

# History of Oceanography

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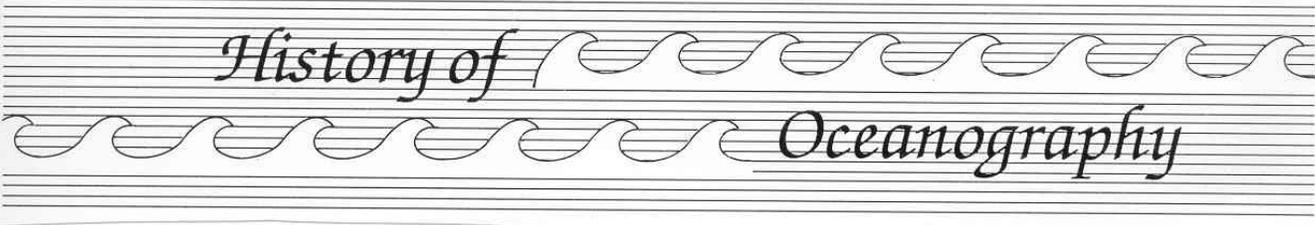
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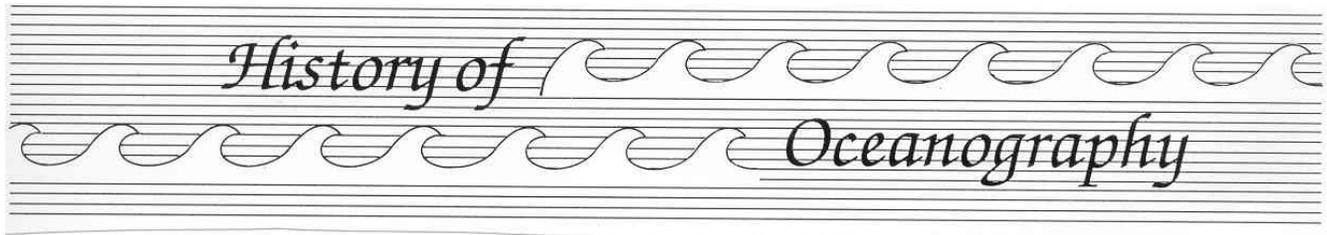
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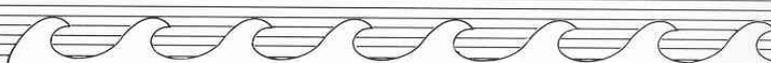
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## **Editorial – Wilhelm Brennecke and S.M.S. Planet, 1906-1907**

The German navy's expedition on S.M.S. *Planet* to the southeast Atlantic, the Indian Ocean and the Southwest Pacific in 1906-1907 came near the middle of extensive German explorations of the oceans, often with imperialistic and colonial aims as well as scientific ones, beginning with the around-the-world cruise of *Gazelle* in 1874-1876, Victor Hensen's Plankton-Expedition in the Atlantic on *National* in 1889, and turning to the Antarctic, with the German South Polar Expedition on *Gauss* under Eric von Drygalski in 1901-1903. After *Planet* came explorations of African coastal waters in *Möwe* in 1911, a failed attempt to cross Antarctica during the German Antarctic Expedition based on *Deutschland* in 1910-1911, and finally the detailed study of the Equatorial and South Atlantic Oceans by Alfred Merz, Georg Wüst and Albert Defant on *Meteor* from 1925 to 1927.

The voyage of *Planet* was aimed at the country's colonial or potentially colonial holdings in the Southwest Pacific, especially around the Bismarck Archipelago (now northern Papua New Guinea). It focused on oceanography, both biological and physical, and the physics of the atmosphere using kites and balloons with measuring instruments. Most of the scientific work – the results of which are now easily accessible online (see <http://edoc.hu-berlin.de/ebind/forschungsreise1-2005-42430/XML/> for the first volume of five and links to the others) - was carried out by naval officers and the ship's physician. The results in several departments were of major consequence, including full delineation of the Walvis Ridge, which, in extending from the Mid-Atlantic Ridge to the African continental shelf, prevents the northward flow of deep water from the Antarctic into the Northeast Atlantic.

The oceanographer on *Planet* was Wilhelm Brennecke (1875-1924) of the German Marine Observatory (Deutsche Seewarte), who began a new phase of his career during the cruise. Brennecke was the son of a teacher. Rather than choosing the more prestigious path of university study, he studied mechanical engineering, mathematics and natural sciences in the Technische Hochschule Charlottenburg (his career is outlined in W. Schott, 1987. *Early German Oceanographic Institutions, Expeditions and Oceanographers*. Hamburg: Deutsches Hydrographisches Institut, pp. 29-30, also the obituary by Gerhard Schott, 1924. *Annalen der Hydrographie und maritimen Meteorologie* 52 (3): 49-50). Moving to the University of Berlin 1898-1901, he studied meteorology, oceanography and related subjects, working thereafter as a meteorologist until appointed to the staff of the Deutsche Seewarte in 1904. In November 1905 his appointment to the scientific staff of *Planet* occurred, beginning, it appears, his conversion to a new profession, oceanographer.

Deeply hidden in the third volume of the *Planet* results (Brennecke's summary of the physical oceanography of the expedition) is a statement, based on his detection of a low-salinity layer centered around 800 meters, that there was a northwardly-directed current in the Atlantic carrying water to at least 13°N, where its properties were lost due to mixing. Drygalski had noted that feature during work on *Gauss*, as had J.Y. Buchanan examining the *Challenger* temperature sections years before. But it

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was Brennecke, with surprising physical intuition, who saw the low salinity water as evidence of global-scale oceanic circulation. Today we call it Antarctic Intermediate Water. A few years later, in the results of his Antarctic experiences on *Deutschland*, he developed a more complex scheme of deep-ocean circulation. Today Brennecke and his insights have been forgotten. As Wolfgang Schott commented, “Brennecke possessed the best nautical and oceanographic knowledge of any oceanographer of his time. It was a tragedy that he passed away so early in life.” We should know more about him and his times.

*Eric Mills*

## ARTICLES

### THE FOUNDING OF MODERN MARINE MICROBIOLOGY: CLAUDE ZOBELL AND HIS *MAGNUM OPUS*, 1946

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#### *Abstract*

In this continuing study of the scientific contributions of Claude Ephraim ZoBell (1904-1989), it has been argued in several of this author's recent publications that he was the founder of modern marine microbiology. This contention is further reinforced here as his *magnum opus* is shown to culminate the first decade and a half of his career and to embody his codification of marine microbiology as a well-defined discipline. From 1933 and his first journal article in what became marine microbiology to 1946 and his first and only scientific book, ZoBell set down the many lines of research that would characterize the nascent discipline and which would be his rich intellectual contribution to science. In three previous publications in this series, and in two in particular, ZoBell's defining of the main themes of the field is considered. Here, the early maturation of those themes is set forth in a work that almost suggests manifesto as it later led to continued amplification of those several threads for decades thereafter in his own work and that of others. The role of *Marine Microbiology: A Monograph of Hydrobacteriology* in the discipline he created is given close attention.

#### I Introduction

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Claude Ephraim ZoBell (1904-1989), it has been argued, was the founder of the discipline of modern marine microbiology.<sup>1</sup> It is not surprising then that he would feel the need at a seeming maturing point in the discipline he created to codify that field in a book.<sup>2</sup> That book and its role in the discipline is the subject of this, the fourth paper in a series on the place of ZoBell in his field and represents both a high point in his career and also a watershed point for this historiographical consideration.

By way of a brief introduction to ZoBell, a reiteration of some short biographical notes is appropriate. As stated elsewhere, Claude ZoBell was born into a family of eight in Provo, Utah on August 22, 1904, but he spent his early years, 1905–1922, on a farm on Idaho’s Snake River. His 1924 diploma was from Albion State Normal School (now Idaho State University, Pocatello) and his 1927 bachelor’s degree in bacteriology from Utah State Agricultural College (later Utah State University), Logan, was followed two years later by an M.S. there. His 1931 Ph.D. in bacteriology was from the University of California at Berkeley. Most of his very early research concerned the non-marine mammalian bacterial pathogen *Brucella* and in this it could be seen that ZoBell’s primary interest was bacterial physiology. That orientation continued on in his work with marine bacteria. From his first publication (1933) at Scripps Institution of Oceanography, SIO (later part of the University of California at San Diego), he had committed almost exclusively to the study of marine microbiology. He had embarked on a career path that would bring him numerous laurels and lead to him being viewed by many as the ‘father of marine microbiology.’ ZoBell spent his entire career at SIO, but did not publish another book in science, though he did publish one work on his own family’s history.<sup>3</sup>

To do historical work on Claude ZoBell is to be constantly frustrated by the fact that much of his personal files held at the SIO library archives are closed until 2009.<sup>4</sup> Studies done to this point are based primarily upon the extensive bibliography of ZoBell for not only are his personal files sealed, but much that could have gone originally to that archival collection evidently was destroyed by ZoBell himself upon his retirement in 1972. Nevertheless, much can be deduced about this important figure in the history of biology through his published works and yet more in those files that are open to the historian’s scrutiny. In my earlier publications, hints of what was to come in the way of a book were

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<sup>1</sup> McGraw, Donald J. 2004. Claude ZoBell and the Foundations of Marine Microbiology (1933-1939). Pp. 45-61 in *Ocean Sciences Bridging the Millennia. A Spectrum of Historical Accounts*. Paris & Beijing: UNESCO and China Ocean Press. See also *Ibid.*. “Claude ZoBell and the Foundations of Marine Microbiology: 1940-1946.” Presented at the XXI International Congress of the Union of History and Philosophy of Science, Section on Oceanography; Mexico City, 2001. Published in *Historisch-Meereskundliche Jahrbuch* 8:103-124, 2001. See also a publication that dealt with ZoBell’s accomplishments in later years, but helps define the man and his role in marine microbiology: *Ibid.* “Claude ZoBell, Hadal Bacteria and the ‘Azoic Zone’” in *Oceanographic History: The Pacific and Beyond*. Keith R. Benson and Philip R. Rehbock, eds. (Seattle: University of Washington Press, 2002), pp. 259-270.

<sup>2</sup> ZoBell, Claude E. *Marine Microbiology: A Monograph of Hydrobacteriology* (Waltham, Mass.: Chronica Botanica, 1946)

<sup>3</sup> See fn 1 above: McGraw, ‘Foundations...1933-1939.’

<sup>4</sup> See fn 1 above for details in footnote 1 of the *Historisch-Meereskundliches Jahrbuch* article.

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made clear by outlining the approach ZoBell took to the field that he was himself so much engaged in creating.

*Marine Microbiology: A Monograph on Hydrobacteriology* (MM here for ease) then was the logical outcome of well over a dozen years of spinning the cloth that would not only make up the various chapters of the book, but that would also hark back to each of the many threads of research he pioneered along with a number of associates and graduate students. Little existed in the literature of marine microbiology prior to about 1930 that could be said to approximate any sort of organic whole but, on the other hand, the literature could hardly have been said to have been depauperate. If it fell to Claude ZoBell to fashion whole cloth—MM and more—from his carefully fashioned threads of research into the microbes of the sea, did he do so in a vacuum or was there already a warp for his weft?

## II. A Prepared Loom: Booklength Works Prior to 1946

While the argument has been made strongly elsewhere (footnote 2 above) that it was ZoBell who seemed to have, almost single-handedly, created the modern field of marine microbiology, he hardly was bereft of predecessors world-wide who had done both field and bench research with the bacteria of the sea, and such work over three-quarters of a century. ZoBell, ever concerned with citing his own previous work in each of his papers over the years, let alone in MM, was also very alert to the accomplishments of others and was sure to cite them, almost without fail.

It has been shown that ZoBell's immediate predecessor at SIO, Albert Haldane Gee (1901-1961) left ZoBell a 125-page document that cited some 420 references in the area of marine microbiology.<sup>5</sup> Surely, this must have been a treasure trove for the nascent specialist ZoBell in his first days at SIO. But there was another trove or two of possibly even greater worth that ZoBell made readily available to himself. Wilhelm Benecke had written a large piece of a greater work for a German handbook in biological methods. Benecke's section has often been seen as almost a stand-alone early 'booklength' work in the field of marine microbiology: *Bakteriologie des Meeres*.<sup>6</sup> It is not believed that this 'Bacteriology of the Seas' has ever been translated into English for general distribution, but ZoBell seems to have hired (or SIO did) a certain E.G. Amstein to do the translation. Amstein is otherwise unknown, but may have been an indigene of the San Diego area or even an employee of SIO. At any rate, ZoBell listed himself as the "Editor" of this work, at least two copies of which exist in the SIO Library as hardbound typescripts of the *Bakteriologie*, in English.<sup>7</sup> The work

<sup>5</sup> See McGraw 'Foundations...1933-1939,' for a short biography of Gee. The Gee commentary was an internal 'status report' and did not purport to be a 'book' on the subject of marine microbiology: Gee, "Scope and Function of Marine Microbiology: Final Report as Bacteriologist, [SIO]," 1932.

