meer. In: Deutsch. Ges. f. Meeresforschung, Mitteilungen 3: 3-9.
- Kortum, G.**, 1994 b: Alexander von Humboldts Besuch auf Helgoland 1790 und die frühe Entwicklung der Meeresbiologie in Deutschland. In: Schr. Naturwiss. Verein Schlesw.-Holst., 64: 111-133.
- Kortum, G.**, 1999 a: Über A. v. Humboldts Atlantikquerung vor 200 Jahren. In: Deutsche Gesellschaft für Meeresforschung/DGM-Mitteilungen 1: 3-9.
- Kortum, G.**, 1999 b: Alexander von Humboldt und seine Ankunft in Südamerika vor 200 Jahren. In: Geographische Rundschau 51, H. 7/8: 428-431.

- Kortum, G.**, 1999 c: „Die Strömung war schon 300 Jahre vor mir allen Fischerjungen von Chili bis Payta bekannt“. – Der Humboldtstrom. In: F. Holl (Ed.): Alexander von Humboldt – Netzwerke des Wissens. Katalog zur Ausstellung im Haus der Kulturen der Welt, Berlin, 6. Juni – 15. August 1999; Kunst- und Ausstellungshalle der Bundesrepublik Deutschland, Bonn, 15. September 1999 – 9. Januar 2000: 98-99.
- Kortum, G.**, 2001 a: Alexander von Humboldt und das Meer. In: Proceedings: Alexander von Humboldt's Natural History Legacy and its Relevance for Today. Boston University Bicentennial Humboldt Symposium, Oct. 8<sup>th</sup> – 9<sup>th</sup>, 1999, *Northeastern Naturalist*, Special Issue 1: 91-108.
- Kortum, G.**, 2001 b: Humboldt der Seefahrer und sein Marinechronometer. In: *HiN – Humboldt in the Net*, *International Review of Humboldtian Studies* II, 3:
- Kortum, G.**, 2002: „Alexander von Humboldt“ als Name für Forschungsschiffe vor dem Hintergrund seiner Meereskundlichen Arbeiten. In: *HiN – Humboldt in the Net*, *International Review of Humboldtian Studies* III, 5:
- Kortum, G.**, 2003: Germania in Pacifico. Humboldt, Chamisso and Other Early German Contributions to Pacific Research, 1741-1876. In: K. R. Benson and P. F. Rehbock (Eds.): *Oceanographic History. The Pacific and Beyond. Proceed. 5<sup>th</sup> Int. Congr. Hist. Ocean*, La Jolla, Calif. Univ. of Washington Press, Seattle/London: 107-117.
- Kortum, G. & A. Lehmann**, 1997: A. v. Humboldts Forschungsfahrt auf der Ostsee im Sommer 1834. In: *Schr. Naturwiss. Verein Schlesw.-Holst.* 67: 45-58.
- Krümmel, O.**, 1907/1911: *Handbuch der Ozeanographie*. 2., vollst. neu bearb. und wesentl. Erw. Aufl., vol. 1-2. Engelhorn's Nachf., Stuttgart: 525/766 p.
- Krauss, W.**, 1996: Comments on the Development of our Knowledge of the General Circulation of the North Atlantic Ocean. In: W. Krauss (Ed.): *The Warmwatersphere of the North Atlantic Ocean*. Borntraeger, Berlin, Stuttgart: 1-31.
- Lee, S. P.**, 1854: Report and charts of the cruise of the U.S. brig Dolphin: made under direction of the Navy Department. B. Tucker, Printer to the Senate, Washington: VII, 331, 2 p.
- Leighly, J.**, 1968: Matthew Fontaine Maury in His Time. In: *Première Congr. Intern. Hist. Océanographie. Bull. Inst. Océanogr. Monaco*, 2. Spec., Vol. I: 147-162.
- Lewis, C. L.**, 1927: Matthew Fontaine Maury, the pathfinder of the seas. The United States naval institute, Annapolis: XVII, 264 p.
- Maury, M. F.**, 1836: A new theoretical and practical treatise on navigation. Key and Biddle, Philadelphia: VIII, 216, 174 p.
- Maury, M. F.**, 1851: Explanations and Sailing Directions to accompany the Wind and Current Charts. C. Alexander, Washington: 315 p.
- Maury, M. F.**, 1855: *The Physical Geography of the Sea*. Harper & Brothers, New York: XV, 274 p.
- Maury, M. F.**, 1858: Explanations and Sailing Directions to Accompany the Wind and Current Charts. 8<sup>th</sup> edit., enlarged and improved. 2 Vols. W. A. Harris, Washington.
- Maury, M. F.**, 1859: *Die physische Geographie des Meeres*. Deutsch bearbeitet von C. Böttger. 2., mehrfach veränderte und vermehrte Auflage. Gustav Mayer, Leipzig: XV, 294 p.
- Maury, M. F.**, 1857: Das Telegraphen-Plateau im nördlichen Atlantischen Ocean. In: *Petermanns Geograph. Mitt.* 3: 507- 508.
- Maury, M. F.**, 1963: *The Physical Geography of the Sea and its Meteorology*. Edited by J. Leighly (Reprint of 8<sup>th</sup> edit. 1861). Belknap Press, Cambridge, Mass.: XXXI, 432 p.
- Maury Corbin, D. F.**, 1888: *A Life of Matthew Fontaine Maury, U.S.N. and C.S.N.* Compiled by his daughter. Sampson Low, Marston, Searle & Rivington, London: VI, 326 p.
- Paffen, K. & G. Kortum**, 1984: *Die Geographie des Meeres. Disziplingeschichtliche Entwicklung*

