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INTERNATIONAL UNION OF THE HISTORY AND PHILOSOPHY OF SCIENCE
DIVISION OF THE HISTORY OF SCIENCE
COMMISSION OF OCEANOGRAPHY

EDITORIAL

In his foundation of this newsletter, Eric Mills has made a real mark in reporting oceanography. It is now up to us, the present generation, to take the journal onwards. We must reach out in two directions: geographically, and across the full spectrum of oceanographic interests.

A recent trawl of interests shows that our membership is active most of all with people working in Europe and North America. We would like to hear from those who work upon any part of the ocean and especially those parts next to Asia and South America. The ocean is global, and our contributing base should reflect that aspect of what it is that we study.

We need also to hear from all the sciences: form both physics as well as the life sciences.

The sharp–eyed and bibliographically minded among you will have noticed a change to our ISSN. ISSN 1013–3917 was for hard copy editions which we no longer produce. The new ISSN 2218 –0796 is for online only versions. This is the trend of modern publication.

After a break in continuity between editions and years, we resume with what is intended to be the annual publication month – January. The rest is up to you.

COMMANDER H.D. WARBURG R.N.
AND THE
1919 AND 1926 INTERNATIONAL HYDROGRAPHIC CONFERENCES

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Further information relating to the life of Harold Warburg, should be considered in light of his international involvement.[1] In 1912 the Imperial Russian Government inaugurated the International Maritime Conference series at St Petersburg. Perhaps as an apology for their absence then, the British hosted the second conference seven years later. This 1919 conference allowed 'the hydrographic representatives of all nations an opportunity to meet and discuss matters of common interest', which was a bold step towards international cooperation in the post-war world.[2] Warburg found himself not only on 'Committee No VI on Tide Tables' but also on others discussing charts, sailing directions, list of lights, time signals, distance tables and other miscellaneous hydrographic publications. With inclusion by by invitation only, nevertheless some twenty-five nations sent delegates to that landmark event, the first International Hydrographic Conference.

The published proceedings of the conference include biographical details of all the delegates. There─Warburg included his previous appointments of Naval Assistant to Hydrographer, Surveying Officer for Special Business and Naval Assistant for Tidal Work. He was by 1919 in charge of tidal matters and he became more directly answerable to the Hydrographer, Sir John F. Parry. With Britain being one of the leading maritime powers in that post-war world, Parry naturally played a leading role at the conference, as, to a lesser extent, did Warburg. In fact when a comparison is made of the participants of each of the six committees only four delegates sat on all six committees, whereas Warburg was one of six men who sat on five (out of the six). Of all the committees he sat on it was only the minutes of the Committee on Tide Tables which recorded any significant contribution Warburg made, although he also had a four page paper on 'Remarks and Suggestions Respecting Tidal Information' published in the proceedings.

It was not all debates concerning hydrography at the conference. The itinerary included provision for delegates to visit all of the main departments connected with hydrography in southern England, starting on the 25th of June with a Conversazione at Burlington House, given by the Royal Society. During the next three weeks the delegates visited (amongst other things) the Royal Naval College and the Royal Observatory at Greenwich, were received by His Majesty the King at Buckingham Palace, witnessed the military tournament at Olympia, toured the Royal Naval Dockyard at Chatham, the Admiralty Compass Department, the Ordnance Survey Office at Southampton, the Port of London, and Trinity House. Apart from the conference business, the three weeks included some leisure time interspersed with numerous luncheons at some of the top hotels in London. When it came to the important business of the conference and Warburg's main area of expertise, the agenda for discussions concerning tide tables contained nine items: method of compilation; time to be used; the advisability of the insertion of "Summer Time"; description of tidal information; datum respecting tide-levels; the necessity for a statement by each country,

[1] Paul Hughes, 'Harold Dreyer Warburg, Tidal Authority', *History of Oceanography,* **21**, (2008), 26-9 (archived at www.ijnhonline.org)
[2] Hydrographic Department, *International Hydrographic Conference 1919,* (London, 1919).

showing the exact connection between the zero used for tidal predictions (i.e., as given in the tide tables) and that of the datum used on the charts; the necessity of establishing the relationship between the datum used on the chart and a well-defined mark placed in the immediate vicinity; unit of measurement and its subdivision for vertical heights of tides; the regular exchange of tidal predictions in advance.

One of the main issues, or debates, Warburg contributed to concerned the translation into French of a technical resolution involving the statement given on charts:

> Mean high water lunitidal intervals and, in places where the duration of rise and fall differs appreciably from the normal, low water lunitidal intervals.

More precisely Warburg questioned how the expression 'mean high water lunitidal interval' when translated into French did not mean exactly the same thing as it did in English. As there was no French equivalent for 'lunitidal interval' a lively debate followed. Warburg not only disagreed with the Chairman, M. Urbain, Principal Hydrographer of the Ponts et Chaussées, Belgium but drew opposition from the Portuguese, Italian and American delegates over the wording and the potential confusion for seamen. Warburg's reply was typically authoritative and the proceedings state:

> there was evidently a misapprehension. British Admiralty charts at present only gave the vulgar establishment, which was exactly the same as the establishment shown on the French charts. In his opinion, it should be recognised that the mean lunitidal interval gave a much more accurate result than the vulgar establishment, and his proposal was that this mean lunitidal interval should be adopted as the standard, and that those countries which now gave the vulgar establishment should gradually discontinue to do so and introduce instead the mean lunitidal interval. This would probably mean that more work would have to be carried out in the British Hydrographic Office than in almost any other Office, but the British recognised that this was the more accurate system and, therefore, he put it forward for the consideration of the Conference, which was attempting to obtain uniformity, to adopt the more accurate system.

To which the Chairman suggested:

> that if the French could not find a suitable translation for the word, the best thing they could do would be to adopt the English form. M. Rollet de l'Isle informed him that the French had no word for "football"; therefore they had adopted the English word. Similarly, if they had no word for lunitidal interval, they could adopt the same expression; otherwise, he could see no way out of the difficulty.

Not to be outdone Commander Warburg had virtually the last word of the session when he pointed out that the word 'lunitidal' was already half French! The committee adjourned to allow delegates time to consider the matter.

The illustration above is from the 1919 proceedings of the International Hydrographic Conference taken at the Royal Observatory, Greenwich. (Author's collection)
Front row (left to right): Captain Moreno (Argentina), Mr Watkins (USA), Rear-Admiral Simpson (USA), Commander Alessio (Italy), Sir Frank Dyson (Astronomer Royal), Mons Renaud (Vice-President, France), Sir John Parry (President, Great Britain), Commodore Dahlgren (Sweden), Rear-Admiral Garezon (Peru), Captain Björset (Norway), Captain Bloch (Denmark), Commander Coutinho (Portugal), Mr Graves (USA), Commander Sakonki (Japan).
Middle Row: Captain Scott-Hansen, Commander Warburg (Great Britain), Commander Berling (France), Captain Spicer-Simpson (Great Britain, Official Interpreter), Lieutenant-Commander de Fourcauld (France), Commander Fablet (Argentine), Mons Urbain (Belgium), Lieutenant-Commander de Vasconcellos (Brazil), Captain Bouckaert (Belgium), Commander Merino (Chile), Commander Chen (China), Captain Luynes (Netherlands).
Back row: Mr Barber (Great Britain, Secretary General), Captain Smith (Great Britain), Dr Ball (Egypt), Commander Edgell (Great Britain), Captain Nisot (Belgian Congo), Captain Douglas (Great Britain), Captain Dunlop, Commander Wilson (Great Britain), Mr Gallé (Netherlands), Lieutenant Neves (Portugal), Mr Purvis (Egypt), Commander Tiselius, Captain Webster (Great Britain), Captain Pradiyat (Siam), Commander Dornonville de la Cour, Mr Minato (Japan).

The 1919 Conference was better known for the proposal put forward by the French for the creation of an International Hydrographic Bureau, which drew comments from sixteen other nations. As for Warburg his contribution in his remarks and suggestions respecting tidal information were invaluable, despite being slightly controversial at the time. When the Hydrographic Department published the resolutions passed in London, they included two pages relating to Tide Tables.[3] It is highly likely Warburg was heavily involved in their preparation although there is no indication of this in that publication. The conference also let Warburg meet up with other men who were interested in tidal theory and science, particularly those from the Belgian Congo, Japan, Peru and Siam. Many of those he would have gone on to meet again in Monaco in 1926.

The 1926 Conference, held in Monaco between 26 October and 10 November, was run along similar lines to the 1919 Conference. Warburg once again made a significant contribution, not only in conversations and decisions relating to tidal matters, but to the

[3] Hydrographic Department, *International Hydrographic Conference held in London from 24th June to 16th July 1919. Resolutions passed* (London, 1919), 16-17.

negotiations concerning navigational lights. He was one of the main contributors to discussions over the range of visibility of lights, bearings to be given from seaward in the list of lights, the tabular method of compiling the List of Lights, notices to mariners and how they were disseminated abroad. Warburg's comments were supported by the representative of British-India, Lieutenant-Commander Thomas M.S. Milne-Henderson O.B.E., which is not surprising considering both men would have received instruction and training from British officers in the British way of undertaking navigational matters.[4]

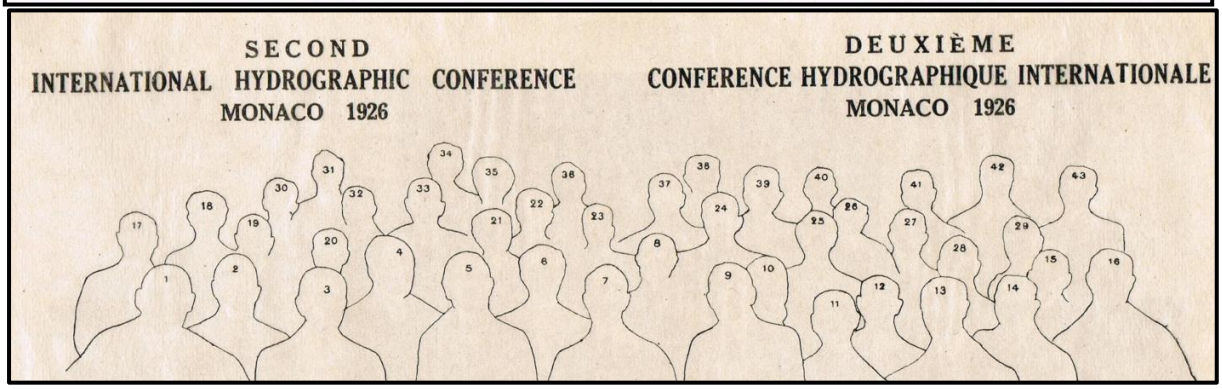
When it came to the Warburg's main area of expertise, that of tides, there were only eight members of the committee chaired by Ingénieur Hydrographe Général Fichot. Milne-Henderson was the vice chairman and Lieutenant H. Bencker the secretary, but Warburg dominated the whole proceedings from the start. The die was cast when he asked the meeting whether 'it would not be possible to discuss the questions in general terms and put off voting on the resolutions to a later meeting'. Nobody disagreed and the tone was set for the rest of the meeting. Out of the one hundred and forty-eight statements which followed (as recorded in the proceedings), Warburg made a staggering forty-three, with the chairman making fifty-five, many of which were in reply to each other.[5] Warburg's dominance was a true reflection of his expertise in the subject, not just from a British perspective but on a worldwide platform on which he had become a recognised expert. His status was further recognised in 1938 by Liverpool University who awarded him an honorary M.Sc. Although little may have thought to be known about what went on behind the green door, the thinking and rationale behind Warburg's proposals and arguments can be alluded to through his contributions to the two international conferences he played a significant role in.