<sup>6</sup> The *Bakteriologie des Meeres* is actually Chapter 5 (pages 717-854) of volume IX of the *Abderhalden's Handbuch der Biologischen Arbeitsmethoden*, published in Munster, Germany at the Westfalia-Wilhelms University in 1933.

<sup>7</sup> *Ibid.* Accession number: QR, 106,B434. Later, Amstein and a Christa Painter were also employed (?) to translate another work from the German. That paper was by Carl Robert Baier of Kiel and derived from the *Archiv fur Hydrobiologie*

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by Gee, as well as that by Benecke, must have gone a very long way to initiate ZoBell into an area of research that, while it was already rich in published works, was not yet a discipline. It is of note, though, that Benecke's work came out in 1933, which was also the year of ZoBell's first publication in marine microbiology. How Benecke played into ZoBell's thinking in this early time is unknown (and may remain unknowable) and just how it affected ZoBell with regard to the contents and/or orientation of ZoBell's earliest papers in marine microbiology remains intriguing, to say the least. This is so because ZoBell, in his second paper (1934) in marine microbiology, announced a grand plan for research into the subject in its broadest possible forms, and I have made much of what I have termed his 'proclamation paper' (see footnote 1, the '...1933-1939' article). How much the reading of Benecke or, for that matter, Gee, Fischer or Issatchenko (both below) may have affected his thinking we do not know. I have argued, however, that much of what ZoBell said he would undertake was heavily influenced by the reading of a work by Henry. B. Bigelow and comments made by the then Director of SIO, Harald Sverdrup.<sup>8</sup>

An even earlier booklength study than that of Benecke had been published by B. L. Issatchenko and a series of papers and short 'book' by Bernhard Fischer were also of great value to ZoBell. The work of both men was cited *in extenso* by him in his *magnum opus*. But, in both cases, and the same is true for Benecke, the studies carried out and/or reported upon by these men were *fragmentary and specialized*. It is for these reasons, at the very least, that marine microbiology had yet to become a clearly defined discipline and also why it remains possible to proclaim ZoBell the founder of modern marine microbiology. For, as Henry L. Ehrlich has said

Although microbiological studies of parts of the marine environment had been undertaken for several decades preceding ZoBell's work...he was the first true marine microbiologist *who examined all parts of the ocean environment systematically*.<sup>9</sup>

Ehrlich's prescient comment is crucial to the notion of ZoBell as founder as opposed to any others who might be considered for such an appellation. A close examination of Benecke's 'book' suggests that he had approached marine microbiology from the viewpoint of one who was reviewing the literature then to date and attempting to bring together in one place a disparate collection of publications concerning bacteria in the seas. He cited only three works of his own, two co-authored, in a surprising

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(29:183-264, 1935) and translated as: "Hydrobacteriological Studies of Standing Inland Waters." The ms was typed by a Frances Sparks and "edited by" ZoBell.

<sup>88</sup> See McGraw, '...1933-1939.' (*Op cit.* footnote 1 above). It may be worthy of some attention to note that in MM, ZoBell gave pride of place to a quotation from Bigelow's own *magnum opus* (see MM page xi). That *may* hint at the importance that ZoBell gave to Bigelow as inspiration behind the 'proclamation paper' and later to be manifested in a more graphic sense—a border drawing encloses the quotation—in MM.

<sup>9</sup> Ehrlich, Henry L. "ZoBell and His Contributions to the Geosciences." In C.R. Bell, M. Brylinsky and P. Johnson-Gree, *Microbial Biosystems: New Frontier, Proceedings of the 8<sup>th</sup> International Symposium on Microbial Ecology*. (Halifax, Canada: Atlantic Canada Society for Microbial Ecology, 2000), pp. 57-62. Emphasis added.

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total of 609 sources. That alone suggests that, unlike ZoBell, Benecke had not undertaken to ‘examine all parts of the ocean environment systematically’ personally, as had ZoBell from 1933-1946. However, one is wont to ask whether ZoBell saw that since Benecke had not attempted a systematic beginning for an earlier founding of marine microbiology, the opportunity was open to him (ZoBell) for the taking. ZoBell was ever alert to chance possibilities, as has been demonstrated in my earlier studies, and so, like Pasteur, he may well have seized an initiative not taken by Benecke.

In the first chapter (‘General Introduction’) of MM’s 18 chapters, ZoBell cites not only Benecke’s book, but also the work (nine papers listed in MM) of Bernhard Fischer. Fischer (1852-1915), ZoBell seemed to suggest, was one of the most important of the early pioneers working with bacteria of the sea. ZoBell noted just a few events and persons from even earlier times. Notable among those was the naming of the first marine bacterium discovered, *Spirochaeta plicatilis*, by Christian Gottfried Ehrenberg (1795-1876) in 1838, astonishingly early for the description of a bacterium. The work by A. Certes while on the *Talisman* Expedition of the later 19<sup>th</sup> century yielded only two citations concerning bacteria in the sea.

Fischer, on the other hand, was clearly an early leader who had invented a sampling device for his work (ZoBell would himself later create one of the best known marine water samplers ever—the J-Z Sampler), which was done in a number of widely dispersed marine locations from the Baltic to the West Indies and elsewhere. Fischer had a distinguished, but regrettably foreshortened career. He fell in Flander’s Fields, serving in his role as an army surgeon. Having also been a naval surgeon, he was earlier an assistant to the great Robert Koch in Berlin and went with Koch on the latter’s famous Cholera Commission expedition to Egypt and India. By 1899, Fischer had become Professor of Hygiene in Kiel, his marine publications having ended at just about the same time.<sup>10</sup> Fischer, while a significant early figure, could clearly not have ‘examined all parts of the ocean environment systematically’ anymore than had Benecke. Nonetheless, Fischer did publish an 84 page publication in 1894 that reviewed the work of others, as well as that of his own.<sup>11</sup> It should be pointed out that this ‘book’ by Fischer chronicled what was primarily a plankton expedition and over the 84 pages still only offered a total of just twelve sources cited, all his own (and reiterated by Issatchenko later). Fischer’s work was the first significant German language offering in this still embryonic discipline. In this thorough citation of Fischer, and the others, ZoBell, in his typically careful literature searches, did ferret out the most significant work and workers in an early version of what would finally become marine microbiology.

The large publication by B. L. Issatchenko (the Germanic spelling used by ZoBell, but which today is usually transliterated as Isachenko—and was so spelled, in Cyrillic, in his own book) was the only other major work to precede ZoBell’s own *magnum opus*. Issatchenko’s (to maintain

<sup>10</sup> Bulloch, William. *The History of Bacteriology*. (London: Oxford, 1938). See page 365.

<sup>11</sup> Fischer, Bernhard. Die Bakterien des Meeres nach den Untersuchungen der Plankton-Expedition unter gleichzeitiger Berücksichtigung einer alterer und neuerer Untersuchungen. *Centralbl. F. Bakt.*, 15: 657-666, 1894.

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ZoBell's use) study, along with that of only Benecke and ZoBell (and a later, 1955, book by Brisou) were still considered by Issatchenko's countryman, A. E. Kriss in his own *magnum opus* to be *the* great works in marine microbiology as late as 1963.<sup>12</sup> What is curious about the Issatchenko book is the fact that it does not appear to have been translated from the Russian into English, and it is not known that ZoBell could read Russian.

Issatchenko's book came out in 1914 in Russian with a French translation of the title half-page and a short version of the table of contents also available in French.<sup>13</sup> The full Russian table is consistent with early publications in having highly detailed descriptions of the contents of each chapter. The 420 references are given in their respective languages of origin, however, and so many are not in Cyrillic and are open to readers limited to English, German and French: two of Benecke's papers are cited, for instance (but not his book, of course, as that did not come out till 1933), and these in German. The twelve Fischer papers (of Fischer's 84 page 'book') are given, as well. Issatchenko had been as careful a reader of the literature as ZoBell was well known to be.

In the copy of Issatchenko from the shelves of the SIO Library, one finds that some of the entries in its bibliography have been transliterated into English, scribbled in pencil in the margins by some translator at a time unknown. The hand does not appear to be that of ZoBell, however. Still, ZoBell was aware of at least the contents of some of the text of Issatchenko as he refers in MM (see page 8) to some minutiae that would be hard to tease out of the Russian text if one did not know the language. On the other hand, direct quotations from authors of non Cyrillic-using languages are given in the original languages as are also all taxonomic binomials throughout the Russian text. If one examines MM where Issatchenko is primarily discussed (page 8), one finds that nearly half of the printed discussion is a listing of binomials—all of which were available in the English alphabet from the original Issatchenko text. How much, then, did ZoBell derive from the work of the Russian scientist? This is not knowable at this time, and may never become so.

Nevertheless, the 'General Introduction' of MM is careful to review the literature of marine microbiology up through Benecke's 1933 book and many papers by many other workers prior to that time and on up to the 1946 publication date of ZoBell's *magnum opus*.

### III. A *Magnum Opus* and Its Reception

ZoBell makes clear his intentions for the MM early on by essentially repeating the key line from his proclamation paper of 1934, which is to say

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<sup>12</sup> Kriss, A. E. *Marine Microbiology: Deep Sea*. (New York: Interscience/John Wiley, 1963). This is the English translation. See page vii for the translators' (J. M. Shewan and Z. Kabata) listing of the main predecessor books prior to Kriss: i.e., Benecke, Isachenko, ZoBell and Brisou.

<sup>13</sup> Issatchenko (=Isachenko), B.L. *Researches on the Microbes of the Glacial Arctic Ocean*. (Petrograd: Monograph, 1914). In Russian.

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During the last two decades [i.e., since just before his own career began in marine microbiology and his intent to form it into what was to become a well-defined discipline] the emphasis has been increasingly upon the *function* of aquatic bacterial and allied microorganisms as biochemical, geological, and hydrobiological agents.<sup>14</sup>

So, in a total of some 208 pages of text and 22 pages of bibliography, ZoBell codified and systematized the work of marine microbiology *qua* discipline. Certainly, if one merely examines the tables of contents of the respective works of Issatchenko, Benecke and ZoBell, it is clear that only the latter offers a highly organized attack on what he had by that time fashioned into a coherent discipline. The actual contents of MM are, for the most part, a reiteration of ZoBell's more than 40 published papers on marine microbiology from 1933 to 1945/6 and those of others to that point.

How was this first foray into a newly formalized discipline received by ZoBell's community of peers? With only one glaring exception, MM was a highly regarded work. The commentary ran from William Burrows' laudatory response to a blistering lambasting issued by the irascible Dutchman, Cornelius B. Van Niel.

William Burrows (1908-1978), student of Edwin Oakes Jordan (1866-1936), founder of the Bacteriology Department at the University of Chicago, was one of the great figures in the history of medical microbiology. Burrows took over the editorship of the famous *Textbook of Bacteriology* in 1936 at Jordan's death and the book still retains Burrows' name in its title to the most recent edition.<sup>15</sup> Burrows had to say that while "...a considerable literature on [freshwater] hydrobacteriology has grown up...interest in the salt water bacteria has persisted in somewhat sporadic form for many years." Indeed, not until "...Baier in 1935 [and] Henrici in 1939...[and, finally, Selman Waksman]" had anyone prior to ZoBell's book begun to undertake a "systematic investigation...[to remove from] relative neglect [these] microorganisms."<sup>16</sup> More forcefully, Burrows went on to note that

Professor ZoBell has contributed much original work in this and closely allied fields and is unusually well qualified to assemble and subject to critical analysis the *widely scattered* information on marine bacteria [emphasis added].

Burrows found the "treatment of the marine bacteria...comprehensive and complete" and that ZoBell had made a

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<sup>14</sup> ZoBell, MM, pg. 9. Emphasis added. Note his own emphasis on bacterial physiology, however, in his choice of the word 'function.'

<sup>15</sup> Ware, Lawrence L. 'William Burrows: A Memorial.' *ASM News* (American Society of Microbiology) 46(5):254-255, 1980.

<sup>16</sup> Burrows, William. Review. *Ecology* 27(3):267-268,

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very valuable contribution to marine biology in this monograph. It can be recommended as a well written, critical, and complete survey of the bacteria native to the sea, that will be indispensable to marine biology and should be read by every bacteriologist.