- seit 1650 und heutiger methodischer Stand. *Geograph. Inst. d. Univ. Kiel, Kiel (Kieler geographische Schriften, 60): XIV, 293 p.*
- Petermann, A.**, 1856: Lieut. Maurys neueste Arbeit über die physikalische Geographie des Atlantischen Ozeans. In: *Peterm. Geograph. Mitt.* 4: 427-428.
- Peterson, R. G., L. Stramma & G. Kortum**, 1996: Early Concepts and Charts of Ocean Circulation. In: *Progress in Oceanography* Vol. 37 (1): 1- 115.
- Reingold, N. (Ed)**, 1964. *Science in Nineteenth-Century America. A Documentary History.* Hill and Wang, New York: 339 p.
- Rennell, J.**, 1832: An investigation of the currents of the Atlantic Ocean, and of those which prevail between the Indian Ocean and the Atlantic. J. G. [&] F. Rivington, London.
- Sartorius von Walterhausen, W.**, 1847: *Physisch-geographische Skizze von Island mit besonderer Rücksicht auf vulkanische Erscheinungen.* Göttingen.
- Scherzer, C. v.** 1861: *Reise der österreichischen Fregatte Novara um die Erde in den Jahren 1857, 1858, 1859 unter den Befehlen des Commodore B. von Wüllerstorff-Urbair. Vol. I. Kaiserlich-Königlichen Hof- und Staatsdruckerei, in Commission bei Karl Gerold's Sohn, Wien.*
- Schlee, S.**, 1973: *The Edge of an Unfamiliar World. A History of Oceanography.* Dutton, New York: 398 p.
- Schlee, S.**, 1974: *Die Erforschung der Weltmeere. Eine Geschichte ozeanographischer Unternehmungen.* Stalling, Oldenburg/Hamburg: 307 p.
- Schumacher, A.**, 1953: Matthew Fontaine Maury und die Brüsseler Konferenz 1853. In: *Dt. Hydrograph. Z.* 6: 87-93.
- Schwarz, I.**, 2001: Alexander von Humboldt's Visit to Washington and Philadelphia, his Friendship with Jefferson, and his Fascination with the United States. In: *Proceedings: Alexander von Humboldt's Natural History Legacy and its Relevance for Today. Boston University Bicentennial Humboldt Symposium, Oct. 8<sup>th</sup> - 9<sup>th</sup>, 1999, Northeastern Naturalist, Special Issue 1: 43-56.*
- Schwarz, I. (Ed.)**, 2004: *Alexander von Humboldt und die Vereinigten Staaten von Amerika. Briefwechsel.* Akademie Verlag, Berlin (Beiträge zur Alexander-von-Humboldt-Forschung, 19): 693 p.
- Schwarz, I. & K. Wenig (Eds.)**, 1997: *Briefwechsel zwischen Alexander von Humboldt und Emil du Bois-Reymond.* Akademie Verlag, Berlin (Beiträge zur Alexander-von-Humboldt-Forschung, 22): 233 p.
- Terra, H. de**, 1955: *The Life and Times of Alexander von Humboldt 1769-1859.* Alfred A. Knopf New York: 386, IX p.
- Wayland, J. M.**, 1930: *The Pathfinder of the Sea. Matthew Fontaine Maury.* Garrett & Massie, Richmond, Virginia: XIII, 191 p.
- Whipple, A. B. C.**, 1963: Stranded Man who Charted the World's Seas. In: *Smithsonian* 14 (12): 171-186.
- Williams, F. L.**, 1963: *Matthew Fontaine Maury. Scientist of the Sea.* Rutgers University Press, New Brunswick, New Jersey: 720 p.
- Wüst, G.**, 1959: Alexander von Humboldts Stellung in der Geschichte der Ozeanographie. In: *Schulze, J. H. (Ed.): Alexander von Humboldt. Studien zu seiner universalen Geisteshaltung.* Walter de Gruyter, Berlin: 90-104.