[4] International Hydrographic Bureau, *Report of the proceedings of the Second International Hydrographic Conference* Cannes, 1926), 445-459.

[5] For the purpose of counting the number of times a person made a statement I have counted as one occurrence if a person spoke on consecutive occasions but appears to have more two or more statements in the proceedings.

The 2nd International Hydrographic Conference
MONACO 1926

La 2me Conférence Hydrographique internationale
MONACO 1926



(Reproduced courtesy of the United Kingdom Hydrographic Office.)

1. Captain Björset (Norway)
2. Captain Luymes (Netherlands)
3. Captain Douglas (Great Britain)
4. Commodore Reinius (Sweden)
5. Rear Admiral Niblack, Director I.H.B.
6. Captain Fablet (Argentine)
7. Captain Crosley (U.S.A.), Vice-President
8. Captain H.O. Ravn (Denmark)
9. Commander Spicer-Simpson, Secretary-General
10. Ingén. Hyd. en Chef de Vanssay de Blavous (France)
11. Ingénieur Hydrographe Général Fichot (France)
12. Captain de Oliveira Sampaio (Brasil)
13. Commander Baldi (Italy)
14. Captain Schweppe (Germany)
15. Captain Herrero Y Garcia (Spain)
16. Captain Caballero Y Lastres (Peru)
17. Lieutenant Bencker, Assistant I.H.B.
18. M. Martin, I.H.B.
19. Commander Benitz (Spain)
20. Commander Shao (China)
21. Lieutenant Commander Chen (China)
22. Lieutenant Commander Golemis (Greece)
23. Captain Kawamura (Japan)
24. Commander Croissandeau (France)
25. Captain Hooykass (Netherlands)
26. Monsieur F. Butavand (Monaco)
27. Lieutenant Commander Monti (Argentine)
28. Commander Rasikotzikas (Greece)
29. Lieutenant Commander Lopes (Portugal)
30. Captain Hori (Japan)
31. Lieutenant Albert, Assistant I.H.B.
32. Professor M. Tenani (Italy)
33. Commander Bouveng (Sweden)
34-36. Interpreters
37. Commander Haselfoot (Great Britain)
38. Commander Denison, Assistant I.H.B.
39. Commander Warburg (Great Britain)
40. Commander Brandon (Great Britain)

41. Mahmoud Bey Bayram (Egypt)
42. Mr Richards (Egypt)
43. Lieutenant Commander Chordasich (Yugoslavia)

EARLY PLANS FOR TELEGRAPHIC COMMUNICATION WITH THE FAROES AND ICELAND IN THE INTERESTS OF METEOROLOGY AND FISHERY

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EARLY COMMERCIAL PLANS

The idea of a telegraph cable crossing the northern North Atlantic emerged in the middle of the 19th century. The Danish King granted an American, Colonel T. Shaffner, a cable connection concession from the Shetland Islands, via the Faroes and Iceland, to Greenland. Shaffner also planned extending it to Labrador.[1] Shaffner interested the British government in the project, which ordered the naval vessel *Bulldog* to make soundings and investigate the nature of the sea floor along the route.[2] Shaffner supplied the Danish scientist, Georg Forchhammer (1794–1865), with surface and subsurface water samples from ten positions between Iceland and Greenland, for use in his pioneer studies on the composition of seawater.[3] At the same time another vessel, *Fox*, was chartered to find suitable landing places for the cables over land. In order to give the project an official stamp, a representative of the Danish government participated in the *Fox's* voyage.[4] With the vessel in Southampton, Queen Victoria and her family favoured the expedition with a visit. In Great Britain, members of the Privy Council and representatives of the Atlantic Telegraph Company heard testimony on the feasibility of laying and operating a cable from Britain via the Faroes and Iceland to Canada.[5] In spite of royal interest the project was not implemented. Obviously there was not sufficient economic support for it, as a more direct telegraph connection between Europe and America already existed.

METEOROLOGICAL INTERESTS

However, European weather forecasters strongly needed meteorological observations from the Faroes and Iceland. So the first director of the Danish Meteorological Institute, Niels Hoffmeyer (1836–1884), stressed the importance to the weather services of a telegraphic communication with these islands.[6] In connection with the Scandinavian Naturalists' Stockholm meeting in 1879, Hoffmeyer succeeded in obtaining a special audience with King Oscar II (1829–1907) of Sweden and Norway, who, to Hoffmeyer´s surprise, turned out to be fully versed in the principles of modern meteorology. The King was very positive with regard to the proposal about the establishment of telegraphic communication with the Faroes and Iceland. He instructed the director of the Norwegian Meteorological Institute, Professor Henrik Mohn (1835–1916), to work for the project in the Permanent Meteorological Committee. The King invited the meetings' participants to the royal castle Drottningholm. At that time, the King asked Mohn, the Swedish meteorologist Hugo Hildebrandsson (1838-

[1] P. Mengel, *Hvor fører kablerne hen?*, (Copenhagen, 1991).
[2] F. L. McClintock, *Remarks illustrative of the Sounding Voyage of H.M.S. Bulldog*, (London, 1861).
[3] Georg Forchhammer, 'On the composition of Sea-water in the different parts of the Ocean', *Philosophical Transactions of the Royal Society of London*, **155,** (London, 1865), 203-262.
[4] T. Zeilau, *Fox–Expeditionen i Aaret 1860 over Færøerne, Island og Grønland med Oplysninger om Muligheden af et nordatlantisk Telegraf–Anlæg*, (Copenhagen, 1861).
[5] A. McConnell, 'Marine Sciences and the British Parliamentary Papers', *History of Oceanography*, **4**, (1992), 7-8.
[6] N. Hoffmeyer, *Études sur les tempêtes de l´Atlantique septentrional et Projet d´un service télégraphique international relatif à cet océan*, (Copenhagen, 1880).

1925), and the Secretary of the Swedish Academy of Sciences, Carl Lindhagen (1860-1946), to assist Hoffmeyer in any way they could. The King also recommended the plan to his Government when it came to carrying through the project. Hoffmeyer estimated that it would make a considerable impression upon the British member, Robert H. Scott, of the forthcoming August 1880 Permanent Meteorological committee meeting at Bern, when Mohn was to indicate royal support. The German committee member, Georg Neumayer (1826-1909), also warmly supported the project.[7]

The Bern meeting passed a resolution in support of Hoffmeyer´s project. In September 1880, the Wien conference on agricultural weather services also spoke in favour of his plans. In negotiations with foreign colleagues Hoffmeyer never discussed the economic side of the project. However, in a letter to the Danish Ministry of Naval Affairs, he did suggest a key for expenses distribution among the countries in the project.[8]

In the meantime another project emerged. Hoffmeyer learned from a newspaper that an agent had come over from the USA to Great Britain to prepare laying out a cable from Europe to Iceland and Greenland. However, Hoffmeyer supposed that in this respect, Carl Frederik Tietgen (1829-1901), founder of the Great Northern Telegraph Company, with whom Hoffmeyer cooperated on the matter, was on his guard against this project.

ICES INTERESTS

None of the projects did materialize, and now the International Council for the Exploration of the Sea (ICES) came into the picture. Under a cooperative project, the Danish Meteorological Institute and Deutsche Seewarte had published North Atlantic synoptic weather charts for several years. These are usually called Hoffmeyer charts, after their founder. In June 1899, the German delegation to ICES assembled at Stockholm, set out a programme of hydrographic work. According to this, the charts should be prepared for the seasonal cruises with as little delay as possible, yet with sea surface temperatures added. In this context it was proposed that the Conference should point to the necessity of a telegraph connection of the Faroes and Iceland with the rest of Europe. This was agreed and a resolution passed:

> The Conference declares that it is of the greatest importance both for high sea-fisheries and for the weather-forecasts for long periods, that the Faroe-Islands and Iceland should be included in the European telegraph system as soon as possible.[9]

As the motivation for the resolution originated in the programme proposed by the German delegation it is no wonder that its chief delegate, Walther Herwig (1838-1912), warmly recommended the project to his Government. In a memorandum to the Imperial Minister of the Interior, Count von Posadowsky–Wehner, he pointed out the advantages that such a telegraphic communication would offer German interests: it would be of the greatest importance to the fishing vessels under the Icelandic coast; it would be of advantage to the fisheries and to German commerce in general; and it would be useful to the weather service. So Herwig strongly advised granting the subvention wanted by the Danish government in connection with the project. Finally, he pointed to the fact that the first German cable ship was just being launched. If German vessels could be involved in laying out the cable it would be an economic gain. Herwig added that the authorities of the Imperial Navy might already

[7] Copenhagen, Rigsarkivet, Archive Nr. 1956, No. A.3, N. Hoffmeyer to General von Raasløff, 21st July 1880.
[8] Copenhagen, Rigsarkivet, Archive Nr. 1956, No. A.3, N. Hoffmeyer to the Danish Ministry of Naval Affairs, 29th December 1880.
[9] *Conférence internationale pour l´exploration de la mer, réunie à Stockholm 1899*, Imprimérie K. L. Beckman, (Stockholm, 1899), XIII-XIV.

be aware how important an exact knowledge of the position of the cable was, as this would facilitate the watching and destruction of the cable in case of war![10]

The second preparatory Conference for the establishment of ICES, held at Christiania (Oslo) in May 1901 repeated the resolution of the Stockholm Conference.[11]

With its dependencies of Iceland and the Faroes, Denmark had a natural interest in telegraphic connection with them. The Danish government had previously broached a plan for financing the project in 1899, via twenty year subscriptions to meteorological telegrams from the islands. Up to February 1904 only two countries had adopted this plan: the Danish–Icelandic Government promised an annual subvention of about £5,000 while Sweden agreed to subscribe for twenty years at £400 per year.[12]

The Danish chief delegate, Christian Frederik Drechsel (1854–1927), eagerly circulated a memorandum on the project at the ICES meeting in February 1904. No response had come from the resolutions passed at Stockholm and Christiania. Drechsel surmised that a reason for the negative attitude might be the British–Boer South African war which had brought the deliberations between the Danish and the other Governments interested in the matter to a temporary stop. The Danish Government then urged the Great Northern Telegraph Company to take the enterprise in hand. However, it was necessary to get financial support from the interested countries. In return, these countries would gratuitously obtain daily meteorological telegrams from Iceland. The telegrams would be sent free of charge by all the European lines belonging to the Telegraph Company. In addition to the subventions by Denmark/Iceland and Sweden there was still a need for about 200,000 Francs annually. It was suggested that Great Britain, Germany, and Russia should each support the project with 20,000 Francs, and Norway, Holland, and Belgium with 10,000 Francs each.[13] Obviously the circular had been submitted in advance to the Director of the Telegraph Company for approval.[14] In response to Drechsel´s circular ICES resolved:

> I. to communicate to the various governments participating in the international investigations in the North Sea and North Atlantic the measures taken by the Danish Government to include the islands of Iceland and Faroe in the European telegraphic system; and
>
> II. to express the opinion that it would be of great importance for the fisheries of the several countries taking part in these investigations and for meteorological purposes that the measures proposed should be carried out.[15]

Several delegates made the reservation that the *measures proposed* meant an extension of the telegraphic system, and not the proposed plan for division of expenses. However, the delegates would consider themselves morally bound to do their best to urge upon their governments the extension of the system.