In Burrows' review, he hit upon what an unnamed reviewer in *The United States Quarterly Book List* would characterize as a "...volume that is at the same time a textbook, a compendium, and a summary of the work that has thus far been done upon aquatic bacteria."<sup>17</sup> That succinct phrase goes a long way to define the nature of MM and to encourage its reading as it was, after all, "...a most satisfying and useful treatise on hydrobacteriology."<sup>18</sup>

Even the highly specialized reviewers in the sanitary microbiology community found MM of significance--and once again help to ratify the central contention of this (and earlier) papers in this series: that marine microbiology, as a distinct discipline, was something new: "[t]his book contains [many features]...in addition to an introduction to the new and highly promising field of hydrobacteriology."<sup>19</sup>

That it was, as has been alluded to in the abstract above, almost a manifesto, could be seen by others, as well. Charles Renn of Woods Hole Oceanographic Institution had to say about ZoBell's fervor regarding how he organized his book that

A very persistent, almost evangelical temperament is necessary to find, sort, and squeeze all of these...scattered studies...into a comprehensible system.<sup>20</sup>

In fact, "...ZoBell is one of the few scientists in the country who, by *experience and interests*, can be regarded as capable of such a project" (emphasis added). Renn went on to note that MM was the first work since "...Benecke's digest of 1933..." that attempted to bring together the whole literature, even to the point that it was "...virtually an unofficial introduction to new work"—that is to the nearly 14 years of ZoBell's significant contributions to unify marine microbiology and make of it a comprehensive, and comprehensible, discipline.

Well-informed about 'microbiology' in its most general sense (the study of small living things), Margaret Hotchkiss of the University of Kentucky lauded ZoBell for satisfying the "...curiosity of the bacteriologist concerning these studies [of marine microbes, *sensu lato*]" because up to that time, such scientists had "...been left unsatisfied [,] because no volume existed which

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<sup>17</sup> TUSQBL. Review. 2:152-153, 1946.

<sup>18</sup> *Ibid.*

<sup>19</sup> Nelson, T. C. Review. *American Journal of Public Health* 36:1446, 1946.

<sup>20</sup> Renn, Charles E. Review. *Science* pg. 715, June, 1946.

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organized the scientific output of the various laboratories...” into a single work suitable to their needs, and their ‘curiosity.’<sup>21</sup>

Another reviewer felt that MM was a “notable contribution” and praised ZoBell and his colleagues for their long history of careful work and many publications—few could resist the temptation to count up the nearly 40 citations with ZoBell’s name in them in the bibliography of MM!<sup>22</sup>

Insightful in his review, Bostwick Ketchum not only found MM “very readable,” but much more importantly pointed out at least two crucial aspects pertinent to the basic contention of the present paper: that the marine microbiological literature, seconding Renn, was 1) “widely scattered,” and that 2) “contributions to marine bacteriology have been made by people of diverse interests,” that is, not by members of any previously clearly defined discipline.<sup>23</sup> In so saying, Ketchum points out once again why it is reasonable to offer up Claude ZoBell as founder: his education was directly in bacteriology, he set for himself and ‘his’ science a series of tasks to accomplish, and he carried through on these. He organized and founded his science.

As with so many others, William Rosenfeld, of ZoBell’s home institution, SIO, found that MM was “well written” and that it provided a “helpful and stimulating tool to research,” and that, finally, it “fills a serious gap in the literature of microbiology.”<sup>24</sup> Perhaps Rosenfeld might be discounted given that he was a colleague of ZoBell’s when he said that “[t]he emphasis upon methodology is deserved because of the demands of technique peculiar to the marine bacteriologist.” This issue of special demands is pointed out in this history because the contrast between Rosenfeld’s views in this particular sentence and those of the last reviewer to be considered here, Cornelius B. Van Niel, are so sharp on this point, among others, upon which Van Niel skewered ZoBell so unmercifully.

C. B. Van Niel (1897-1985) was one of the great bacteriologists, intellectually if not socially. Likely a step or two removed in the pantheon from Pasteur, Koch, and their first group of students, Van Niel still towers in the history of the field and during the 1940s and 1950s it has been argued that he dominated bacteriology as a “central intellectual authority.”<sup>25</sup> Why was it, however, that he felt the need so vigorously to flail ZoBell and his new book when not one other of the many reviewers took even the slightest negative bent? A clear answer is not yet forthcoming but, couched in Van Niel’s words, one tends to believe that his lifelong obsession with the notion of “general microbiology” may have had something to do with his excoriation of ZoBell. Indeed, Van Niel found in Selman Waksman’s words in the Foreword to MM the unacceptability of what Waksman innocently

<sup>21</sup> Hotchkiss, Margaret. Review. *The Scientific Monthly* 63(3):239-240, 1946.

<sup>22</sup> Woods, D.D. Review. *New Phytologist* 45(2):286-287, 1946.

<sup>23</sup> Ketchum, Bostwick. Review. *Chemical and Engineering News* 24:2284, 1946.

<sup>24</sup> Rosenfeld, William D. Review. *The American Naturalist* 80(794):586-587, 1946.

<sup>25</sup> Spath, Susan. *C.B. Van Niel and the Culture of Microbiology: 1920-1965*. (Ann Arbor, MI: UMI Dissertation Services, 1999).

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noted: that ZoBell preferred the term “marine microbiology” versus the phrase “marine bacteriology.” Van Niel harranged on this point by stating that

This preference on the part of ZoBell’s is hardly an adequate reason for the use of a title which suggests an account of the nature and activities of marine microorganisms. Instead, the contents are almost exclusively limited to a rather elementary treatise of the bacterial population of the ocean...<sup>26</sup>

Van Niel chose the pages of one of biology’s most prestigious journals to dismember ZoBell saying how “fragmentary” was the book. And it is in that section of the review where Van Niel may give himself away as to what had raised his ire:

It is also obviously dominated by the standardized methodology for the study of pure cultures of bacteria which, so far, has achieved little more than conventionalizing a number of procedures the general value of which is highly problematical.

What the basis for this calumny could have been may be traceable to Van Niel’s ‘program’ of “general microbiology.” Van Niel believed that

the fundamental purpose of science was to achieve rational comprehension of the natural world. He valued the unity of science, the integration of knowledge, the diversity of life, and the mutual interdependence of living things.<sup>27</sup>

Indeed, he viewed himself as something which one might term a ‘philosophical microbiologist’ as opposed to what he saw as unconscionably ‘practical’ microbiology—or bacteriology!—as reported by ZoBell in MM.

Van Niel was adamant about the use of the terms ‘bacteriology’ and ‘microbiology’ and wanted to limit them to precisely what the terms suggested. The history of the struggle over the use of the terms for varying purposes or for the same purpose in the areas of biology that study microbes is an old one and a standard usage of the two terms has yet to be established; it probably never will be. While one might argue that this issue is not directly pertinent to the present study, the fact remains that

<sup>26</sup> Van Niel, C.B. Review. *The Quarterly Review of Biology* 21(3):302-303, 1946.

<sup>27</sup> Spath, Susan. “C.B. Van Niel’s Conception of the ‘Delft School.’” in *Beijerinck and the Delft School of Microbiology*. Page 215. This book was originally published in 1940 by Nijhoff in The Hague and authored by G. Van Itersen, Den Dooren de Jong, and C.B. Van Niel’s famous colleague A.J. Kluyver. In 1983, a reprinted version was circulated in limited numbers (this one from my collection) and had three new essays added; that by Spath was one of those. The pagination is for the revised version of the work. The Spath paper preceded her doctoral dissertation (cf above) by about three years. There also exists an actual reprint of the original done by Science Tech, Inc, Madison, WI, 1983, which includes a Foreward by Van Niel himself and a Preface by Thomas D. Brock.

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ZoBell's book is almost purely bacteriology, *sensu stricto*, as compared to microbiology (probably *sensu lato*?) and so is worthy of at least this mention. The interested reader may wish to look further into the strongly philosophical discussions about this whole matter that have roots in Holland extending back to the 1840s.<sup>28</sup> Indeed, Van Niel was at least the third microbe biologist to be trained into this more philosophical approach. He was preceded by both Jan Kluyver and Martinus Beijerinck in the so-called 'Delft school of microbiology,' about which topic there has grown up an entire historiographical 'industry' (see the contents of the last two footnotes).

Van Niel found MM to contain "contradict[ions]," terms that were "meaningless," the cobbling together of "elementary principles," and a "rather uncritical compilation from the literature." Worse,

ZoBell's book is rather eloquent evidence for the conviction that little of fundamental significance has been achieved during the intervening years [since Benecke's book].

Powerful words! But Van Niel saved his most damning for last:

But as a monograph it does not reach a very high standard, and seems, on the whole, rather trifling.

What we are to make of Van Niel's withering review is not very clear. Was there some unrecorded animosity between the two men? Can Van Niel have been such a purist that he felt he must be some sort of self-appointed guardian of the program of "general microbiology." Was it his consecrated duty to seek greater microbiological truths while shunning the mere scutt-work of practical bench and field microbiology? This issue clearly needs more study.

Suffice to say that, *in toto* ZoBell and his *magnum opus* came through the dreaded period of book reviewing with flying colors in all regards except, regrettably, for the one review done in a major journal and by a "central intellectual authority" in the field.

#### IV. Encomia and the Pages of Time

By the later 1960's, E. J. Ferguson Wood was professor of marine microbiology at the Institute of Marine Science, University of Miami, Florida and in his signal work of that time, hailed ZoBell's early leadership in the discipline.<sup>29</sup> Ferguson Wood was effusive when he spoke of ZoBell's role as founder.

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<sup>28</sup> See the extended volume noted in the fn just above and the essay by Bert Theunissen, "Martinus Willem Beijerinck and the Delft Tradition in Microbiology" therein; pages 183-192.

<sup>29</sup> Ferguson Wood, E. J. *Microbiology of Oceans and Estuaries* (Amsterdam: Elsevier, 1967)

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When my dear friend and colleague ZoBell wrote his textbook on *Marine Microbiology*...there were many who shook their heads at his presumption. When I entered the *virgin field* in 1937, it was made clear to me that I would not be able to make marine microbiology a full-time study...<sup>30</sup>

This was so because conditions were just not right at that time, Ferguson Wood implies.

ZoBell was merely a voice crying in the wilderness, and a rather hostile wilderness at that. For one thing, it was widely believed that microbes did not exist far below the photic zone—temperatures were too low...[and] pressures were too great...<sup>31</sup>

To Ferguson Wood, the 1930's and 1940's were "early, pioneering days." But, by the penning of his then newest textbook on the subject in 1967, "[t]he development [of the discipline was] due entirely to the tremendous scientific progress of the last four decades."<sup>32</sup> Scientists could bring the field to that point because, said Ferguson Wood, "the work of ZoBell inspired me and a few others, so...the interest [had] grown in marine microbiology until all other branches of oceanography and marine biology are looking increasingly to the microbiologist for help and information."

So significant had the discipline become to the greater world of ocean science that

It is so easy, for example, for a geologist to say "oh, that [process] must be microbiological" when the laws of thermodynamics would show that microbes are not needed.

Just how far marine microbiology had matured, Ferguson Wood made clear in such words. Indeed, ZoBell became, in the decades after 1946, a leader in what he and others would term 'geomicrobiology' and would play a major, if not the leading, role in helping to demonstrate that petroleum was largely due to the action of microbes upon ancient plant materials. ZoBell even founded the journal *Geomicrobiology* and was its first editor. Of this, more in subsequent studies.

Ferguson Wood in his next textbook of marine microbiology (of 1975) called ZoBell "the pioneer of marine microbiology."<sup>33</sup> Nor was he publishing alone in that time period, for the very next year Carol Litchfield's chapter authors would have occasion to cite ZoBell no fewer than 35 times over the various chapters and would herself say that

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<sup>30</sup> *Ibid.*, p. 1.

<sup>31</sup> *Ibid.*; see also footnote 1 in this present paper and the article by McGraw on the 'Azoic Zone' for an expansion on this general view and ZoBell's climactic role in ultimately proving the nonexistence of such a zone.

<sup>32</sup> *Ibid.*, p. 2.

<sup>33</sup> Ferguson Wood, E.J. *The Living Ocean: Marine Microbiology* (London: Croom Helm, 1975). See page 37.

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many of the authors of included papers have kindly provided suggestions and helped me to place my ideas in a better historical perspective, especially Dr. C. E. ZoBell, to whom I am most grateful for insight and suggestions.<sup>34</sup>

And by that time, ZoBell had been 'retired' for half a decade. But, not unlike so many other scientists, he remained intellectually active for many years after his formal retirement in 1971.

His allure had not dimmed even by as late as 1988 when B. Austin of Heriot-Watt University wrote his own textbook on marine microbiology for, as he said,

There has been a steady momentum of research activity in marine microbiology since the pioneering efforts of Dr C.E. ZoBell. Indeed, his treatise...has been a source of inspiration for students and established scientists alike.<sup>35</sup>

Austin began his life in the discipline in 1972, he tells us, as "a few fruitful days were spent, closeted in the library, reading ZoBell's book."

It was not only the more generalist oriented among marine microbiologists that continued many decades after MM came out to turn to it and other published articles of ZoBell's for fundamental information, but also those writing highly specialized treatises. In the opening sentence in one such work on biofilms, we are again reminded of ZoBell's founder role: "The first serious study of biofilms was perhaps that of ZoBell (1943), who suggested a two step process for microbial colonization [on surfaces]."<sup>36</sup> And the geomicrobiology community, too, acknowledged ZoBell, along with Sergei Winogradsky and Selman Waksman as central to the founding of their area of specialization.<sup>37</sup>

Even as recently as 2000, the notion that one had to turn back to ZoBell to find the founder remains a standard approach:

Although the pioneering work of ZoBell was done over 50 years ago (ZoBell, 1943), interest in biofilms has recently seen a resurgence...<sup>38</sup>

So it was that after more than a dozen years (1933-1946) of concerted effort to systematize the disparate publications and research directions into a nascent discipline of what Claude Ephraim ZoBell

<sup>34</sup> Litchfield, Carol D. Editor. *Marine Microbiology* (Stroudsburg, PA: Dowden, Hutchinson and Ross, 1976). See Preface.