## Appendix

1. Letter of Alexander von Humboldt to Matthew Fontaine Maury,  
Berlin, Monday, [September 12<sup>th</sup>, 1853]

In: Schwarz 2004: 325.

Je reviens de Potsdam à cause de l'arrivée du Roi et de la Reine: je suis malheureusement forcé d'aller mercredi et jeudi à la campagne, ma famille partant pour Rome. Dans le vif désir que j'ai d'avoir bientôt le bonheur de voir Mr. le Lieutenant Maury et de Lui dire combien j'admire Ses grands travaux d'Astronomie nautique, de Météorologie, de Physique du Globe, j'ose être assez indiscret pour demander, si demain mardi dans la matinée il seroit assez libre pour me faire l'insigne honneur de venir me voir de 1 à 2<sup>h</sup>. J'irais à Son hôtel, mais je pense que cela le gêneroit d'avantage et Lui feroit perdre le tems de m'attendre.

Agréez, je Vous supplie, Monsieur, l'hommage de ma haute et respectueuse considération.

A. Humboldt à Berlin,  
Oranienburger Str[asse] n. 67  
ce lundi soir

[in another hand:] 12<sup>th</sup> Sept[ember] 1853.

2. Letter of Matthew Fontaine Maury to Alexander von Humboldt  
Washington, November 10<sup>th</sup>, 1853

In: Schwarz 2004: 325.

National Observatory  
Washington Nov[ember] 10<sup>th</sup> [18]53

My dear Sir

I have the pleasure of sending you - herewith a statement of the deep sea soundings of the Dolphin Lt. Beryman - also some remarks by that officer also a chart showing his soundings also a drawing of the Deep sea soundings apparatus invented by Passed Mid[shipman] J. M. Brooke U[nited] S[tates] Navy. Also a copy of a General Order recommending the abstract logs a recommendation by the Brussels Conference to be kept on board of any vessel in the U[nited] S[tates] Navy.

Pray will you not lend me the powerful aid which a word from you would have in favour of a Main General Meteorological Conference of one that should take Cognicion of the land as well as the sea - and aim at the establishment of a universal system of observations.

I should be most happy to hear your views upon the subject. Pardon, my Honored Sir, the Liberty I take & believe me now as I truly am

Your friend & admirer  
M.F. Maury

Baron  
Alexander Humboldt  
Berlin.