FINAL IMPLEMENTATION

[10] Berlin, Geheimes Staatsarchiv Preussischer Kulturbesitz, MS Walther Herwig to the Imperial Minister of the Interior, Count von Posadowsky-Wehner, 16th February 1900. Previously: DDR Zentrales Staatsarchiv, Abt. Merseburg, Rep. 87B, Nr.3646, Blatt 216-220.

[11] *2 Conférence internationale pour l´exploration de la mer réunie à Kristiania 1901*, Première partie, Steen´ske Bogtrykkeri, (Kristiania, 1901).

[12] Copenhagen, Rigsarkivet, Arkiv Nr. 10.649, Box 5, File 1.A.4, Director of the Great Northern Telegraph Company, Edouard Suenson, to C.F. Drechsel, 16th February 1904. (Note, this item is archived under the year 1914.)

[13] *Conseil permanent international pour l'Exploration de la Mer, Rapport et Procès-verbaux,* vol. II, (1904), 29-32.

[14] Copenhagen, Rigsarkivet, Arkiv Nr. 10.649, Box 5, File 1.A.4, Director of the Great Northern Telegraph Company, Edouard Suenson, to C.F. Drechsel, 20th February 1904. (Note, this item is archived under the year 1914.)

[15] *Conseil permanent international pour l'Exploration de la Mer*, *Rapport et Procès-verbaux,* vol. II, (1904), 18.

In the meantime other plans for obtaining telegraphic communication with the North Atlantic islands had come up, and the matter could be solved without the cooperation of ICES.[16] As regards the section to the Faroes and Iceland the old Shaffner project was now carried out by the Great Northern Telegraph Company. The communication with the Faroes was opened 1st August 1906 and extended to Iceland 27th August 1906. The last part of the project, via Greenland to North America, was implemented as late as New Year 1963.[17]

Acknowledgment

I am greatly indebted to Dr. Artur Svansson for much assistance in processing this and other manuscripts.

[16] Copenhagen, Rigsarkivet, Arkiv Nr. 10.649, Box 5, File 1.A.4, Director of the Great Northern Telegraph Company, Edouard Suenson, to C.F. Drechsel, 14th April 1904. (Note, this item is archived under the year 1914.)

[17] P. Thestrup, *Vogn og tog - prik og streg. P&Ts historie 1850-1927*, (Copenhagen, 1992).

EARLY INTERNATIONAL NORTH SEA CURRENT STUDIES

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INTRODUCTION

An 1899 conference held in Stockholm eventually led to establishment of the International Council for Exploration of the Sea (ICES). That conference adopted a programme for hydrographic work stating, 'observations on currents and tides should be carried out as frequently as circumstances allow'.[1] The programme called for the direct investigation of currents with meters, or indirectly by means of suitable drifters. It recommended research vessels to anchor occaisonally to measure the current throughout a complete tidal period. During the early years, the hydrographic part of the international investigations concentrated upon seasonal cruises. However, they obtained a fairly complete picture of North Sea water mass distributions. This included their temperature, salinity, oxygen content, and seasonal variation.

NEW FACILITIES FOR CURRENT-MEASUREMENTS

Before about 1900, ocean current information was mainly deduced from temperature and salinity distribution. The Norwegian oceanographer, Bjørn Helland–Hansen (1877-1957), stated that that this method offered only superficial knowledge. However, the early years of the 20th century brought possibilities for direct measurement of current direction and velocity, both at the surface and at depth. The appearance of new current-meters, such as Walfrid Ekman's (1874-1954) propeller design, Otto Pettersson's (1848-1941) bifilar and Fridtjof Nansen's (1861-1930) pendulum made this progress possible.[2] Between 1904 and 1905 A. M. van Roosendaal and Cornelis H. Wind (1867-1911) took observations in the North Sea to test and compare these instruments. Then A. F. H. Dalhuisen and W.E. Ringer continued these measurements into 1906.[3]

Helland–Hansen made extensive use of Ekman's instrument in 1906 for measurements in the Norwegian fiords, Norwegian Sea, and North Sea. He concluded, that the measurements proved the reliability of current observations at considerable depth.[4]

THE NEED FOR A SUMMARY OF NORTH SEA CURRENTS

The question about current measurements emerged in a council meeting at Amsterdam in February-March 1906. With the five year cooperation period coming to an end in 1907, they had to discuss the future. The meeting considered that international cooperation had promoted science with regard to practical and theoretical fishery problems. They desired to

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[1] *Conférence internationale pour l'exploration de la mer réunie à Stockholm 1899,* (Stockholm, 1899).
[2] V. W. Ekman, 'Kurze Beschreibung eines Propell-Strommessers', *Publications de circonstance*, **24**, (1905); A. M. van Roosendal and C.H. Wind, 'Prüfung von Strommessern und Strommessungsversuche in der Nordsee', *Publications de circonstance*, **26**, (1905); O. Pettersson, 'Beschreibung des Bifilar-Strommessers', *Publications de circonstance* , **24**, (1905); F. Nansen, ' Methods for Measuring Direction and Velocity of Currents in the Sea', *Publications de circonstance*, **34**, (1906).
[3] A. F. H. Dalhuisen and W. E. Ringer, 'Fortgesetzte Strommessungsversuche in der Nordsee', *Publications de circonstance*, **36**, (1907).
[4] B. Helland-Hansen, *Current-Measurements in Norwegian Fiords The Norwegian Sea and The North Sea in 1906*, Bergen Museums Aarbog 1907 No 15, (Bergen, 1908).

continue cooperation in the best form for the participating governments.[5] The Council's Bureau requested them to prioritise problems.

Max Weber reported that the Netherlands government laid great stress upon receiving a summary of the conditions of North Sea currents, both at the surface, and, as far as possible, at deeper layers. He also wanted this before July 1907.

Later, the Dutch expert, Wind, explained in detail to the Council's Bureau what was wanted:

> 1. Collection and working up of all material useful for the purpose, mainly from the log-books of light-ships, sailing ships, and steamers. In the Netherlands such work was already in hand and partly finished.
> 2. Amalgamation of the direct current-measurements with what might be concluded from other hydrographical data, such as surface temperature and salinity, and drift bottle experiments.
> 3. Enhancements of the material of direct current-measurements both by continuation of the ongoing work and by organizing direct measurements at surface and several depths from light-ships.

Wind wanted one person to do the work of 1 & 2 instead of each country handling it separately. An obvious candidate would be the Bureau's Hydrographical Assistant, Martin Knudsen (1871-1949). Had he not the necessary time and assistance, the Bureau would give the lead to another of the participating scientists, such as Professor Krümmel (1854-1912).[6]

Wind's application occasioned the Bureau to invite Knudsen to express his view on the matter. Knudsen stated that the currents in the North Sea were much studied with abundant material collected.[7] The Council's Hydrographical Section mentioned the following as among the more important, relevant results:

> Water of high salinity streams into the North Sea from the Atlantic Ocean in part through the English Channel but mainly by the North. The salt stream entering by the Channel becomes mixed with the North Sea water especially by the strong tidal currents. It must be born in mind, however, that the action of strong winds, often prevalent in the region, on the progress of Channel water and its mixing with North Sea water, may be very great. Considerable changes in the alternating tidal currents during stormy weather have been pointed out by observations on certain lightships.
>
> These changes, although temporary, if occurring at certain times of the year, may produce great alterations in the physical conditions of life in the shallow and narrow parts, and greatly modify the transported surface plankton.
>
> Complete knowledge of the movement of the surface-water has been obtained at certain places mainly through observation on lightvessels and this is to a certain degree true of the deeper layers also in at least one place in the open sea, this result having been obtained by direct current measurements.
>
> Certain phenomena suggest that the water masses in the southern part of the North Sea to a certain degree belong to a region by itself with distinct hydrographic conditions.
>
> The exact knowledge of the conditions of the currents is of great importance for the study of the fate of pelagic fish-eggs.
>
> A branch of the Atlantic current spreads over the northern North Sea plateau, running from the sea north of Shetland in a southerly and south-easterly direction. This current which is influenced by the configuration of the bottom, carries salt water partly into the central area of the northern North Sea plateau (more than 80 m deep), partly along the western slope of the Norwegian Channel into the deeper parts of the Skager Rak. Giving off heat to the air during the winter this water is cooled down to a relatively low temperature, which is retained during the summer, the water in question then being the bottom-layer. The upper water-layers are renewed by new water masses which together with the coastal waters off Scotland and Norway produce a cyclonic circulation on the northern North Sea plateau, this fact being proved by the hydrographical conditions and also by experiments with drifting bottles.
>
> North of the Dogger Bank there is a region in which the cold bottom water is, from a hydrographic point of view, somewhat different from the surrounding water. The coastal waters in

[5] *Rapports et Procès-verbaux des Réunions*, **6**, (1906).
[6] Copenhagen, Rigsarkivet, Archive number 1935 Box D.2 (hereafter RAC), Wind to the Council's Bureau, 20th July 1906.
[7] RAC, Knudsen to the Council's Bureau, 25th August 1906.

> the western as well as in the southern part of the North Sea acquire a special character from the strong tidal currents which act so as to render the water practically homogeneous from the surface to a considerable depth.
>
> It has become obvious that the unperiodic variations in the North Sea are of very great importance. The variations take place with very varying rapidity. The conditions may also be very different from year to year. Thus the Atlantic water obtained a much greater extension in 1905 than in previous years, both temperature and salinity having unusually high values in 1905 not only in the Atlantic Ocean and in the Channel but also in the North Sea.

This extract is the North Sea part of *A brief statement of the present state and of some of the most important results of the Hydrographical Investigations, prepared by the Hydrographical Section of the Council, at Amsterdam, March 1906*. Knudsen quotes the German version of the statement.