<sup>35</sup> Austin, B. *Marine Microbiology* (Cambridge: University Press, 1988). Page xi.

<sup>36</sup> Characklis, William G. and Kevin C. Marshall. *Biofilms* (New York: John Wiley-Interscience, 1990), page 3.

<sup>37</sup> Ehrlich, Henry Lutz. *Geomicrobiology* (New York: Marcel Dekker, 1990). This is the second edition of at least four in existence.

<sup>38</sup> Stolz, John F. "Structure of Microbial Mats and Biofilms." In Robert E. Riding and Stanley M Awramik. Editors. *Microbiology Sediments* (New York: Springer, 2000).

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would finally christen ‘marine microbiology,’ his only scientific book, his *magnum opus*, would become the bible of a new field of endeavor.

## V. Thoughts on the Nature of Founding a Discipline

Many have lauded Louis Pasteur as the sole founder of bacteriology. But that is clearly false; Robert Koch played a role virtually as large as that of Pasteur in the discipline building of their shared science.<sup>39</sup> And Bruno Latour finds such concepts as single founders unacceptable as he argues, to use the excellent paraphrased words of Robert Bud: “...one man could no more be the unique source of a discipline than a general’s genius the sole cause of victory in battle.”<sup>40</sup> These statements may well carry much truth, but there is a distinct difference between the building of a discipline that must discover the very essence of what inheres in it: bacteria, microbes, were essentially unknown living things prior to Pasteur and Koch. With ZoBell, however, his discipline-building was of a different nature: the creation of a field built upon a category of known and already quite well-understood organisms, but which discipline studies them in new settings is a fundamentally different thing. One might argue, of course, that marine microbiology should be considered a *sub*-discipline of the greater science of microbiology or bacteriology. So conceded. Yet the trained practitioners still see the various fields within the greater realm of microbiology, *sensu lato*, as somehow a whole each unto themselves. Industrial microbiology is strikingly different than is medical microbiology; its practitioners train in the fundamentals of microbiology, it is true, but once specialization begins the spheres in which each specialist will ‘live’ is strikingly different. Cross-over is not necessarily commonly undertaken and no microbiologist of any stripe would contend that marine microbiology was merely a minor variant of medical or industrial microbiology, for instance.

There is a unifying, singular authority that is embodied in the work of ZoBell that is simply not present in Issatchenko, Bennecke or Fischer. No, contrary to Latour, it can be said, especially given ZoBell’s *systematic* undertaking with his organisms and their unique ecological setting, that he alone created the modern discipline of marine microbiology.

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<sup>39</sup> See, for instance, Donald J. McGraw’s review (*Isis* 80(303):542-543, 1989) of *Essays of Robert Koch*, translated by K. Codell Carter (New York: Greenwood Press, 1987) for more on this subject.

<sup>40</sup> Latour, Bruno. *Microbes: Guerre et Paix; Suivie de Irreduction*. (Paris: A.-M. Metilie, 1984) and Robert Bud. *The Uses of Life: A History of Biotechnology*. (Cambridge: University Press, 1993). See page 7. *A propos* of the general nature of the present study, it should be noted that Bud said the following: “...a medically oriented bacteriology whose *father*, Robert Koch...” Page 14; emphasis added. It should also be noted that Selman Waksman, in his Foreword to MM, said that “[m]arine microbiology has become as much an essential *branch* of oceanography as have marine zoology...” (emphasis added). Waksman was not, however, engaged in discussions about the precise meaning of the word ‘discipline’ when he employed the notion of ‘branch’ of the already polyglot ‘oceanography.’

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## A “BATHYTHERMOGRAPH” WITH A DEEPER MEANING

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During the first quarter of the nineteenth century, an enlightened movement towards cultural and scientific development took place in Southeastern Europe.<sup>41</sup> One of the vehicles used by the scholars of the period for the dissemination and popularization of early modern science was the journal *Hermes the Scholar*, which, surprisingly, survived for about ten years until its circulation ceased in 1821 for political reasons (during that year the Greek War of Independence against the Ottoman Empire started).<sup>42</sup>

The history of oceanography in Greece from 1750 to 1950 has already been studied extensively.<sup>43</sup> What I would like to do in this short presentation is to discuss the first appearance of an oceanographic instrument in the Greek scientific literature. We owe this reference to a young Greek student in the University of Pavia, Italy, in the early nineteenth century, Dimitrios Schinas, who was a regular correspondent of *Hermes the Scholar*.

In 1811, in a series of articles under the general title “Physics,” Schinas discussed among other subjects the development of several types of thermometers. Doing so, he described also a type of thermometer that while the observer is absent could register the variations of atmospheric temperature.<sup>44</sup> According to Schinas, this “automatic thermometer was invented by Six.”<sup>45</sup> Six’s thermometer was very widely used, and as Schinas mentioned, he found its description in the Italian

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<sup>41</sup> Iannis Karas and George Vlahakis (eds), *History and Philosophy of Sciences in the Greek-Speaking Lands (17<sup>th</sup>-19<sup>th</sup> Centuries)*. Athens 2003, 781pp., figs., index (in Greek).

<sup>42</sup> George N. Vlahakis, 1999. The Greek Enlightenment in science. *Hermes the Scholar* and its contribution to science in early nineteenth-century Greece. *History of Science* 37: 319-345.

<sup>43</sup> George N. Vlahakis, *Oceanography in Greece (18<sup>th</sup>-20<sup>th</sup> Century)*. Athens 1999, 212pp, figs. (in Greek).

<sup>44</sup> Dimitrios Schinas, “Physics,” *Hermes the Scholar* Volume 1 (1811), p. 290.

<sup>45</sup> Actually James Six, FRS (1731-1793) is known for his invention of a maximum-minimum thermometer described in his book *The Construction and Use of a Thermometer for Shewing the Extremes of Temperature in the Atmosphere*, London 1794, reprinted in 1980 as *Construction of a Thermometer by James Six F.R.S. Prefaced by an Account of his Life and Works and the Use of his Thermometer over Two Hundred Years* by Jill Austin and Anita McConnell. London: Nimbus Books. Furthermore, in 1780 he had also invented a self-registering thermometer which was the most widely used for deep-sea temperature measurements until 1870. This model was later modified by W.A. Miller (1817-1870) and became the well-known Miller-Casella thermometer.

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scientific journal *Opusculi Scetti sulle Scienze e sulle Arte*, Milano, vol. XX. A few such thermometers still survive in collections of scientific instruments like that in the University of Urbino, Italy.

According to Schinas, who apparently studied the subject in detail, an improved version of Six's thermometer was described by Giovanni Fabbroni<sup>46</sup> in another Italian scientific journal, *Memorie di Matematica e Fisica delle Italiana*, 1809, vol. XIV, Parte 2. Schinas referred briefly also to two other types of "thermometrographs" which were described by the Belgian chemist and professor at the University of Louvain, J.B. van Mons (1765-1842), and in the *Philosophical Transactions of the Royal Society of London*.

Because all the above thermometers were used mainly for the measurement of air temperature, Schinas expressed the belief that a similar self-registering instrument could be developed for the measurement of water temperature in the sea, lakes and rivers, keeping in mind that the relevant attempts to that date for the construction of such an instrument had failed. As a result, scientists were forced to use common thermometers for such measurements, insulating them as best they could from heat transfer to get reliable measurements. Such were, according to Schinas, the thermometers used by the Swiss naturalist Horace Benedict de Saussure (1740-1799) for his measurements of water temperature during the famous expeditions in Switzerland described in his well-known book *Voyage dans les Alpes* (1779-1796).

But the technique of insulating the thermometers, along with the probable inaccuracy of the measurements, also had a number of technical deficiencies. The solution to this difficult problem was given by Angelo Bellani<sup>47</sup> who invented a thermometrograph described in the Italian scientific journal *Il Giornale di Fisica, Chimica e Storia Naturale del Regno Italico* (edited by Luigi Brignatelli), vol. IV, 1811, Pavia. The actual title of Bellani's article was "Memoria sopra un nuovo termometrografo ossia termometro per luoghi inaccessibili." An earlier description of this instrument is found under the title "Termografo, ossia descrizione di un termometro ad indice" in *Nuova Scelta d'Opuscoli Interessanti sulle Scienze e sulle Arte di C. Amoretti*, 1804.

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<sup>46</sup> Giovanni Fabbroni (1752-1820), the physicist and naturalist, was born in Florence. He worked closely with the famous Italian naturalist Felice Fontana, participating actively in the foundation of the Museum of the Natural Sciences (1773) and succeeding Fontana as its director in 1807. Fabbroni traveled across Europe and in 1778 wrote the book *Reflections sur l'État Actuel de l'Agriculture*. He corresponded with many scientists and politicians in the United States, among them President Thomas Jefferson.

<sup>47</sup> Angelo Bellani (1776-1852), who first used the term "thermometrograph," was a priest from Monza engaged in the production of precision thermometers and meteorological instruments.

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...αίρας, τὸ ὅσον ἀπολαύσει τὸ ψῆφος ἕως εἰς θ, ἰσῆται μίς β, ἢ εἰς 17 βαθμοῦς, εἰ ὅσον ἀναπαύονται εἰς ἀλλήλους τὴν δὲ δὲ μίαν προκρινθεῖσιν. Ἡ κλίμαξ τοῦ θερμομετρητήρου τούτου, ἔχει τοὺς βαθμοῦς ἐκθερμομετρικοὺς ὡς ἐντελοῦς ἐξ ὑδατομέτρου θερμομετρητῶν ἵνα εἰ ἐκτελεσθῆ (ὡς εἰς σχῆμα α. καὶ β.) ἢ μὴ ἐκθερμωθῆ (ὡς εἰς σχῆμα α.) δεικνύοντα τοὺς βαθμοῦς τοῦ ψυχροῦ, ἢ ἐκ εὐθείας ἢ ἀνατετραμμένῃ τοῦ βαθμοῦ τοῦ ψυχροῦ, καὶ ἀντικρῶς εἰς τὸ β, Σχῆμα.

Ἐπισημαίνω καὶ χρῆσιν τοῦ θερμομετρητήρου. Ἐπισημαίνω (ὡς ἀποδείξει) ἐν τῷ ἔργῳ ἡμιῶν πάλιν ὁ Συγγραφεὴς τὴν κατά δύο ἄρας τοῦ χροῖου διατρίβου κρῆνον βαθμοῦς λίαν, διὰ τὴν περιστάσιν τὴν πρῶτην τοῦ ὑδατομέτρου ἀνομένου, τὸ ὅσον κατὰ τὰς παρατηρήσεις τοῦ Σωκράτους, τοῦ Ἰωάννου, τοῦ Ὀυῖ, καὶ τὰς ἑτέρας, διαμείνει ἐν τῷ βαθμοῦς μίαν εἰς ἀπὸ τῶν κρῆνον, τὴν πρῶτην, κατὰ τὸν χροῖον, ἀπὸ τοῦ ἴσου, ὅτι ἡ τοῦ αἵρος ἢ ἡ τῆς λίανος ἐπιφανείας κρῆσις εἶναι περὶ ἓνα βαθμῶν ὑπερῶν τοῦ τῆς σφαιρίδιου (ὡς καὶ μὴ ἄλλο παρὸδὸς θερμομετρητῶν τὸ βεβαιώσαι), καθὼς τὸ θερμομετρητῶν κατὰ τὸ Σχῆμα α. ὅπου εἶσι μετὰ τὸ σφαιρίδιον τοῦ ὑδατομέτρου μίς 2 ἴσῃ τῆς πρῶτης κ, ἕως ἀν φθάσῃ εἰς τὸ βαθμῶν 10 ἐκείνου ἔπειτα, καὶ ἀπὸ τοῦ ἐκείνου, ἢ ἐπὶ τῆς ἐπιφανείας τῆς λίανος, ἢ ἀπὸ τῆς εἰς τὸν πρῶτον κρῆνον τοῦ ἴσου βαθμοῦ, τότε δίδω ἐκείνῃ τὸν ὑδατομέτρου καταβέβηκα εἰς τοὺς τρεῖς βαθμοῦς, εἰς τοὺς ὁποῖους προσέειπε τὸ ὅσον εἶχε πρότερον τὸ θερμομετρητῶν, ἵνα ὅτι τὸ βαθμῶν τῆς λίανος ἢ το βαθμοῦς τοῦ ὑδατομέτρου. Εἰς τὴν ἐκκατάστασιν τῆς πείρας, εἶναι, ὡς πρὸς τὴν ἐκείνου, χρῆσις τῆς ἰσοσταθμῆς ἢ ὑδατομέτρου εἰς τὸ δοχεῖον β. τούτῳ δὲ γίνονται θερμομετρήσεις τοῦ κρῆνον α, ἢ ἐπὶ τῆς χειρὸς, ἢ διὰ τοῦ σφαιρίδιου, κτλ. Ἄν δὲ κατὰ τὴν δὲ δὲ μίαν ἄρας τοῦ χροῖου, εἰς κρῆνον π. χ. τοῦ αἵρος, ἢ τῆς ἐπιφανείας τῆς λίανος 20 βαθμοῦν, πείρασι, τότε ἀνατετραμμένῃ τὸ ἀνατετραμμένον ἔργον κατὰ τὸ Σχ. β. μὴ τὸ σφαιρίδιον τοῦ ὑδατομέτρου εἰς α, τὸ ὅσον εἶναι μίαν βεβηκασίαν ἰσῆται κατὰ τὸ β. Μετὰ τὸν βαπτισμῶν

Clearly based on Bellani's article in Brugatelli's journal (easily found in the university because Brugatelli was professor of chemistry there and a colleague of the famous physicist Alessandro Volta), Schinas cited an extensive description of the "bathythermograph" (above) as well as describing an experiment showing its use, accompanied by drawing of the instrument.