Max Weber requested preparation of the summary before the July of 1907, but it was not possible. Therefore at the London council meeting that June, the Hydrographical Section proposed a resolution instructing:

> the leader of the Hydrographical Department of the Bureau to prepare, if possible by the beginning of March 1908, a numerical and graphical account of the currents of the North Sea both on the surface and in deeper layers as far as the data available allow and makes a grant from the funds of the Council to meet the necessary expense of the work.[8]

WALFRID EKMAN CHARGED WITH SUMMARY PREPARATION

The General Secretary, Paulus P. C. Hoek (1851-1914), pointed out that the *Draft Expenditure* assigned no funds for next year to meet the expenses of the proposed work. However, by transferring the task to the council's central laboratory, the meeting overcame this problem. From the laboratory's 1902 inception at Kristiania (Oslo), the Norwegian government accepted having to pay 10,000 Kroner for its annual running. With the council's future beyond 1907 uncertain, the Laboratory's leader, Fridtjof Nansen, was not able to secure Norway's contribution for the ensuing year. In spite of this, and after considerable discussion, the council agreed to pay the usual 11,700 Kroner. However, at the request of Cornelis Wind and seconded by several members of the Hydrographical Section, the council wanted the laboratory's acting director, V. Walfrid Ekman to report upon the North Sea currents. Nansen accepted this condition.

Knudsen submitted this decision to Ekman, explaining that the work was mainly to collect existing observations, printed or unpublished, and amalgamate them into a numerical and graphical summary.[9]

Atuned to the matter, Ekman requested countries bordering the North Sea to supply him with a list of observations they already possessed. New observations might then be carried out on the coming August cruises.[10]

Knudsen reported the Danish Meteorological Institute publishing current-data from Danish light-vessels in the series *Nautical-meteorological Annual*.[11]

According to its Director, Wladimir Peter Köppen (1846-1940), the Deutsche Seewarte had a large collection of log-books from which information about the currents might be deduced. This work would cost for three to four hundred Marks. The Seewarte was interested in the purpose of the desired charts: should they only present average conditions or should they depict approximate synoptic movements? With a view to the physical conditions of the North Sea in general, and especially to the aim of the International Study of the Sea a synoptic handling of the problem would be very advantageous.[12]

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[8] *Rapports et Procès-verbaux des Réunions*, **7**, (1907).
[9] RAC, Knudsen to Ekman, 24th June 1907.
[10] RAC, Ekman to Knudsen, 26th June 1907.
[11] RAC, Knudsen to Ekman, 28th June 1907.
[12] RAC, Köppen to Ekman, 10th July 1907.

Ekman sent Knudsen a copy of this letter, dated 10th July 1907, asking whether he believed that the material offered by Köppen should be worked up at the Bureau's expense. Ekman for his part thought that there was every reason to do this, and that he preferred the synoptic treatment.[13]

Knudsen too was of the opinion that the log-book material should be worked up, and if at all possible the synoptic method used. However, he doubted that the Bureau could defray the expenses. If the Laboratory paid for the work, Knudsen would consider this procedure fully warrantable.[14]

Ekman was not sure whether the Laboratory would have the necessary funds for defraying the expenses involved in working up the German observations. He thought that Copenhagen might defray the expenses, referring to the resolution's words that the council 'makes a grant from the funds of the Council to meet the necessary expense of the Work'. 'In any case, the work must be done', he added.[15]

Knudsen admitted that he had forgotten the last sentence of the resolution. He did not think that the Council would pay; however, to be safe he would ask the Bureau.[16] The General Secretary declared that no funds were available for the purpose.[17]

EKMAN'S PROGRAMME FOR NORTH SEA CURRENT MEASUREMENTS

In the meantime, Wind requested Ekman to come up with an international programme of North Sea current-measurements for 1907. However, Ekman was in doubt whether the tidal currents or the water transport should have preference. In view of the relatively few measurements obtainable, he preferred a compromise between the alternatives, though with main stress upon tidal currents. In any case, this would only give a valuable result if the water transport problem was also taken.

On this basis Ekman set up a draft programme, involving Belgium, Scotland, Norway, Germany, Sweden and Holland. In August 1907 he sent the draft to Bjørn Helland-Hansen, with whom Wind had contact.[18] In view of the late date, only very few of the planned measurements were carried out: those of the Belgian in the Channel, a few by the Scots, and the usual Dutch ones.[19]

THE PROJECT HELD IN ABEYANCE

At the Copenhagen council meeting of July 1908, an Hydrographical Section agenda item was: 'Report on the elaboration of the observations regarding the currents in the North Sea'. The item further informed the Section that, 'Dr. V. Walfrid Ekman would soon report on the currents of the North Sea'.[20]

Thirteen months later, the same item recurred on the agenda, where 'Mr. Helland-Hansen stated that Dr. Ekman was busy at work'. The section acknowledged the urgent necessity of getting this work finished soon.[21] Helland-Hansen's statement is somewhat puzzling. Ekman had just spent some months in Manchester working on the problem about the stability and instability of the movements of fluids. Ekman informed Knudsen that he had presently laid aside North Sea current work. He did so, after consultation with Nansen, for the

[13] RAC, Ekman to Knudsen, 2nd September 1907.
[14] RAC, Knudsen to Ekman, 5th September 1907.
[15] RAC, Ekman to Knudsen, 7th September 1907.
[16] RAC, Knudsen to Ekman, 10th September 1907.
[17] RAC, Knudsen to Ekman, 11th September 1907.
[18] Bergen, Statsarkivet i Bergen, Helland-Hansen Arkivet (hereafter HH), Ekman to Helland-Hansen, August 1907.
[19] HH, Ekman to Helland-Hansen, 7th January 1908.
[20] *Rapports et Procès-verbaux des Réunions,* **11**, (1909).
[21] *Rapports et Procès-verbaux des Réunions,* **12**, (1910).

sake of his own future, though he disliked in this way deferring a task that he had accepted. What reconciled him was that the amount of material would continue increasing, so that any eventual charts would be better than if published now.[22]

This viewpoint upset the hydrographers. Otto Krümmel (1854-1912) asked Knudsen, "Has Prof. Ekman really not yet finished his work on the currents of the North Sea?"[23]

As a matter of fact Knudsen had just requested some information from Ekman about working up the current-observations.[24] Ekman explained that before the Central Laboratory's closure he had prepared some preliminary statistical working up of current-observations at Danish and English coastal stations, of water level observations, and differences in dead reckoning at German vessels.[25] In the coming year he did not expect to be able to spend any appreciable time on North Sea currents. However, he hoped that there should be no need for further delay.[26]

Ekman's continuing interest in the project shows itself in his asking for copies of the current-measurements undertaken during the seasonal cruises. Although few in number, he considered the direct measurement material the more important. In the time left before working up the material into the current charts, he was considering a proposal on the measurement method.

Knudsen passed on the content of Ekman's letter to the Hydrographical Section in August 1910, where t*he Section acknowledged the communication with regret*.[27] Knudsen gave Ekman the supplementary information, that Krümmel had found the delay understandable, and they would look forward to finishing the work with interest.[28]

OBSERVATIONS FROM ANCHORED VESSELS

In spite of Krümmel's words, some people may now have lost patience. In any case, the Danish Commission for Sea Research proposed continuous North Sea observations by an anchored vessel for two months. It stressed the importance of having some knowledge of the hydrographical and biological changes taking place in deeper water over a short time period. It further maintained, that with regard to hydrographic investigations, only in this way would it be possible to get information about deep currents for a long enough time to display the effect of different meteorological conditions. By such an undertaking it would be possible, in a more complete and rational way than hitherto, to procure really connected observations of the hydrographical and biological conditions. Through the continuity of these observations material would be obtained which might be expected to be specially well suited for elucidating the question of the connection between the hydrographic, planktological, and biological changes.

Wind commented, that instead of using one vessel for several months, using several vessels for two weeks would provide an advantage. The vessels should be anchored, possibly in early June, and each participant country to provide one vessel for the investigation.

This resolution ended the discussion:

> The international Council having discussed the proposal of the Danish Commission to anchor a ship for 2 months in the North Sea for hydrographical and other observations, agrees that the time has now come to investigate in greater detail the fluctuations of the different hydrographical and biological elements in the North Sea.

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[22] RAC, Ekman to Knudsen, 24th June 1909.
[23] RAC, Krümmel to Knudsen, 18th August 1910. The quotation is a translation from the original German.
[24] RAC, Knudsen to Ekman, 1st August 1910.
[25] Method for determining the current from the difference between the ship's position expected from the course steered and the distance travelled as recorded on the log, and the real position.
[26] RAC, Ekman to Knudsen, 10th August 1910.
[27] *Rapports et Procès-verbaux des Réunions*, **13**, (1911).
[28] RAC, Knudsen to Ekman, 27th September 1910.

> To this end, having regarded also the questions put forward by the Dutch and British Governments (comp. Proc. Verb. VI 24, VII 30), it is resolved that observations of temperature, salinity and currents, and of plankton and other biological conditions be taken at 7 selected positions at several depths from anchored ships at short intervals during a period of 14 days as early as possible in June 1911. At the same time similar observations at lightships should be carried out.
>
> These observations of temperature, salinity and currents are to be published in the Hydrographical Bulletin; and the Assistant for Hydrography is instructed to prepare a digest correlating the results obtained.[29]

Each of Sweden, Germany, Norway, Denmark and the Netherlands would supply one ship, and Britain two. Suitable positions for each ship were given, and a number of light-vessels from which observations should also be carried out were pointed out.

As the resolution referred to the original requirements from the Dutch government the new project might in a way be considered as a further development of the earlier plans.

The measurements were carried out according to the plans, although stormy weather caused some problems. The raft from which the Swedish hydrographers preferred to make measurements capsized, resulting in loss of instruments.[30]

Otto Pettersson (1848-1941), the Council's Swedish *father*, momentarily became pessimistic with regard to the future of hydrography in the Council. He felt a need tofor a reorganize the work.[31] Martin Knudsen on the other hand found that the situation was much better now than a couple of years ago. With the continuous measurements carried out in June last the hydrographers were on the right track. These investigations should be continued to get better determinations of the tidal movements and obtain real information about the resulting currents.[32]

Petterson was happy to learn that the June current-measurements were a success. With regard to Sweden they had now overcome the difficulties, by fastening the instruments to a subsurface buoy.[33] Pettersson stressed that Knudsen must present a résumé of the results; this was for persuading the hydrographers to repeat the measurements.[34]

Pettersson discussed the meteorological situation concerning the day when the storm overturned the Swedish raft. He inquired whether Knudsen had prepared synoptic weather maps for the period 1st–14th June.[35] Knudsen explained that the Danish Meteorological Institute would prepare such maps for the period. Later, Pettersson approached Nils G. Ekholm (1848-1923) at the Meteorological Office in Stockholm, to discuss working up the meteorological observations collected during 28th May–15th June 1911. Knudsen was asked to supply Ekholm with the relevant material.[36]

Ekholm did work up the meteorological observations, from which he published a paper on the weather on the North Sea during the first half of June 1911. He preceded this with a long section on the history of meteorology!.[37]

Obviously Knudsen now realized how much work was involved in working up the current-measurements. So he declared that if the investigations should be repeated he must receive the material in a more worked up form than hitherto, or he would be overwhelmed.[38]

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[29] *Rapports et Procès-verbaux des Réunions*, **13**, (1911).
[30] RAC, Knudsen to Ekman, 31st March 1911.
[31] RAC, Pettersson to Knudsen, 30th November 1911.
[32] RAC, Knudsen to Pettersson, 4th December 1912.
[33] RAC, Pettersson to Knudsen, 7th December 1912.
[34] RAC, Pettersson to Knudsen, 10th December 1911; Pettersson to Knudsen, 26th December 1911.
[35] RAC, Pettersson to Knudsen, 27th December 1911.
[36] RAC, Pettersson to Knudsen, 15th February 1912.
[37] N. Ekholm, 'Das Wetter auf der Nordsee während der ersten Hälfte von Juni 1911', *Publications de circonstance*, **64**, (1913), 1-30.
[38] RAC, Knudsen to Pettersson, 3rd January 1912.

Pettersson agreed to a repetition of the current-measurements in 1912, preferably in August. However, he stressed that they should be combined with biological investigations. The biologists and their administrators did not understand why vessels should be deployed in the North Sea for a fortnight each year just for obtaining tidal constants and current-velocities alone. However, they would understand an investigation that threw light upon the life and distribution of migrating fish at spawning time.[39] Knudsen was also in favour.[40]

By late February 1912, Knudsen received the last part of the hydrographical observations from the investigations of 1st–14th June 1911. About a month later, he distributed to the council's members and experts a provisional report. This presented preliminary results of the tidal currents and mean currents, which he followed with a proposal for similar investigations in council–year 1912–13.[41]

By return of post Knudsen received congratulations from Pettersson, who had great visions. He now saw these investigations as the start of a great international cooperation which in the course of time would also include the oceans![42]

At the Council meeting at Copenhagen in April 1912 Knudsen reported on the working up in tables and charts of the data collected in the 1911 project. That discussion resulted in the resolution:

> 1. that observations of temperature, salinity and current be printed *in extenso* as tables;
> 2. that a summary be given containing the most important tidal constants with their graphical representation;
> 3. that, by way of example, the complete series of diagrams of the observations taken at the Horns Reef and the Dutch station be given [in order to compare the results obtained by use of two different sorts of instruments];
> 4. that the meteorological conditions be presented by means of charts and otherwise.

The publication should form a part of the Hydrographical Bulletin. In accordance herewith it was included in Bulletin Hydrographique pour l'année Juillet 1910-Juin 1911, issued in 1912.

A discussion on repeating the project resolved:

> That continuous hydrographical observations be carried out at selected points in the North Sea during the first fourteen days of August 1912.[43]

This year, however, only Sweden, Germany, Scotland, and England sent research vessels. Light-vessels from Denmark, Germany, Belgium, England, and the Netherlands participated in the project. Detailed instructions for the observations were given. It was considered advisable to have the working up of the current-measurements carried out in a uniform manner in the Hydrographical Department of the Bureau. So it was resolved

> that the velocities and directions of the currents obtained by each country be transmitted to the Bureau for further elaboration.

With the project a success, the September 1912 Council meeting decided upon annual repetitions, passing a resolution that:

> A fortnight's hydrographical observations are to be undertaken once a year in the Skager Rak and the North Sea from ships at anchor, by the following countries: Sweden, Germany, Holland, England and Scotland. The observations are, as far as possible to be carried out simultaneously, at times and places which from year to year are to be determined by the Council, or by correspondence.
>
> The definite selection of locality and date of the fortnight's observations at anchor during the summer 1913 should, if possible, be postponed till the results of the 1912 observations are

[39] RAC, Pettersson to Knudsen, 6th January 1912.
[40] RAC, Knudsen to Pettersson, 10th January 1912.
[41] RAC, Knudsen to the Council's members and experts, 12th April 1912.
[42] RAC, Pettersson to Knudsen, 14th April 1912.
[43] *Rapports et Procès-verbaux des Réunions*, **14**, (1912).

> available. However, in order to secure uniformity, the first half of August is provisionally considered most suitable.[44]

England, Scotland, and Sweden sent a research vessel each, with a further two Dutch and four English light-vessels participating.

The British Board of Agriculture and Fisheries published ship positions: with the English vessel *Hiawatha* east of Shields, the Scottish vessel working north-east of Aberdeen, and the Swedish vessel in the Skagerak.[45] Their observations were of current-measurements near the surface and bottom every hour of the fortnight, and in fine weather at intermediate depths. Special attention was paid to the submarine waves expected at depths where the heavier bottom water and lighter surface water were in contact with one another. The instrument descriptions imply that Ekman's propeller and Jacobsen's Libelle were the types of current-meter used. The temperature and salinity of various water layers were determined, and plankton samples collected.

At the Copenhagen Council meeting in September 1913 the Hydrographical Section

> considered it desirable, that continuous observations should also be made during the present year, for a period of 14 days, from ships at anchor in the Skager Rak and the North Sea.

A resolution to this effect was passed, stating that Denmark, Germany, Holland, Belgium, and England would make observations on light-ships only, whereas places for observations by Sweden and Scotland were not yet decided upon. Obviously the project was reduced in scale, for simultaneous observations were no longer necessary.[46] When it was stated that observations should be made *during the present year* this must be understood as the *Council-year*, that is 22nd July 1913 – 21st July 1914. Apparently no observations from ships at anchor were carried out in this period.

The Report on the activities of the Hydrographical Department of the Bureau for the year July 1913 – July 1914 states that the harmonic analysis of the continuous current-observations in the North Sea during the first half of August 1912 were completed. A brief report on the results as well as graphical representations of them were worked out and the tables made ready for printing.[47]

END OF THE PROJECT

The outbreak of war in August 1914 brought the project to a stop. The Hydrographical Department continued with working up the collected material. According to the report of work during the years 1914–1916 a harmonic analysis of the continuous current-measurements in the North Sea August 1913 was carried out, and a brief survey of the results of the continuous current-measurements undertaken in the North Sea and Skagerrak during the previous years was published in the Hydrographical Bulletin.[48]

Ekman now became active. In April 1913 he approached Otto Pettersson to finance an assistant for working out the North Sea current survey, that he had taken upon himself several years ago. Pettersson was keen on having the current-measurements worked up. However, they considered whether it should be done just then or to wait until the the 1913 observations became available. He suggested to Knudsen, that on his next visit to Copenhagen they might get Ekman to come over from Lund for a discussion.[49]

In December 1914 Pettersson took up the matter in a letter to Knudsen. When the Bureau considered Ekman's request of the previous year it decided to forward his request to the September Council meeting, that was cancelled because of the war. Pettersson suggested

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[44] *Rapports et Procès-verbaux des Réunions,* **15**, (1913).
[45] 'Hydrographic and plankton observations in the North Sea', *Nature*, **91**, (1913), 593-4.
[46] *Rapports et Procès-verbaux des Réunions,* **19**, (1913).
[47] *Rapport Administratif 1913-1914*, (1915).
[48] *Rapport Administratif 1914-1915, 1915-1916*, (1917).
[49] RAC, Pettersson to Knudsen, 30th April 1913.

that a budget entry, '600 kr. (VII, 27). Working up material from special cruises', would meet Ekman's request, if Knudsen agreed.[50]

Unfortunately the amount in question was normally used as payment for working up annual current-measurements. Knudsen would therefore appreciate that the entry in question also this year might be kept for this purpose. This would also make it possible to carry out the calculations of the tides which Pettersson had asked for in the above letter. When the budget had been adopted Knudsen would be willing to find a way out for the 600 kr to Ekman.[51]

Pettersson was sour upon receiving this answer. He pointed out that if the Ekman fee did not figure in the budget, it might look as if the Copenhagen office staff were monopolizing the budget. Pettersson declared that these items were, despite warfare, taken up with the full amounts – to which he had no objection.[52]

Otto Pettersson also received problems from another direction. His draft budget for 1914-15 included honorariums to the editor of plaice questions, the leader of the herring investigations, the leader of the eel investigations and the amount to Ekman.[53] Henry Maurice (1874-1950), the council's English Vice-President, gave the draft a very rough reception. He pointed to favouratism among the nations. With regard to the proposed payment to Ekman Maurice's view was:

> That is a new payment and therefore all the more less suitable to be included in an emergency budget, but I have not the slightest doubt that the Council will be prepared to pay whatever sum is justified in respect of Prof. Ekman's work after they meet.[54]

After this letter the three items were omitted from the budget whereas the payment to Ekman survived. So the estimate then carried the item: *Prof. Walfrid Ekman for hydrographical work (cf. Proc. Verb. VII, p. 34) 600 Kroner* together with a remark, *According to proposal of Professor Pettersson has been included as a new item 600 Kr. to Professor Walfrid Ekman for work already carried out and partly paid out by Professor Ekman.*[55]

Otto Pettersson and Gustaf Ekman (1852–1930) each paid Walfrid Ekman 300 kr in advance. G. Ekman wrote:

> Walfrid Ekman has now got 600 kr. and will return the 300 kr. he has got of us. I have asked him to send the amount to Hans [Pettersson (1888-1966)] who will return it to you. (From Swedish).[56]

It is surprising to learn Ekman was still working on North Sea currents as late as February 1916. At that time he asked Knudsen whether the current-observations published in the Nautical-Meteorological Annuals had been analysed with regard to the tidal current, especially those from the light–vessels Horns Rev, Vyl, and Skagens Rev. If not, he had to carry out such analyses, perhaps also for the stations in the Kattegat, as a preparation for their use in the study of the North Sea currents. Although the observations were estimates only, Ekman considered this material very valuable in view of the long continuous series. At the same time Ekman asked whether use of anemometers and of Jacobsen's instrument had been contemplated. Observations by means of these instruments would make the material even more valuable.[57] On behalf of Knudsen, Jacobsen replied that only part of the current-observations had been analysed. His current-meter had been applied on some of the light-

[50] RAC, Pettersson to Knudsen, 11th December 1914.
[51] RAC, Knudsen to Pettersson, 15th December 1914.
[52] RAC, Pettersson to Knudsen, 19th December 1914.
[53] St. Andrews, University of St Andrews library, D'Arcy Thompson's archive, Pettersson to Maurice, 6th January 1915.
[54] D'Arcy Thompson's archive, Maurice to Pettersson, 11th January 1915.
[55] 'Rapport Administratif 1913-1914', *Rapports et Procès-verbaux des Réunions*, **VII**, (1915).
[56] Gothenburg, Landsarkivet, The Otto Pettersson Collection, Pettersson to G. Ekman, 5th April 1915.
[57] RAC, Ekman to Knudsen 2nd February 1916.

vessels and part of the material obtained had been worked up. The wind speed had not been measured.[58]

What Ekman's belated activities resulted in is a mystery.

ACKNOWLEDGEMENTS

I am greatly indebted to Dr. Artur Svansson for much assistance in the processing of this and other manuscripts.

[58] RAC, J. P. Jacobsen to Ekman 5th February 1916.