Probably the main question for a historian of science is the reason for the publication of the description of such an instrument in a journal at the European scientific periphery, where even more basic scientific instruments failed to be used by scholars of the period. We must keep in mind, though, that Schinas studied in one of the most prestigious and progressive universities of the early nineteenth century not only in Italy but throughout Europe. He was likely deeply impressed by the advancement of science and especially the work of his professor, Alessandro Volta. He seemed to consider himself a messenger to his homeland of the new scientific ideas. Thus his purpose was much more ambitious than, and not restricted to, the mere description of an admittedly ingenious scientific instrument. As he confessed in the last paragraph of his article addressed rhetorically to the editor of *Hermes the Scholar*, he intended to encourage those engaged in the physical sciences in Greece to occupy themselves with the design and construction of scientific instruments.

This was an inspired demand, considering the situation of physical sciences in the Greek-speaking lands during that period. Most Greek scholars had studied in European universities and had more or less transferred the average knowledge of physics, chemistry and natural history to Greece, but their activity remained generally at an educational level. They had to take a decisive step and proceed

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farther to the research and development level. For this purpose, they needed instruments but they lacked the necessary funds to buy them directly from the European market. An alternative would be the domestic construction of the necessary instruments for experimental and field work. The argument presented by Schinas in support of his view was that the instrument makers “with their brilliant theories and their wise experiments” brought science and technology to the highest degree of perfection. Furthermore, such a practice would give to the Greek scientific community increased international esteem and a more significant role in Southeastern Europe. Schinas was among the very first who recognized the benefits of such a choice.

Thus we may conclude that the first description of an oceanographic instrument by a Greek scientist served also a more general and important purpose, as a vehicle for the dissemination of the idea of nineteenth-century science. Taking into account Greece’s strong connection with the sea since antiquity due to the fact that it is surrounded by the Aegean, Ionian and Cretan Seas and the urgent need for measurement of its physical variables, Schinas cleverly used the presentation of the bathythermograph to impose a more serious idea. This was the development of construction of scientific instruments in the Greek-speaking lands as a tool for upgrading scientific practices from the educational and popularization level to the level of original research, an upgrade which today still seems to be a wish of the Greek scientific community after almost two centuries.

## THE MUSEUM FÜR MEERESKUNDE IN BERLIN

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(This article was first published in another format in June 2006 in *Hydro International* 10 (15): 10-11 in the anonymous series “As It Was” by “An Old Oceanographer.” – *Editor*)

With the unification of the German nations into the Kaiserreich in 1871, marine affairs became a dominant factor in the foreign policy of the new nation. As early as 1861, the Prussian Naval Ministry had established a Hydrographic Bureau in Berlin for surveying and charting the sea. This was transferred to Hamburg in 1875 and extended to become a marine observatory, the Deutsche Seewarte, for closer contact with trading vessels in Germany’s main seaport. But after the successful deep-sea,

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around-the-world expedition of the corvette *Gazelle* (1874-1876), a national maritime centre, including a museum, was proposed for Berlin.

One hundred years ago, on 5<sup>th</sup> March 1906, Kaiser Wilhelm II celebrated the opening of the Museum für Meereskunde in Berlin, accompanied by Prince Albert I of Monaco, who just four years later inaugurated his famous Musée océanographique. Both had begun their plans in 1899; the results, however, could not have been more different. While the building in Monaco was exposed to the Mediterranean Sea and showed the results of Prince Albert's own oceanographic research, the Museum in Berlin was located in a gloomy side street (Figure 1) and its main attraction was a German Navy exhibition.



Figure 1. The façade of the Museum für Meereskunde of the University of Berlin, Georgenstrasse 34-36, probably about 1920.

Actually this collection became the nucleus of the Museum. Pieces had been being assembled since Wilhelm II acceded to the throne in 1888 with the statement that the future of Germany would lie at sea. Ten years later, the collection was presented to the public and the leading newspaper in Berlin promoted its permanent exhibition as a vehicle to foster imperial marine affairs. The Kaiser, in childhood already dressed as a little sailor, supported the idea but wished to combine the exhibition with an academic institution for marine science. The latter was founded at the University of Berlin in 1900 under the geographer Ferdinand von Richthofen, and, although six years ahead of the opening of the Museum, it was already named “Institut und Museum für Meereskunde.” It proved very successful

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in attracting public attention through popular lectures up to four times a week before audiences of 200 or more, and publications “for the awareness of the national importance of the ocean and its naval affairs.”

Although the naval collection turned out to be the main attraction at the Museum, the exhibitions of the other departments were of high quality in terms of scientific approach. Each exhibition was arranged in such a way that visitors got a broad impression of what was being show; for example, via dioramas, new at that time. Sections were devoted to navigation, oceanography, marine biology and fisheries.

After World War I, when German scientists and the German language were unacceptable at international scientific conferences, the Institut regained international reputation when it undertook the first large-scale systematic oceanographic investigation of the tropical and southern Atlantic during the *Meteor* Expedition (1925-1927). The results were published in 50 volumes – the last in 1965.

While oceanographic research activities at the Institut expanded, the Museum remained practically as at its founding. Many plans were discussed for transferring the naval collection to a separate and more attractive building, using arguments like “the Reichsmarine is the embodiment of Germanic manly power as it manifests in the world.” But this priority fell from grace after the assumption of power by the Nazi regime. This was land-oriented in its lust for conquest, and hydrography and oceanography were degraded so as to merely serve naval operations.

When in 1941 the first bombing raids reached Berlin, the evacuation of important cultural objects was considered. Near the final phase of World War II, most movable cultural objects, like those at the Museum für Meereskunde, were removed from Berlin and stored in various castles, bunkers and tunnels to the north, east and south of the capital. Some even underwent further transfers. These are astoundingly well documented considering the circumstances, and example of the reliability of German bureaucracy, even in extreme situations.

After the war, the fate of exhibition items depended on their location, that is, whether they belonged to the western or eastern area of foreign occupation. Those collected by the Soviet Army were brought to the Central Marine Military Museum in Leningrad. Years later, they were returned, in the meantime restored, to the German Democratic Republic (mainly the German Army Museum in Dresden, the Museum of German History in East Berlin, and the Marine Science Museum in Stralsund). Objects that found their way into West Germany (in particular the Institut für Meereskunde library) are now integrated into the stock of various places. These include the German Transportation and Technology Museum in Berlin, the Federal Maritime and Hydrographic Agency in Hamburg, the Institute of Marine Science in Kiel, and the Naval Academy in Flensburg/Mürwig.

The story of the Berlin Museum suggests an impossible state of affairs right from the beginning: the combination of military and marine-science exhibitions in an unattractive place. A new initiative for a German marine science museum began in 1951 in the old Hanseatic trading town of Stralsund on the Baltic, in a disused church. Since then, it has undergone continual growth, established outstations in the neighborhood, and its latest extension, an Oceanum (Figure 2), will be opened in

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2008. After the reunification of Germany, the museum was awarded the status of national marine science museum.

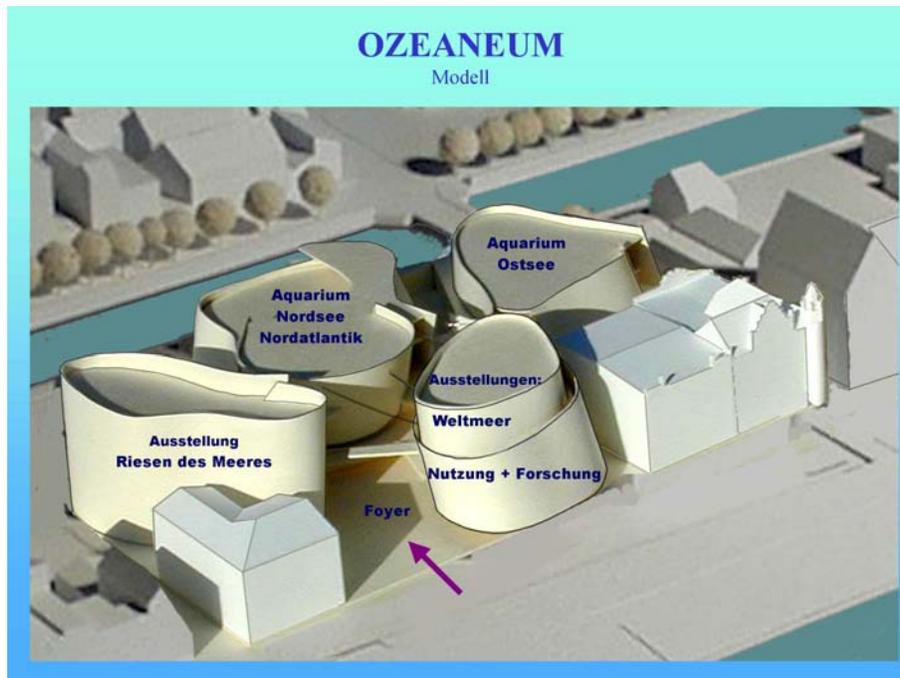


Figure 2. The plan of the Oceanum in Stralsund, Germany, on the Baltic.

Further reading: Museum für Verkehr und Technik Berlin, 1996. *Aufgetaucht – das Museum für Meereskunde*. Berlin: Nicolaische Verlagsbuchhandlung. 171pp.

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## **Sir George Deacon Medal AWARDED TO GERMAN MARINE SCIENTIST DR. HJALMAR THIEL ABOARD HMS *Warrior* AT THE 11<sup>th</sup> DEEP SEA BIOLOGY SYMPOSIUM IN THE UK (JULY 9 – 15, 2006)**

Robert Y. George

George Institute for Biodiversity and Sustainability (GIBS)  
305 Yorkshire Lane, Wilmington, North Carolina 28409, USA  
[georgeryt@cs.com](mailto:georgeryt@cs.com)

“I first met Sir George Deacon during the ‘Challenger’ centenary in Edinburgh in 1972 and he introduced me to such eminent ocean scientists like Alister Hardy, C. M. Yonge and Roger Revelle. These four prominent men sat in the front row when I (a young and emerging American scientist at age 35) presented two papers, one on deep-sea zonation in the Northwest Atlantic and another on hydrostatic pressure as a factor in deep-sea adaptations. I also met George with his daughter Margaret Deacon at Woods Hole Oceanographic Institution (WHOI) during the auspicious occasion of the celebration of 50 years of history of WHOI. We became friends. I met George again when Max Dunbar hosted the “‘Polar Oceans’” symposium in Montreal where I sought his support in my plans to hold an international symposium on the Antarctic Krill *Euphausia superba*, George readily offered his help and promised to participate. His enthusiasm was apparent since he described the ‘Southern Ocean’, as you all know, in his famous *Discovery Report* on the water masses and currents prevailing south of the Antarctic Convergence.”

“In 1982 Sir George Deacon came as my guest to North Carolina for the ‘First International Symposium on the Antarctic Krill’ (see *Journal of Crustacean Biology* Vol. No. 4 No 1, Symposium proceedings, edited by George, 1984). Deacon gave the symposium keynote address on the link between Antarctic winds and currents and the distribution of krill. He told the audience about the ruthless slaughter of whales around South Georgia. In this evening gathering in the Morton Auditorium at the University of North Carolina at Wilmington, Chancellor Dr. William Wagoner awarded him the Nathaniel Palmer Medal and introduced George to the faculty, students, symposium participants and the public (Figure 1).”

“ In 1983 I went to Cape Town, South Africa for the SCAR (Scientific Committee for Antarctic Research) symposium and from there I went to see George in Wormley where the British National Institute for Oceanography (NIO), which he founded and directed. Sir George died the following year. Today we are so pleased to have in our midst his daughter Margaret Deacon (Figure 2) to award the ‘Sir George Deacon Medal’ to an eminent deep ocean scientist Prof. Hjalmar Thiel of the University of Hamburg, Germany. Let us all give a round of applause for Margaret who wrote the book on the History of Oceanography”.

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Then the 300 participants of the 11<sup>th</sup> deep-sea biology symposium, standing on the middle deck of *Warrior*, clapped to recognize Margaret Deacon.

These were the words (three paragraphs above) I used to set the stage for the Sir George Deacon Medal award. The sun was shining and the atmosphere aboard *HMS Warrior* was warm with a gentle breeze blowing toward the bow of the ship.



Figure 1. Photo taken in 1982 during the Wilmington Krill symposium. Left – Prof. Bob George. Middle – Chancellor William Wagoner and right – Sir George Deacon.

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Figure 2. Margaret Deacon, Bob George and Hjalmar Thiel aboard HMS *Warrior*.



Figure 3. Bob George announcing the 6<sup>th</sup> recipient of the Sir George Deacon Medal from the captain's deck while participants learned about Prof. Hjalmar Thiel (2006 Deacon Medalist) from Germany.

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Standing on the deck were the 300 participants from 28 nations (Figure 3) and Torben Wolff (Deputy leader of the *Galathea* Expedition, 1950 –52), the fifth recipient of the Sir George Deacon Medal in 2003 in Oregon at the 10<sup>th</sup> International Deep-Sea Biology Conference, was one of the participants. Torben was invited to the captain’s deck. Two members of the Deacon medal nomination committee, Prof. Craig Smith of the University of Hawaii and Dr. Peter Herring of the National Oceanography Centre Southampton (NOCS -Host of the conference), joined Torben Wolff, Bob George, Hjalmar and Margaret on the top deck before the medal was presented (Figure 4).

Bob George Introduced Margaret Deacon who awarded the Sir George Deacon Medal to Prof. Hjalmar Thiel for building bridge between deep-ocean biology and marine conservation science. Prof. Thiel played a key role over the past decades in emphasizing the need for environmental impact studies in the deep-seas related to dumping of low-level radioactive waste products (1965-1968), manganese nodule mining (1972), and metaliferous mud mining in the Red Sea (1977-1981). Whereas these projects remained a standard investigation in biological oceanography, the break-through in environmental impact studies became the DISCOL (Disturbance and Re-colonization Experiment) project (1988 – 1998), experimentally disturbing 11 square kilometers in the Southeast Pacific Ocean to observe the re-establishment of the benthic community for a period of seven years. Prof. Hjalmar Thiel also worked with Prof. Robert George in 2003 to write to UN General Secretary Koffi Annan to take immediate initiatives to prevent human exploitation of the deep-sea environment such as using heavy trawls over the sea bottom, thereby threatening benthic life on seamounts as well as deep-sea corals. Prof. Thiel was GIBS guest of honor in 2005 at the 3<sup>rd</sup> International deep-sea coral symposium in Miami where he presented his proposal to establish “Science Priority Areas (SPAs)” on the ocean floor of the high seas.



Figure 4. Prof. Craig Smith and Dr. Peter Herring applaud aboard *HMS Warrior*.

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Figure. 5 Prof. Hjalmar Thiel receiving the Sir George Deacon Medal from Margaret Deacon while Prof Bob George stands close to them (Photo by Dr. Thomas Ahlfeld, MMS).

Previous recipients of Sir George Deacon Medals include Prof. Leonard Pietrafessa of the North Carolina State University (1987), Prof. Robert Y. George of the University of North Carolina at Wilmington (1993), Prof. Jarl-Ove Stromberg of the University of Göteborg, Sweden (1993), Prof. Edward O. Wilson of Harvard University (1999) and Dr. Torben Wolff of the Copenhagen University, Denmark (2003). Currently the Deacon medal award is administered by the George Institute for Biodiversity and Sustainability (GIBS – [www.GIBSconservation.org](http://www.GIBSconservation.org)).

The Deacon Medal is awarded to an outstanding scholar who has made significant contributions to build bridges between two disciplines. The nominees for the award are reviewed by a committee of five members (one from GIBS board of Governors, two eminent scientists), one anonymous individual known for interdisciplinary and international approaches to the future, and Prof. Robert George of GIBS as chair). We are now in the process of revitalizing the Deacon Medal selection criteria to include clear definition of criteria for selection and calls for nominations. The guidelines will include the rationale for the award, the types of accomplishments expected in awardees, and the need for anyone who nominates to include a minimum of a one-page description of the worthiness of the nominee. The next Deacon Medal award is planned for 2009 and all those who wish to nominate should sent the nomination not later than December 31, 2008. Nominations may be submitted by snail mail to GIBS, 305 Yorkshire Lane, Wilmington, North Carolina 28409, USA or by e-mail with an attachment to [georgeryt@cs.com](mailto:georgeryt@cs.com)

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## NEWS AND EVENTS

**DEATH OF JOEL HEDGPETH.** Joel W. Hedgpeth (1911-2006) died on Friday, July 28, in Hillsboro, near Portland, Oregon. He was one of the great icons of twentieth century marine biology. His archives contain correspondence with every well known marine biologist of the twentieth century. He was a world-class expert on pycnogonids; wrote hundreds of articles and essays (including many philosophical and environmental pieces in the *Quarterly Review of Biology*, disguised as book reviews); edited the massive Volume 1 of the *Treatise on Marine Ecology and Paleoecology* in 1957, still a gold mine of obscure 19<sup>th</sup> and 20<sup>th</sup> century literature and known in earlier years as “The Big Red Book;” edited and authored much of *Between Pacific Tides* through several editions (and objected very vigorously when Stanford University Press declined to name him the editor of the fifth edition); became a champion of the rare freshwater Californian shrimp *Syncaris pacifica*; and monitored the state of the environment from the 1930s through the 1990s. He was consumed with water issues and water resources of the west for his entire life and vividly remembered meeting California Governor George Pardee (1857-1941), who once looked at Joel and remarked, “I like the cut of your jib” (Joel was very proud of that encounter). Joel’s first scientific publication was in 1939, and he will appear as a co-author of the pycnogonid chapter in the fourth edition of *Light’s Manual* (now the *Light and Smith Manual*) due out in early 2007 (University of California Press).

Joel took his undergraduate degree in 1933, his Master’s in 1940 under S.F. Light (on diaptomid copepods), and his Ph.D. in 1952 under Ralph I. Smith, all at the University of California at Berkeley. His doctorate was on the distribution and ecology of invertebrates along the Texas and Louisiana coasts. Joel traveled extensively, including Point Barrow, Alaska; much of Europe; three visits to Antarctica (“South Pole, 1974” being one of them, according to Joel’s notes); and one expedition to the Galápagos Islands (producing one of the first essays on the intertidal life of the Galápagos), although he never took a formal sabbatical. He was director of the now extinct Pacific Marine Station at Dillon Beach, California and the Oregon State University Marine Science Center in Newport, Oregon, served on innumerable panels and committees, received the Browning Medal in 1976 for environmental stewardship (often proudly pointing out how he had made the “Environmental Protection Agency hit list,” wrote *Seashore Life of the San Francisco Bay Area*, and could speak knowledgeably about thousands of species of marine invertebrates and vertebrates around the world. He was honored in 1976 by a special symposium at the Linnean Society of London (a Hedgpeth *Festschrift* resulting from that meeting was published in the Society’s *Zoological Journal* in 1978).

Joel Hedgpeth founded the Society for the Prevention of Progress, and wrote poetry under the synonym Jerome Tichenor (for whom he had special stationery printed, showing his famous red squirrel logo, and with an extensive entry at the bottom on a “bardic tradition” that the first environmental impact report was submitted by a delegation of squirrels at the time of Elizabeth I; the

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stanzas are written in Welsh and English). Joel had an abiding interest in poetry of the sea, and produced a 500-page unpublished manuscript on sea poetry.

Our last extensive conversations were in November 2000 (when Joel and I sat on his couch in Santa Rosa and turned each page of *Seashore Life*, discussing the needed revisions), and December 2001. I last saw him in 2005. In 2001, at the age of 89, Joel still fluidly laced his conversations with phrases in Latin, German, Welsh, and Russian (and expected his listeners to keep up). Joel Hedgpeth led a long and distinguished career as a scientist, environmentalist, writer, poet, historian, traveler, critic and philosopher, and represented the grand tradition of an earlier generation who took great pride in the depth of their knowledge of the natural world. (Contributed by Jim Carlton, Williams-Mystic Maritime Studies Program, Mystic, Connecticut, USA).

**SAYED ZAKARIA EL-SAYED (1926-2005).** Our colleague Sayed El-Sayed attended ICHO VII in Kaliningrad in September 2003, where he contributed two papers. He was also the author of an article on the oceanographer and historian of oceanography A.A. Aleem in *History of Oceanography* 16 (2004). Following is an extract from his obituary notice.

Dr. Sayed Z. El-Sayed, an oceanographer whose pioneering research studied the effects of ozone depletion on Antarctic marine phytoplankton, died at his home on Whidbey Island, Washington, December 21. He was 79 years old. Professor Emeritus at Texas A&M University, he was a leading scholar on marine productivity and marine ecosystem dynamics. His research spanned the globe from the Gulf of Mexico to the Atlantic, Pacific and Indian Oceans and the Mediterranean Sea. He carried out a number of studies of these ecosystems, receiving grants from the National Science Foundation, National Oceanic and Atmospheric Administration, and U.S. Agency for International Development (USAID). Dr. El-Sayed's professional passion was the Antarctic. He traveled to the Antarctic more than twenty times and led efforts to establish the international BIOMASS (Biological Investigations of Marine Antarctic System and Stocks) program, which studied the Antarctic marine ecosystem with a view to safeguard the marine living resources of the Southern Ocean from overexploitation. He often described his experience by citing a quotation, "Antarctic research has been described as yielding nothing other than heroism, obscure scientific data, and endearing photographs of penguins." He was a leader in the Middle East as well, facilitating joint scientific ventures among scholars from the U.S., Egypt, and Israel. For more than twenty years he served as the Chief Scientist of the Cooperative Research Program for the Middle East, leading cooperative efforts among scientists from these countries.

Sayed El-Sayed was born in Alexandria, Egypt on March 17, 1926 and received degrees from the University of Alexandria. He received a Fulbright Scholarship and traveled to the United States to study in 1952, receiving his Ph.D. from the University of Washington. He joined the faculty of the Oceanography Department at Texas A&M University in 1959 and received many distinguished honors and awards. He received two National Science Foundation Antarctic Service Medals and a Distinguished Service Award from the American Institute on Biological Sciences (AIBS). He was a

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Fellow of the American Association for the Advancement of Science (AAAS) and an Honorary Member of the Polar Society. In 1973, the “El-Sayed Glacier” in Antarctica was named in his honor by the U.S. Board of Geographical Names. He relocated to Whidbey Island, Washington from College Station, Texas in 2000, where he soon became an expert on another subject – after the events of September 11, 2001 seeking to dispel negative myths and stereotypes about Muslims and lecturing and writing about the teachings of Islam. An avid tennis player and fitness enthusiast, he enjoyed traveling, Italian food, music, sunsets and animated conversation with family and friends. (Source Selim Morcos, Santa Clarita, California, USA and a published obituary)

## **DIGITIZING PROGRAM AT SCRIPPS INSTITUTION OF OCEANOGRAPHY ARCHIVES.**

A program is underway in the Scripps Institution of Oceanography Archives to reformat magnetic media as digital files, then to enter metadata, allowing permanent storage of the digital files with descriptive background information, subject analysis, technical data, copyright status information etc. Thus in some cases, for the first time there will be information on who is speaking on each recording, the type of content (radio interview, conference, lecture, press conferences, oral history interview, festschrift, memorial service etc.) plus the date and title. Some recordings were made in the field, such as field notes, marine sounds, even recordings of musical events on a Pacific island visited by SIO scientists. There is, for example, a recording of the First International Congress of Oceanography, held in New York in 1959. There are excellent recordings of papers and discussions by important oceanographers like Harry Hess, Anton Bruun, Bruce Heezen and a number of Russians, including Filatova, Ponomareva and other *Vitiaz* scientists. There is lots of meaty discussion of continental drift, deep-sea trenches, and pithy differences of opinion among Danish, U.S., and Soviet scientists. Once vulnerable magnetic recordings have been digitized, other kinds of recording (on LPs, etc.) will be reformatted, and, resources permitting, soundbites from all may be made available on the internet. As an example of the latter, there is a recording of a U.S. Public Broadcasting System program titled “Options on Oceanography broadcast November 18, 1976, in which there is a discussion by H.W. Menard of the *Challenger* Expedition and by Sir Edward Bullard of Alfred Wegener. In the long term, a significant amount of valuable video material in the SIO Archives will need to be reformatted too. (Contributed by Deborah Day, Scripps Institution of Oceanography Archives, UCSD, La Jolla, California, USA)

**AMS GRADUATE FELLOWSHIPS IN THE HISTORY OF SCIENCE.** The American Meteorological Society invites applications for a 2007/2008 AMS Graduate Fellowship in the history of science, to be awarded to a student wishing to complete a dissertation on the history of the atmospheric, or related oceanic or hydrologic, sciences. The stipend is US \$15,000 and will support one year of research. Fellowships cannot be deferred and must be used for the year awarded, but can be used to support research at a location away from the student’s institution provided this is approved by the student’s thesis advisor. For information, contact Donna Sampson at (617) 227-2426, ext. 246, or

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dfernand@ametsoc.org. Details are also available at <http://ametsoc.org/amsstudentinfo/scholfelddocs/index.html#4>. Application packages must be postmarked no later than 9 February 2007. [This notice presumably is directed to students in U.S. graduate schools – *Editor*]

## **FELLOWSHIP ON THE HISTORY OF ASTRONOMY AND NAVIGATIONAL SCIENCES.**

The Sackler Short-Term Research Fellowship on the History of Astronomy and Navigational Sciences at the National Maritime Museum, Greenwich, has been established to promote advanced research in the history of science and scientific instruments, specifically related to the Royal Observatory's collections. The National Maritime Museum invites applicants of any nationality who are conducting research into 1) one or more types of instruments represented in the collection, 2) into some aspect of the navigational sciences or of the Royal Observatory, Greenwich. The Fellowship is intended for younger postgraduate or postdoctoral scholars, but applications from other individuals committed to advanced research in those fields may be considered. It will tenable by arrangement within the academic year 2007-2008. Applications should be returned by 1 November 2006. For information and application forms, see

<http://www.nmm.ac.uk/server/show/conWebDoc.13246/outputFormat/print>, or contact [research@nmm.ac.uk](mailto:research@nmm.ac.uk).