PRINCE ALBERT AND J.Y. BUCHANAN: MEDITERRANEAN INVESTIGATIONS

by
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Before he succeeded his father as the Sovereign Prince of Monaco, Prince Albert (1848-1922) had already decided to devote himself to marine research. He organized and led four oceanographic cruises into the Atlantic on board his schooner *Hirondelle* between 1885 and 1888. He was familiar with the news of the circumnavigation of *Challenger* which was appearing in the French scientific press, and even in the *Journal de Monaco*.

Being eager to make the acquaintance of John Young Buchanan (1844-1925), who had been the chemist on board *Challenger*, Prince Albert was able to arrange a meeting through the good offices of his friend and co-academic Henry Guillemard (1852-1933). On the 12th and 13th of March 1890 all three men went out in the yacht *Amphiaster* which the Prince had hired from the Swiss scientist Hermann Fol (1845-1892), for some offshore research.[1] (Figure 1)

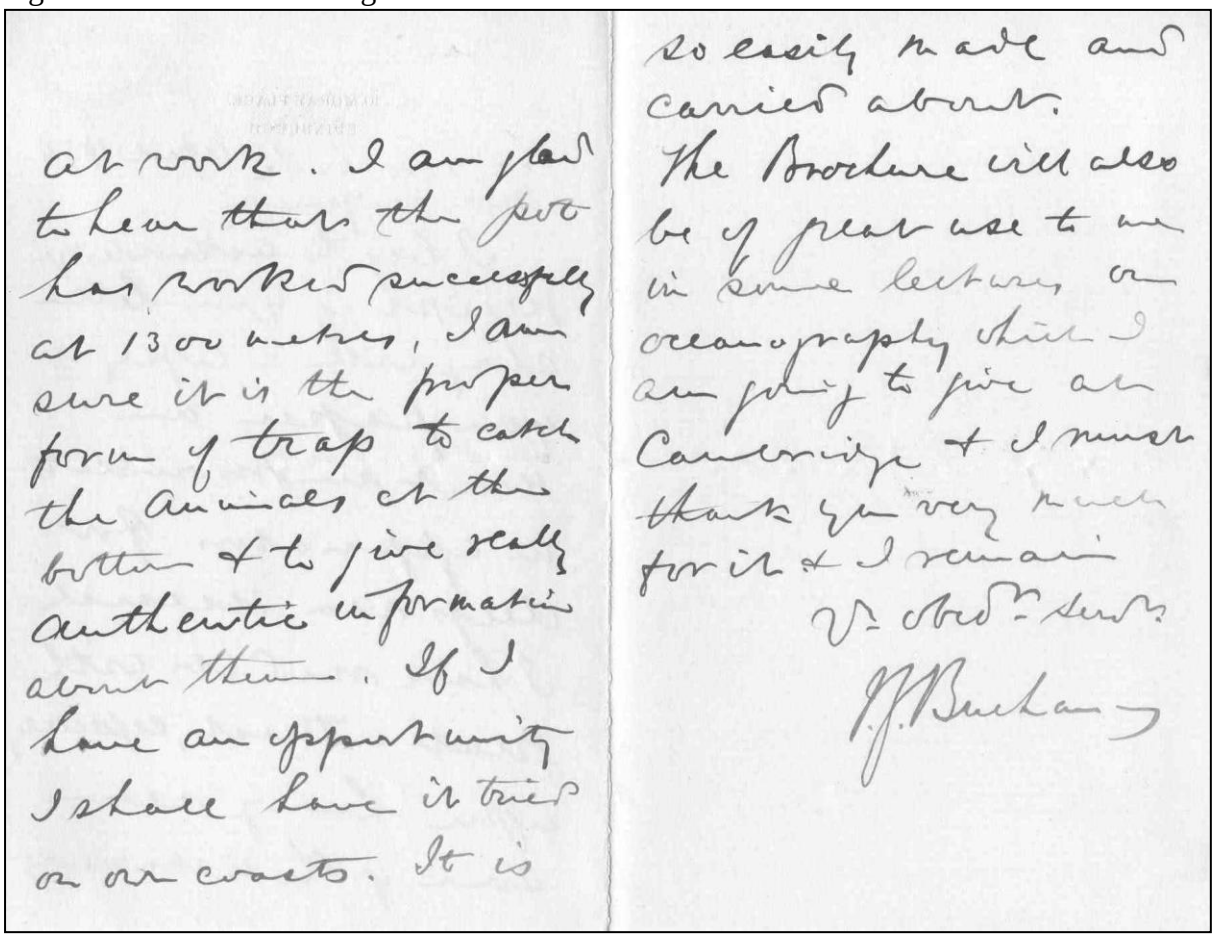
A lively correspondence of over 250 letters and telegrams from Buchanan is now preserved in Monaco. It is clear that a warm friendship soon developed. It is difficult for a Prince to have true friends who are neither beggars nor flatterers; it is equally difficult to befriend a Prince, while maintaining freedom of thought, speech and action. Buchanan's letters, while they maintain a formal address, are frank and open in content, giving details which probably exist nowhere else. Important, too was the fact that for many years Buchanan served as the informal channel of communication between Prince Albert and the British scientific community, often through letters to the journal *Nature* or to *The Times* newspaper.

In 1889, Prince Albert ordered a new ship to be built at Blackwall, near London. Buchanan, accepting the invitation to the launch of this yacht, the *Princesse-Alice*, added that he would "look forward with much interest to having the opportunity of studying the laboratory and other arrangements for scientific work at sea".[2] A few months later he attended the trials of the yacht.[3] On 15 July 1891, Prince Albert gave a lecture entitled *A new ship for the study of the sea* at the Royal Society of Edinburgh; of course, Buchanan was among the audience.

Prince Albert's voyages continued; every summer he organized and led a cruise lasting two or three months in the Mediterranean or Atlantic. In 1892 the *Princesse-Alice* sailed from the Edinburgh port of Leith to Genoa where the Prince and his passengers attended the celebrations of the 400th anniversary of the discovery of America. Before joining the vessel, Buchanan wrote "I will bring my hydrometer & also I hope a very simple form of water bottle which I am putting in hand today" and two days later, "I propose to bring ... what is required for the density determinations at sea.[4] Any results that we can get whether in the open or in the Mediterranean or (perhaps still better) between the two in the Straits of Gibraltar will have an

[1] Monaco, Archives du Musée océanographique de Monaco (hereafter AMOM), 1890. Monaco, manuscript of Prince Albert; AMOM, J.Y. Buchanan to Prince Albert, 16th April 1890.
[2] AMOM, J.Y. Buchanan to Prince Albert, 10th January 1891.
[3] AMOM, J.Y. Buchanan to [Prince Albert], [9th July 1891].
[4] AMOM, J.Y. Buchanan to Prince Albert, 10th August 1892.

Figure 1 First surviving letter from Buchanan to Prince Albert.



at work. I am glad to hear that the pro has worked successfully at 1300 metres, I am sure it is the proper form of trap to catch the animals at the bottom & to give really authentic information about them. If I have an opportunity I shall have it tried on our coasts. It is so easily made and carried about.

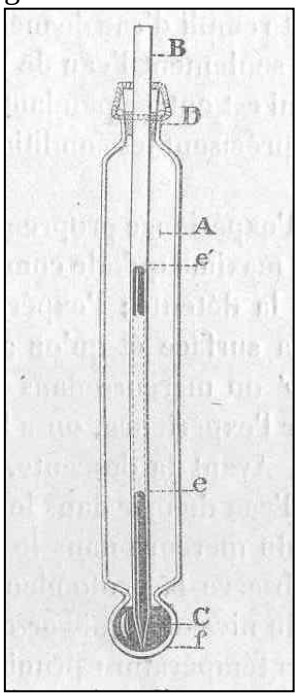
The Brochure will also be of great use to me in some lectures on oceanography which I am going to give at Cambridge & I must thank you very much for it & I remain

Yr obed. Servt.

J. J. Buchanan

(AMOM)

Figure 2 Piezometer.



(Buchanan 1904)

interest for me."[5] Throughout the entire cruise, he collected water samples and measured the density and alkalinity of the seawater.[6]

Anticipating the cruise of 1893, Buchanan commented,

> There are two problems of density which might well be taken in hand. The warm dense water of the Mediterranean overflows at the bottom into the Atlantic. A few series of temperatures & densities off the Straits of Gibraltar would suffice to map this stream provisionally. No current floats have been stranded on the Cape Verde Islands or on the Guinea Coast of Africa. The waters of the North Atlantic circular current are characterised by the fact that the salinity of the water goes always diminishing from the surface downwards. The waters of the equatorial & Guinea region are characterised by the fact that the salinity of the water increases from the surface to a depth varying from 30 to 150 fathoms where a maximum is found. I believe that the floats are not able to pass from the one region to the other & therefore that the delineation of the line where the maximum salinity just sinks below the surface is an important problem in oceanography. For this a number of densities would have to be taken of waters from the surface down to perhaps 200 fathoms.[7]

But health problems kept him from that cruise and it was only in 1894 that he could study temperature and specific gravity in the eastern Atlantic. At the Sixth International Geographical Congress, held in London in July-August 1895, in the absence of the Prince who that year was cruising in the Azores area, Buchanan delivered on behalf of the Prince his paper on the scientific voyages of the yacht *Princesse Alice*.[8]

One of the main events of the 1895 cruise was the capture of a sperm whale which, on dying, regurgitated fragments of a scaly cephalopod hitherto unknown to zoologists. This episode convinced Prince Albert of the value of capturing cetaceans. Buchanan, together with Captain Henry Charlwood Carr (1848-1918), second in command of the yacht, helped him to choose and purchase a whale-boat, harpoons and other gear, and hire a whaler, and he published a note in *Nature* on the importance of the event.[9] The following spring, the Prince caught several cetaceans off Monaco. He detailed this hunt in a letter which Buchanan translated and sent to *The Times*, where it appeared under the heading 'Monaco a whaling station'.[10] He reported back to Prince Albert with some glee,

> It was exactly what was wanted for the information of the British public, of the serious work which is being done at Monaco and having appeared in the Times it is the duty of every British subject to know it, or, at any rate, to pretend to know it. A hundred communications to scientific periodicals would not have the same effect, and the genuine sporting spirit which pervaded it, naturally appealed to the many who care little for science.[11]

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[5] AMOM, J.Y. Buchanan to Prince Albert, 12th August, 1892.

[6] J. Y. Buchanan, 'Sur la densité et l'alcalinité des eaux de l'Atlantique et de la Méditerranée,' *Comptes rendus hebdomadaires des séances de l'Académie des sciences*, **116**, (1893), 1321-1324; Albert Ier de Monaco, 'Sur les premières campagnes scientifiques de la « Princesse-Alice »,' *Comptes rendus hebdomadaires des séances de l'Académie des sciences*, **120**, (1895), 20-24.

[7] AMOM, J.Y. Buchanan to Prince Albert, 11th June 1893.

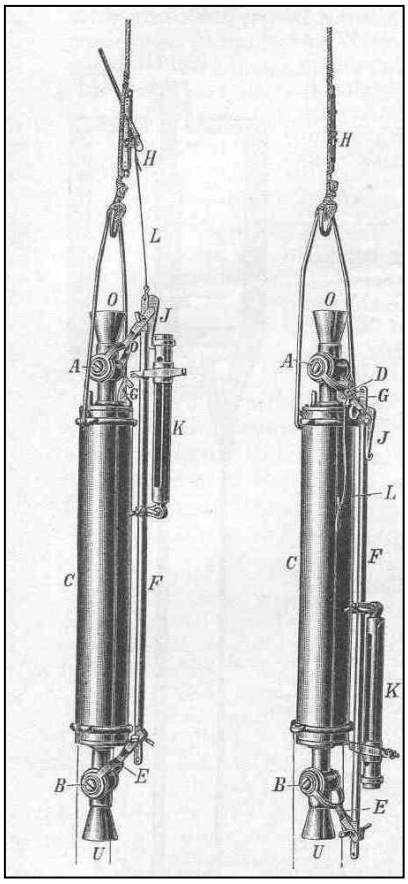
[8] Albert Ier de Monaco, 'Voyages scientifiques du yacht "Princesse Alice"'. In: *Report of the Sixth International Geographical Congress, held in London, 1895*, (London, 1896), 437-441.

[9] J. Y. Buchanan, 'The sperm whale and its food,' *Nature*, **53**, (1896), 223-225.

[10] J. Y. Buchanan, 'Monaco a whaling station,' *The Times*, June 15th 1896, [reprinted in J. Y. Buchanan J.Y., *Accounts rendered of work done and things seen*, Cambridge: University Press, **16**, (1919), 259-260.]

[11] Monaco, Archives du Palais princier de Monaco (hereafter APM, C.677), J.Y. Buchanan to Prince Albert, 18th August 1896.

Figure 3 Buchanan waterbottle.



O. Krümmel, *Handbuch der Ozeanographie. 1. Die räumlichen, chemischen und physikalischen Verhältnisse des Meeres*, **2**, Auflage, (1907), page 326, fig. 42.

Figure 4 Buchanan's display case at the Colonial Exhibition, Marseilles, 1906.

Buchanan was always invited, but other obligations and his declining health only allowed him to participate in the cruises of 1892, 1894, 1898 and 1902.

Within the area and research project which the Prince selected for each cruise, Buchanan planned his own work schedule and commissioned the necessary instruments at his own expense. In addition to the longer voyages, he went on several of the short spring cruises near Monaco when new apparatus or methods were tested.

From Buchanan's publications it is evident that he had learnt to lampwork glass and to make simple apparatus as part of his training in Glasgow under Sir William Thomson (1824-1907), and he habitually adapted apparatus to suit his needs. Among his own inventions employed on the Prince's cruises were a water bottle, a sounding tube, and two types of piezometer.

Piezometers are instruments for measuring the compressibility of liquids under varying pressure and as such would seem a reliable way to measure depth. Before he sailed with *Challenger* Buchanan was aware that depth measurements based on the length of hemp line paid out were often suspect and he had already experimented with water piezometers in the nearby deep parts of Loch Lomond, and had his instruments tested in the pressure chamber of Casella, the London instrument maker who provided most of *Challenger'*s thermometers. Buchanan knew that a volume of water is changed more by compression than by temperature, whereas a volume of mercury changes more by temperature. In theory, a water piezometer would be suitable to measure depth, a mercury piezometer to measure temperature, provided that both could be corrected for the lesser effect. The apparatus he constructed on board *Challenger* had not proved entirely satisfactory, and Buchanan spent the next thirty years trying to resolve the various problems.[12] Strangely, he seems never to have questioned the uncertain performance of the indexes which so easily shifted as the instruments were hauled in through rough seas.

In 1902, invited to join Prince Albert's cruise, Buchanan announced that he was "bringing some instruments for measuring the effects of pressure which I think will give interesting results".[13] This probably included what was known as the overflow piezometer; the instrument consisted of an open tube secured within a sealed glass envelope. Seawater filled the envelope; mercury partially filled the tube which was open to the sea at its upper end and dipped into a bulb of mercury at its lower end. At maximum depth, if the volume of mercury was adjusted correctly, the pressure drove seawater past the mercury and added to the volume in the envelope. On recovery the mercury would be found to stand higher in the tube. From a formula combining this change in height, the density and volumes of the original water and mercury, and temperature, the pressure could be calculated.[14] These instruments, plus others from *Challenger*, were exhibited at Marseilles (see below and Figure 4). But the piezometer was not a good way to measure depth; Prince Albert was already sounding with wire line and obtaining far more reliable measurements than *Challenge*r and her contemporaries had obtained with hemp lines. (Figure 2)

In 1892 the brassfounder James Milne of Edinburgh constructed to Buchanan's design the first bottle to combine sampler and thermometer. A messenger consisting of a 2-kg lead ring was sent down the wire to strike a trigger which closed the valves and released the thermometer frame, overturning the thermometer to freeze its record. Buchanan took this on Prince Albert's autumn cruise that year, but its performance was not entirely satisfactory and Milne was asked

[12] J. Y. Buchanan, 'Laboratory experiences on board *Challenger*.' *Journal of the Chemical Society*, **33**, (1878), 445-469.

[13] APM C.677, J.Y. Buchanan to Prince Albert, 8th July 1902.

[14] J. Y. Buchanan, 'Sur un nouveau type de piézomètre,' *Comptes rendus hebdomadaires des séances de l'Académie des sciences*, **139**, (1904), 238-241; C. Carpine, 'Catalogue des appareils d'océanographie en collection au Musée océanographique de Monaco. 7. Instruments divers, matériel de pont, instruments de laboratoire,' *Bulletin de l'Institut océanographique, Monaco*, **76**, n° 1443, (1998), 36.

to make various changes, which were ready by December.[15] These modified bottles proved satisfactory on the 1894 and subsequent cruises.[16] (Figure 3)

The Buchanan combined sampler and sounding tube was intended to collect water that was in contact with the sea bed. It was designed in 1893 and by the following year Milne had prepared several which were forwarded for trial by Prince Albert during his cruise off Morocco.[17] It served regularly on later cruises.

Buchanan was a frequent visitor to the site of the new Oceanographic Museum, under construction from 1898. He was also consulted on the choice of the ships whose names were to be modelled along the top of the Museum façade. Two plaques had been allocated to British vessels. *Challenger*'s pride of place was not in question, but Buchanan argued for one of the cable-laying ships belonging to the Silvertown Company which had allowed him on board to undertake his own researches. And so the name of *Buccaneer* appears on the façade. There is no proof that Buchanan and the Prince discussed the choice of apparatus to be displayed in the gallery devoted to physical and instrumental oceanography; it would seem likely, however, given their shared concern with apparatus. A small display of Buchanan's apparatus that had been exhibited at the Marseilles Colonial Exhibition in 1906 found its way into the Museum galleries alongside other of his instruments that had been employed on the Prince's ships.[18] (Figure 4)

Buchanan was appointed to the scientific advisory board of the Oceanographic Institute, founded by the Prince in 1906 with headquarters in Paris, administratively linked with the Oceanographic Museum, which figured ever more often in his letters as the day of its inauguration approached. Writing early in 1910 he wished the Museum and the Institute "prosperity and fame in saecula saeculorum".[19] By March he was able to report "I am intensely gratified that Sir Archibald Geikie has chosen me to represent the Royal Society at the Great Inauguration. It is the one thing which I most desired."[20]

At the Ninth International Geographic Congress, held in Geneva in 1908, it was proposed to create two commissions for scientific exploration, one for the Atlantic and one for the Mediterranean, both under the chairmanship of Prince Albert. The Mediterranean Commission met for the first time in Monaco, on 30 March 1910, the day following the opening of the Oceanographic Museum. In addition to those delegates nominated for the Commission, Prince Albert also invited ten other people, including Buchanan, to attend this meeting.

Subsequently Great Britain declined to take part in the Commission, "His Majesty's Government being hardly concerned in the question of the oceanographic exploration of the Mediterranean regrets that it finds itself unable to take part in the 'Commission de la Méditerranée'... My Government will be, nonetheless, happy to learn about the work this Commission will be undertaking".[21] Buchanan therefore took no further part in its activities.

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[15] AMOM, J.Y. Buchanan to Prince Albert, 11th December 1892; AMOM, J.Y. Buchanan to J. Richard, 25th January 1893; J. Y. Buchanan, 'On some modifications of the water-bottle and thermometer for deep-sea research,' *Proceedings of the Royal Society of Edinburgh*, **19**, (1893), 238-242; Albert Ier de Monaco, 'Oceanography of the North Atlantic,' *Geographical journal*, **12**, (1898), 445-469.

[16] C. Carpine, 'Catalogue des appareils d'océanographie en collection au Musée océanographique de Monaco. 4. Bouteilles de prélèvement d'eau,' *Bulletin de l'Institut océanographique, Monaco*, **75**, n° 1440, (1993), 76.

[17] C. Carpine, 'Catalogue des appareils d'océanographie en collection au Musée océanographique de Monaco. 4. Bouteilles de prélèvement d'eau,' *Bulletin de l'Institut océanographique, Monaco*, **75**, n° 1440, (1993), 146.

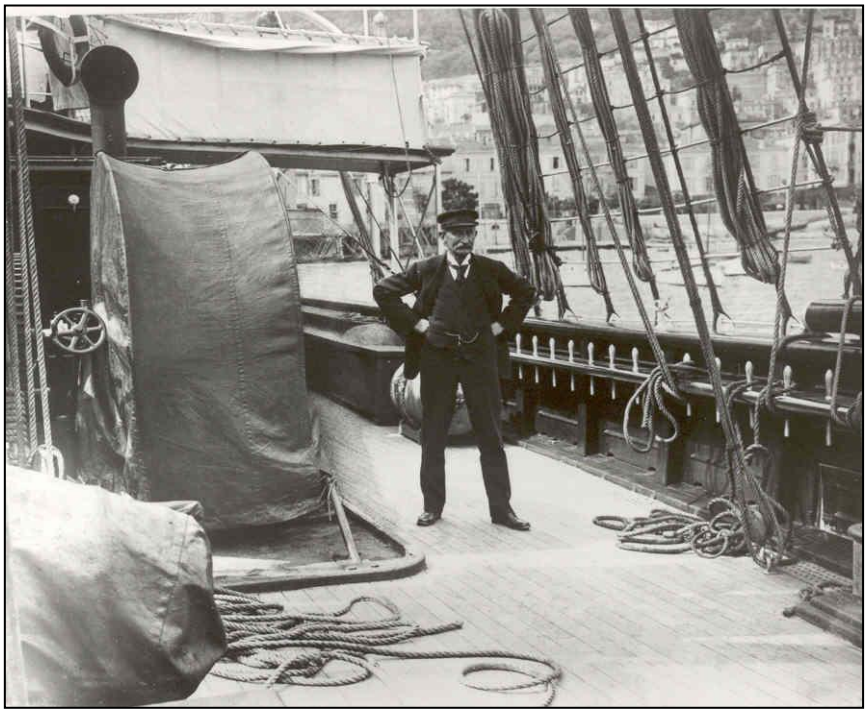
[18] AMOM, J.Y. Buchanan to Prince Albert, 7th November 1906; C. Bénard, 1907, *Rapport général, Section internationale d'océanographie, des pêches maritimes et des produits de la mer, Exposition coloniale de Marseille, 1906*, (Marseille, 1907), 336.