**CONTENTS OF RECENT ISSUES OF THE *Historisch-Meereskundliches Jahrbuch*.** The only journal of the history of oceanography, published by the Deutsches Meeresmuseum in Stralsund on behalf of the Deutsche Gesellschaft für Meeresforschung, the *Jahrbuch* contains a great deal of material of importance to historians of the marine sciences. Volume 10, published for 2003/2004 contains the following:

Das Forschungsschiff "Professor Albrecht Penck" – über 50 Jahre im Dienste der Meeresforschung (*H.-J. Brosin*)

Seemann und Forscher – eine Erinnerung an Hans von Pettersson anlässlich der 100. Wiederkehr seines Geburtstags (*P. Hupfer*)

Estimation of primary production from chemical changes in the upper layer of the sea: a historical review (*G. Weichert*)

Die frühe ökologische Wattforschung in Deutschland in Verhältnis zu ausländischen Entwicklungen (*H. Bietz*)

Prof. Dr. phil. And Dr. med. Alfred Willer (1889-1952) and three decades (1920 to 1950) of fisheries science and fisheries policy in Germany (*W. Nellen*)

Die Entwicklung der internationalen Standardisierung für ozeanographische Beobachtungen im Laufe der zweiten Hälfte des 19. Jahrhunderts (*Dieter Basener*)

Beiträge zur maritimen Meteorologie der Südhemisphäre in der Tradition von Heinrich Berghaus (1797-1884) und Matthew Fontaine Maury (1806-1873) (*Cornelia Lüdecke*)

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Alexander von Humboldt and Matthew Fontaine Maury – two pioneers of marine sciences (*G. Kortum & I. Schwarz*)

Volume 11 (2005) contains the following:

Von der “Georgius Agricola” zur “A. von Humboldt (*Hans-Jürgen Brosin*)

Das Maritime Observatorium Zingst der Universität Leipzig 1957-1994 (*Peter Hupfer, Hans-Jürgen Schönfeldt und Armin Raabe*)

German research on the Agulhas Current system between the World Wars: a lost scientific achievement (*Johann R.E. Lutjeharms and Gerhard Kortum*)

Chemical and biological investigations with special emphasis on interdisciplinary cooperation during the Deutsche Atlantische Expedition 1925-1927 (*Hjalmar Thiel*)

Kieler Meeresforschung zur Kaiserzeit: zum Leben und Werk von Otto Krümmel (1854-1917) (*Gerhard Kortum und Johannes Ulrich*)

Martin Knudsen (1871-1949) and the Standard Seawater (*Jens Smed*)

Each volume also contains book reviews and the addresses of the authors.

**A CENTURY OF DISCOVERY: PUBLICATION OF THE SYMPOSIUM PAPERS.** A symposium titled “A Century of *Discovery*,” commemorating the return of Robert F. Scott’s ship *Discovery* from the Antarctic in 1904 was held at the Southampton Oceanography Center in the U.K from June 28-30, 2004. The papers given there have now been published in a special issue of the *Archives of Natural History* 32 (2) (October 2005), pp. 127-414, edited by Gwyn Griffiths and David Walton. The contents are as follows:

A century of Antarctic science; planning and serendipity (*G.E. Fogg*)

*Discovery* Investigations: an early attempt at ecologically sustainable development (*R. Marsden*)

Discovery at sea; a heady mix of scientists, ships and sailors (*A.L. Rice*)

*Terra Antarctica*: a history of cognition and landscape (*W.L. Fox*)

The Poles: information for exploration (*R.K. Headland*)

From natural history to biodiversity: collections of discovery (*P.S. Rainbow*)

The foundations of Antarctic glaciology (*R.L. Cameron*)

Modern glaciology in Antarctica (*D.G. Vaughan*)

From *Discovery* to discovery: the hydrology of the Southern Ocean, 1885-1937 (*E.L. Mills*)

Southern Ocean circulation (*S.A. Cunningham*)

Southern Ocean pelagic ecosystems (*M.V. Angel*)

Southern Ocean pelagic ecosystems: the era of conservation (*I. Everson*)

Antarctic meteorology and climatology: an unfolding story of discovery (*M. Walker*)

Aspects of modern Antarctic meteorology and climatology (*J. Turner*)

Surveying terrestrial magnetism in time and space (*A. McConnell*)

The Magnetic South Pole: its influence on the atmosphere (*A. Rodger*)

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The role of Antarctica in the development of plate tectonic theories: from Scott to the present (*M.R.A. Thomson & A.P.M. Vaughan*)

Antarctica and the global jigsaw – a centennial perspective (*D. Walton*)

## **HISTORICAL GEOGRAPHIES OF THE SEA IN THE *Journal of Historical Geography***

Volume 32 (3), pages 479-688, of the *Journal of Historical Geography* (2006) is titled *Historical Geographies of the Sea*. The contents include:

Currents, visions and voyages: historical geographies of the sea (*D. Lambert, L. Martins & M. Ogborn*)

There was *No More Sea*: the supersession of the ocean, from the bible to cyberspace (*C. Connery*)

Geographies of exploration and improvement: William Scoresby and Arctic whaling, 1782-1822) (*M. Bravo*)

Shipwreck and salvage in the tropics: the case of HMS *Thetis*, 1830-1854 (*F. Driver & L. Martins*)

History, distance and text: narratives of the 1853-1854 Perry expedition to Japan (*S. Hones & Y. Endo*)

'Our home on the ocean': Lady Brassey and the voyages of the *Sunbeam*, 1874-1887 (*J.R. Ryan*)

Extending modern cartography to the ocean depths: military patronage, Cold War priorities, and the Heezen-Tharp mapping project, 1952-1959 (*R.E. Doel, T.J. Levin & M.K. Marker*)

The last outpost of Empire: Rockall and the Cold War (*F. MacDonald*)

**NETHERLANDS WORKING GROUP FOR THE HISTORY OF OCEANOGRAPHY.** In March, a working group for the history of oceanography was established in The Netherlands. The organizers now have more than twenty addresses of institutions and individuals with an active or passive interest in the history of oceanography in general, and especially in oceanography and related subjects in The Netherlands. Regular meetings will be organized and a newsletter (in Dutch) will be circulated to exchange ideas and information. Participation is free for anyone interested in these activities. For those abroad, information is available from the following: Johan van Bennekom, Anna Blamanweg 62, 4103 WJ Culemborg, The Netherlands ([bennekom@kwarteel.nl](mailto:bennekom@kwarteel.nl), phone 31-345-474012), or Leo Otto, Th. Backerlaan 7, 3984 PJ Odijk, The Netherlands ([leo.otto@kpnplanet.nl](mailto:leo.otto@kpnplanet.nl), phone 31-30-6572081).

**FRIDTJOF NANSEN – OTTO PETTERSSON CORRESPONDENCE.** Work is in progress to edit and publish the correspondence between the Norwegian marine scientist Fridtjof Nansen and his Swedish colleague the oceanographer Otto Pettersson in the years between 1888 and 1917. The result will appear in a book with the working title "Bäste Broder Nansen og kjære Pettersson" [Dear Nansen and Dear Pettersson], probably in 2007. The transcription of 158 letters, telegrams and cards in Swedish and Norwegian is the joint work of the historian of science Vera Schwach in Norway and the oceanographer/historian of science Artur Svansson in Sweden. The authors are writing an introduction in Norwegian and Swedish, but will include a comprehensive summary in English. (Contributed by

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Vera Schwach, Norwegian Institute For Studies in Higher Education, Center for Innovation, Oslo, Norway)

**FIRST ROMANIAN RESEARCH STATION INAUGURATED IN ANTARCTICA.** Monday, February 20, 2006 was a historic day for Romanian polar research. The first Romanian scientific research station in Antarctica was inaugurated. The foundation of the Law-Racovitza Station (named in part for the great Romanian biologist Emil Racovitza, a participant in the Belgian Antarctic Expedition on *Belgica* 1897-1899) was promoted and finally achieved by Dr. Eng. Teodor Negoitza, manager of the Romanian Institute for Polar Research, with support of Romanian authorities. The official ceremony was attended by Romanian polar researchers, the Australian Government's representative, and the Russian and Chinese station leaders in the region. This event was an opportunity for the researchers to request national authorities' further support for "Promotion of a National Programme regarding Antarctic research, taking over of the Romanian Antarctic Foundation or of the Romanian Institute for Polar Research by the Ministry of Foreign Affairs (according to the Bulgarian or other countries' model), public authority status granted to the Romanian Antarctic Foundation (documentation existing at the Ministry for Education and Research), finalization of the Memorandum regarding the obtaining of consultant statute for Romania to the Antarctic Agreement (still in progress at the Ministry for Foreign Affairs), payment of taxes to the Antarctic Agreement, Scientific Committee for Antarctic Research and Managers Council for Antarctic National Programmes, all incumbent on Romania as member of the Antarctic Agreement" as stated by T. Negoitza in a letter to the President of Romania from the "Romanian Embassy in Antarctica". (cf. M. Lechkun, daily national newspaper "Romania libera", 4850, February 18. (Contributed by Alexandru Bologna, Romanian Marine Research Institute, Constanta, Romania)

## CONFERENCE REPORT

**HISTORY OF OCEANOGRAPHY AND METEOROLOGY IN WOODS HOLE.** Colleagues interested in the history of meteorology and oceanography met in Woods Hole, Massachusetts in May 2006 for an intensive week of study, conversation, and fellowship generously supported by the Dibner Institute and Dibner Fund. Participants included historians of science (both students and faculty), oceanographers and meteorologists. The seminar investigated the case for common ground between the fields, arguing that meteorology and oceanography share characteristic features that have shaped their histories: they deal with complex global phenomena, developed correspondingly large-scale programs for international cooperation in research, share similar approaches to experiments and models, and similar relationships with technological innovation. In the words of the organizers (Naomi Oreskes, University of California at San Diego; James Fleming, Colby College/Smithsonian Institution; and Erik Conway, Jet Propulsion Laboratory/ Caltech)

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investigating these characteristics contributes a critical historical dimension to the “growing scientific and public awareness that the Earth's climate and biosphere depend on the interaction of the ocean and atmosphere.” Even with the organizers’ clear articulation of the thematic interaction between the fields, the discussions and readings covered a daunting range of topics and issues (for a list of sessions and participants, see

<http://dibinst.mit.edu/DIBNER/DIConferences/WoodsHole/WoodsHoleTopic.htm>).

The range was always stimulating but sometimes difficult to fit together. Chronologically, the seminar focused predominantly on developments in the twentieth century. In many ways this helped the topics and discussion cohere, but sometimes foreshortened perspectives on how scientists in different eras understood scale and complexity or how institutions and data collection were organized. The liveliest discussions of the week centered around how to understand ‘contexts of motivation’ – how to treat technological innovation as an influence, how economic goals, policy questions or military interests have interacted with research questions, how to gauge the meaning of metaphors connecting oceans and atmospheres. Perhaps inevitably, given the sessions on very recent science, the seminar also repeatedly returned to questions about the role of historians of science in present-day ocean or climate policy. Since 1989, this seminar, covering a different theme annually, has been supported by the Dibner Fund and the Dibner Institute. The close of the Dibner Institute this fall will bring changes. In 2007, the seminar will be known as the MBL-Arizona State Seminar. It will be supported this coming year again by the Dibner Institute, and thereafter by Arizona State University (Katharine Anderson, Science & Technology Studies, York University, Toronto, Canada)

## BOOK REVIEWS

**King, C. 2005. *The Black Sea. A History*. Oxford: Oxford University Press. 276 pp**

*The Black Sea. A History*, by Charles King, an Associate Professor in the School of Foreign Service and the Department of Government at Georgetown University, where he also holds the university's Ion Ratiu Chair in Romanian Studies, is a remarkable original contribution added to others devoted to this real "unicum hydrobiologicum," as the Black Sea has been certainly best characterized by the Russian oceanographer N.M. Knipovich early in the last century. This achievement does represent an editorial event, the results of exhaustive research, based on the author's personal traveling experience, documentation and literature search, on the historical evolution of the Black Sea region and its hinterlands. The author's investigations were considerably helped by his fluency in the Russian and Romanian languages and by his reading abilities in French, Italian and Turkish.

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After acknowledgements and explanations of the local languages, orthography, and correct pronunciation, the reader is introduced to the quite interesting and *ab initio* cosmopolitan Black Sea universe. The book is structured adequately and organized into five chronologically-arranged, well-elaborated, historical development stages: antique Greek/Roman (700 BC-500 AD), Italian (500-1500), Turkish (1500-1700), Russian (1700- 1860) and contemporary (1860-1990). Most important and relevant events are concisely discussed and commented upon in a clear objective manner. Less fortunate are some Romania-related connotations, in spite of the author's direct access to literature. So are some over-reactive negative assessments of Dobrudja as "a hotbed of banditry and separatism," with "stagnant economy and inadequate social services" (p.10), an area which, on the contrary, progressed well during the last decades and is an example of multiethnic understanding. Even worse is the statement that "Romania emerged from the postwar treaties with the former Hungarian region of Transylvania, Russian Bessarabia, Austrian Bukovina, and part of Dobrudja now inside its borders" (p. 224)! This, hilarious if not sad, is incorrect and frustrating: an insufficiently informed reader could easily perceive those provinces as conjunctural (and therefore unjustified) "possessions" or gifts, contrary to historical and statistical evidences of the prevailing role of Romanians in the course of history (see, at least, "Transylvania Romanian land: the Transylvanian issue according to an American", by Milton G. Lehrer, Bucuresti, 1944, republished 1989) Last but not least, as a matter of fact, as to "Oil refineries sprouted up along the Romanian coast, " (p..231), there was and still is, partially operating now, only a single such industrial site, Petromidia, at Cape Midia. In addition to historical core considerations, the relatively recent severe collapse and disequilibrium affecting the Black Sea ecosystem is well summarized and documented.

All quotations and selected literature prove the author's strong ability to analyze and synthesize the vast amounts of consulted documents, occasionally in their original languages. This work may be considered as one of the best ways to become familiar with Black Sea historical (and succinctly ecological) issues, and attests to Professor's King reputation as a Black Sea historian.

Perhaps the undoubted attractiveness of this publication could have been increased by more generous illustrations. A quite apt Romanian translation, except for annoying errors such as misspelled <Istanbul> (probably due to previously used Stambul) throughout the entire text and a few other errors (<submarin sovietic german>, <de la Neagra/Nordului pana la Marea Caspica>, <hipoxemie>), is also already available thanks to Brumar Printing House, Timisoara, 2005, besides which there are translations in Italian and Polish, as well as Bulgarian and Czech in preparation.

Pax et bonum !

(Alexandru S. Bologa, Romanian Marine Research Institute, Mamaia 300, RO-8700 Constantza, Romania)

**Gary Wright (Coordinator and English Editor), 2004. *Ocean Sciences Bridging the Millennia: A Spectrum of Historical Accounts*. (Based on papers selected from the Sixth International**

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**Congress on the History of Oceanography). 507pp., illus., bibls., index. Paris: UNESCO Publishing. € 45 (paper)**

(The importance and complexity of the ICHO VI volume, already reviewed in *History of Oceanography* merit more attention. This review is presented in that spirit, and as a way of publicizing the availability of this attractive and important book – *Editor*)

The papers selected from ICHO VI in China 1998, printed in *Ocean Sciences*, encompass contributions from various disciplines but have an emphasis on biological oceanography and marine zoology. The articles cover mainly the 19<sup>th</sup> and the 20<sup>th</sup> century, and they include voyages of discovery and exploration, lives and achievements of notable oceanographers, institutional and national contributions, technology and management, but also global, regional and bilateral cooperation. Several of the articles in *Ocean Sciences* deal with non-European history, for example, the reader will find contributions on Chinese oceanography along with marine studies in the Indian Ocean and the Black Sea. The papers are all very well presented; many are rich illustrated. To overcome the intrinsic difficulties of translating cultural contexts and glossary, the editors have put effort into short but very useful explanations of political and/or social history and terms.

(Vera Schwach, NIFU, Center for Innovation, Wergelandsveien 7, N-0167 Oslo, Norway)

## BOOK ANNOUNCEMENTS

**Tjossem, Sara, 2005. *The Journey To PICES: Scientific Cooperation in the North Pacific. Alaska Sea Grant.* ISBN 1-56612-099-3. US \$20.00. Order online from <http://www.uaf.edu/seagrant/bookstore/pubs/AK-SG-05-04.html>, or call 1-888-789-0090. This book is a contribution to the history of international marine scientific organizations. It looks in depth at the process of creating the North Pacific Marine Science Organization (PICES). It seems obvious enough that such an organization was needed - the best way for the Pacific Rim nations to gain knowledge about the enormous North Pacific Ocean is through cooperative research - yet PICES was two decades in birth. The reasons for this lengthy incubation become obvious to the reader through the author's tracing and interpretation of events. Fisheries regulation was scrupulously avoided, and governments balked. The process required aggressive promotion, incredible patience, and dogged perseverance; these eventually led to PICES, a vibrant six-nation international marine organization contributing substantially to marine science.**

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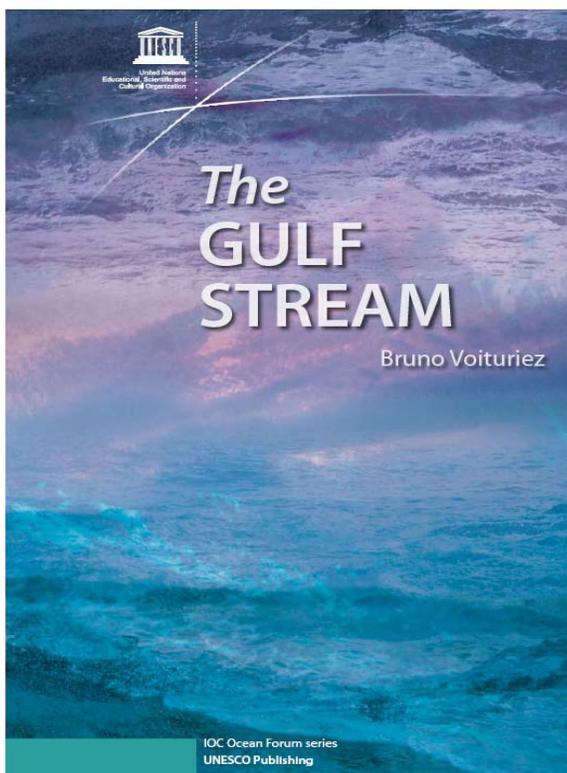
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**Lutjeharms, Johann R.E., 2006. *The Agulhas Current*. New York etc., Springer. 330pp. U.S. \$169.** The Agulhas Current is the major western boundary current of the southern hemisphere. It plays a key role in the global ocean circulation by the manner in which it regulates the exchange of water, heat and salt between the Indian Ocean and the Atlantic Ocean at the southern tip of Africa. This book covers in detail – supported by all currently available publications in the primary literature – the circulation of the South Indian Ocean, the sources of the Agulhas Current, the Current proper, its retroflexion, Agulhas rings, the Agulhas Return Current, and the influence of all these on the adjacent shelves and coastline. It deals in depth with the influence of this current system on local weather, climate, and climate variability. It also identifies those areas and regions where very little is known and for which better information is crucial if we ever want to carry out operational oceanography and prediction for the region. A total of more than 800 publications, covering a period from 1778 to the present, have been scrutinized and their contents integrated to give the reader an up-to-date and authoritative overview of what is known about the Agulhas Current system. The text is amply illustrated and is interspersed with interesting inserts on the origin of the name of the current, the history of research on the Agulhas Current, vignettes of key researchers who have studied the current, descriptions of a research vessel that played a key role in these investigations and even stories on favorite hypotheses on the current that have turned out to be wrong. An exhaustive bibliography, an index of researchers, and a detailed index, complete the book and make it particularly user-friendly.

**Svansson, Artur. 2006. *Otto Pettersson, Oceanografen, Kemisten, Uppfinnaren [Otto Pettersson, the Oceanographer, the Chemist, the Inventor]*. Göteborg: Tre Böcker Förlag AB. 376pp. Abstract in English.** Among the most influential of early twentieth century oceanographers, Otto Pettersson (1884-1941) was originally a physical chemist, but became best known for his great influence as one of the founders of the International Council for the Exploration of the Sea. Although

there are short biographical notices of this seminal figure of oceanography, there has not been a full-scale biography until now. *History of Oceanography* will have a detailed review of this important volume as soon as possible.

**Branagan, David, 2005. *T.W. Edgeworth David: a Life*. Canberra: National Library of Australia. 650pp. Paperback. Aust \$39.95.** Edgeworth David (1858-1934), Australian geologist and Antarctic explorer, became well known for his work on the second British Antarctic Expedition led by Ernest Shackleton on 1907, but his greatest significance to



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oceanographers was his involvement in the drilling of Funafuti Atoll in the 1890s, an attempt to verify Charles Darwin's theory of coral reef formation.

## **THE GULF STREAM**

**By Bruno Voituriez**

UNESCO and its Intergovernmental Oceanographic Commission (IOC) announce the publication of a book on the Gulf Stream for classrooms and for the general, science-interested readership. By the time this issue of the *Newsletter* goes online, the three language editions (English, French and Spanish) should be available, or nearly so. The latest in the '**IOC Ocean Forum**' series, this book is oriented towards the busy professional, government official, student or anyone else who is perhaps not well versed in the marine sciences but needs or wants to better understand the oceanic forces at work in the planet's environment. The first chapter (see below) should interest the *History of Oceanography Newsletter* readers as it discusses the history of the discovery and scientific study of the Gulf Stream. Below are the table of contents as well as the descriptive blurb which is found on the back cover of the book.

Format: 15.5 x 24 cm.

Number of pages: 224

Well illustrated, with several images in colour

ISBN-10: 92-3-103995-4

ISBN-13: 978-92-3-203995-8 (*effective January 2007*)

UNESCO Publishing price: €18.00

### **French edition: *Le Gulf Stream***

ISBN-10: 92-3-203995-8

ISBN-13: 978-92-3-203995 (*effective January 2007*)

### **Spanish edition: *La Corriente del Golfo***

ISBN-10: 92-303995-1

ISBN-13: 978-92-3-303995-7 (*effective January 2007*)

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Chapter 2	What is the Gulf Stream?
Chapter 3	The Gulf Stream and Earth's Climate
Chapter 4	The Gulf Stream and the Ecosystems of the North Atlantic
Conclusion	Towards an Operational Oceanography
Glossary	
To Learn More	(additional reading recommendations)

Amid contemporary scenarios of potential climatic catastrophes and global warming that might be imagined to bring a new ice age, the powerful image of the Gulf Stream rising from the Florida Straits and flowing to the North Atlantic inevitably provokes questions about its ecological significance and whether it might ever stop. Answering these questions demands the sober presentation, given here, of the remarkable scientific fact that even dramatic climatic change would not bring an end to the Gulf Stream.

Combining complex scientific information with an engaging narrative, this volume paints an elaborate but accessible portrait of this extraordinary natural phenomenon, tracing its historical discovery and the paradigms of its exploration, outlining its causes and dynamics, and examining its profound importance for the marine ecosystems of the Atlantic Ocean.

Bruno Voituriez, in this compact and handy book, offers an analysis of the Gulf Stream and discusses the relevant issues at stake. Keenly interested in the history of oceanography as well as the science itself, the author is an experienced specialist and writer. He is a former research director for France's IRD (Institute of Research for Development). Dr. Voituriez authored/co-authored two

previous titles in this same series: *El Niño – Fact and Fiction* and *The Changing Ocean – Its Effects on Climate and Living Resources*. Generally speaking, these books, in an accessible language and engaging style, retrace the evolution in oceanographic research and explain the mechanisms linking ocean dynamics with those of the atmosphere and marine ecosystems. They examine the issues and benefits of the further development of oceanography –a science which, like meteorology before it, must become more operational.

▪ **For further details**, including how to order the book (retail price, mailing charges etc.), contact one of the following:

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