[19] APM C.677, J.Y. Buchanan to Prince Albert, 4th January 1910.

[20] AMOM, J.Y. Buchanan to Prince Albert, 18th March 1910.

[21] APM A.877, Francis Bertie, English Ambassador, to Léopold Balny d'Avricourt, Monaco's Minister in Paris, 10th August 1911. 'Le Gouvernement de Sa Majesté Britannique n'étant pas suffisamment intéressé à la question de l'exploration océanographique de la Méditerranée, regrette de ne pas se trouver à même de prendre

Figure 6 Buchanan on board the second *Princesse-Alice*, in Monaco harbour; photograph taken by Louis Tinayre, during the inauguration festivities for the Oceanographic Museum, 29 March - 1 April 1910.



(AMOM)

Once the lengthy festivities and meetings were over, Buchanan wrote an exceptionally warm letter.

> Since I left Monaco I have thought much of the last words that you addressed to me. I look back on the week of the Inauguration as on a dream. I said, at the time, to Hergesell[22] & others: - none of us realise the greatness of the function in which we are taking part: the importance of it will grow on us; but it will take time.
>
> For myself no words can express my gratitude for the kindness and distinction with which I was treated.
>
> To be received in the Palace among the representatives of Sovereigns, was a great honour: but what affected me most was the way in which your Highness distinguished me at the meetings of the scientific commissions, and the crowning honour of the Commander's cross of the order of S^{t} Charles.[23]
>
> I particularly value the honour of being made vice-president of the Comité de Perfectionnement, that is, the second highest position in the science of Oceanography. That alone is adequate reward for the work of a lifetime.
>
> I hope I may still have some years in which to work for the Institute & to justify the rewards I have received.[24]

Typically, he also sent notice of the new museum to the journal *Nature*.[25] (Figure 5)

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part à la "Commission de la Méditerranée" ... Mon Gouvernement sera, toutefois, heureux d'apprendre les progrès des travaux qu'entreprendra cette Commission'.

[22] Hugo Hergesell (1859-1938), German meteorologist.

[23] the honours went only in one direction; Prince Albert was never even proposed for election to the Royal Society.

[24] AMOM, J.Y. Buchanan to Prince Albert, 21st April 1910.

[25] J. Y. Buchanan , 'The Oceanographical Museum at Monaco,' *Nature*, **85**, (1910), 7-11.

One of the last events in which Prince Albert and Buchanan took part was the Prince's silver jubilee, celebrated in Monaco at Easter 1914. Three and a half months later came the outbreak of the first world war, and Buchanan went to live in the United States. After the war, he returned to the Principality, but his poor health prevented him accepting, in 1920, the invitation to the wedding of Princesse Charlotte, Prince Albert's grand-daughter.

What Monaco and Prince Albert meant to Buchanan is expressed in a letter he had sent from Boston in the dark days of 1916 when he feared he might never see Europe again,

> It seems such a long time since we met at the memorable Jubilee Festival at Monaco: and what has happened since then would almost fill a century of ordinary time.
>
> That Festival was particularly interesting to me: I knew well that it was probably the last time that I should have the privilege of enjoying the Princely hospitality of the Palace, and although unable to join in all the festivities, I had the greater leisure to recall all the remembrances of my association with your Highness in the development of the great work of oceanic exploration with which your Highness' name is connected.
>
> But along with the scientific satisfaction of being connected with so great a work, I look back with particular pride and satisfaction to the friendly intercourse which I was permitted to have with your Highness during these many years. ...
>
> It is an exile, but my exile is often illuminated by pleasing recollections of all that is connected with the name of Monaco.[26]

[26] AMOM, J.Y. Buchanan to Prince Albert, 17th September 1916.

ONE HUNDRED YEARS OF ROMANIAN OCEANOLOGY

by
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More than a century ago now, Adrien de Gerlache (1866-1934), the Belgian Naval officer leading the Belgica Antarctic Expedition invited Emil Racovitza (1868-1947), a biologist, to turn his attention to the sea. From this, Racovitza became the founder of Romanian oceanography. In turn Racovitza motivated two other Romanian scientists, Professor Ioan. Borcea (1879-1936) the zoologist, and Dr. Grigore Antipa (1867-1944) the marine ichthyologist, to dedicate their work to the development of marine sciences in the Black Sea and Mediterranean.

Figure 1 The Marine Zoological Station *I. Borcea* at Agigea

Source: the authors

In 1926, I. Borcea created the Marine Zoological Station at Agigea (Constantza) (figure 1). He specialized in anatomy, embryology, crustacea, applied entomology, and marine and general biology. Among his numerous achievements, Romanians recognize Borcea for the introduction of biology in high school education (including zoology courses), practical training in marine biology, promotion of the theory of evolution, organization of scientific research, and methodological contributions in the biological fight against noxious insects. Romanians also know him as a humanist, animateur of the younger generation, and a promoter of social progress. He became dean of the Faculty of Natural Sciences at the University of Iassy, director of that city's Museum of Natural History, and minister of Culture and Public Instructions. He was a founding member of the Academy of Sciences of Romania (since 2007 re-named the Academy of Romanian Scientists), and a corresponding

member of the Academy. As a member of the Zoological Society of France he rose to its post of honorary chairman, and there became a knight of the "Légion d'Honneur".

Through 1894, 1895 and 1896, Antipa initiated major research into the Black Sea on board the cruiser *Elisabeta*. This work brought him major public duties as first organizer, then director general, and eventually chief inspector of the State Fisheries of Romania. Due to his growing reputation, in 1925 H.S.H. Prince Albert I of Monaco invited him to join the Commission Internationale pour l'Exploration Scientifique de la Mer Méditerranée (CIESM). Thank to his prodigious activity, CIESM designated him reporter for the Black Sea in 1927, which area it extended the following year to the entire environs of the Eastern Mediterranean. Then in 1932 he founded the Bio-oceanographic Institute at Constantza (figure 2). CIESM held a general assembly and congress at Bucharest in 1935, which Antipa organised, and a second at Bucharest – Constantza in 1966

Figure 2 The Bio-oceanographic Institute *G.Antipa* at Constantza

Source: the authors

After 1945, Mihail C. Bacescu (1908-1999) the biologist, led most of the marine research, in both field and laboratory. This Academician served as director of the Museum of Natural History *Grigore Antipa* at Bucharest for twenty-four years from 1964, and between 1954 and 1970 led the Sector of Marine Biology at the Constantza Academy. He rose to become Vice-President of CIESM in 1963 and served there as the national delegate from 1966 to 1999. In co-operation with the Mediterranean Association of Marine Biology and Oceanography, he and his fellow Academician and biologist, Eugen A. Pora (1909-1981), of the University of Cluj-Napoca, organised an international course on the biology of Black Sea brackish waters. The lectures included in the course also rose to publication in French.[27] In 1964, Professor Nicolae Panin, (1938-) a marine geologist and geophysicist, created the Laboratory of marine sedimentology at Constantza / Agigea; and three years later Doctor of

[27] *Biologie des eaux saumâtres*, 2 volumes, IRCM, (Constantza, 1977).

Engineering Constantin Bondar (1931-) the potamologist and marine hydrologist, created the Oceanographic research station at Constantza. At some point the Fisheries Research Station *Dr. G. Antipa* succeeded the Bio-oceanographic Institute. Then in 1970 at the initiative of Bacescu and Pora, they and the two other marine research related institutions along the Romanian littoral, the Marine Zoological Station *Prof. I. Borcea* and the Sector of Marine biology, all merged into the Romanian Marine Research Institute (RMRI), located in Constantza. This development to the RMRI facilitated Romanian research among the cruises carried out off the coasts of Libya, Argentina, and Somalia.

In 1999, the Romanian government took the decision to reorganise the RMRI as the National Institute for Marine Research and Development *Grigore Antipa* (NIMRD). As the leading or associate partner, and as the organizer or co-organizer of various scientific events, and as a participant in congresses, conferences, workshops, exhibitions, and trade fairs in both Romania and abroad, NIMRD's achievements so far comprise various aspects of R&D and training activities.

On October 29th 2010, NIMRD celebrated its 40th anniversary by a symposium on its premises. Dr. Hans Dahlin, the Director of EUROGOOS, Dr. Violeta Velikova of the Black Sea Commission at Istanbul, Turkey, Prof. Roger H. Charlier of the Free University of Brussels, Belgium, Prof. Bayram Öztürk of the University of Istanbul & TUDAV, Turkey, Prof. Bouchta El Moumni of the University Abdelmalek Essaadi Larache, Kingdom of Morocco, and the representatives of marine research institutions around the Black Sea were among the invited personalities. This event was also devoted to the International Black Sea Day of October 31st.

BOOK NOTICES

by

Eric Mills

Bates, Charles C. 2005. **"HYDRO" to "NAVOCEANO". 175 Years of Ocean Survey and Prediction by the U.S. Navy 1830-2005.** Editor G.L. Hanssen. Rockton, IL: Cornfield Press. xxiv + 329pp. 0-9774144-0-X.

Charles Bates's career included exploration geophysics, military meteorology, offshore weather forecasting, and civilian service with U.S. Navy and Coast Guard. His account of the history of the U.S. Naval Hydrographic Office (HYDRO), founded as the Depot of Charts and Instruments in 1830, and renamed the Naval Oceanographic Office (NAVOCEANO) in 1962 is informal, irreverent and amusing in places, occasionally idiosyncratic – but also full of the kind of historical information that only an insider can provide. Two chapters deal with the first century, 1830-1937, three with the Second World War years, five with the post-war years 1946-1969, and two with the reorientation (and as he sees it, the gutting) of U.S. Naval oceanography in recent years. Bates decries the attitude that he sensed in 2005, the U.S. Navy's interest in oceanography only as an aid to warfare rather than a contribution to comprehensive knowledge of the oceans. This book deserves attention as a companion to academic studies such as Gary Weir's *An Ocean in Common. American Naval Officers, Scientists, and the Ocean Environment* (Texas A&M Press, 2001)

Berger, Wolf H. 2009. **Ocean. Reflections on a Century of Exploration.** With contributions by E.N. Shor. Berkeley: University of California Press. x + 519pp. 978-0-520-24778-9.

The polymathic geological oceanographer Wolf Berger - more accurately described as an enthusiastic naturalist - describes the aim of this book as "to deepen understanding and appreciation, as in a guided tour of selected exhibits" of the ocean sciences, centering on, but not restricted to, the contributions of the Scripps Institution of Oceanography in geological and biological oceanography, and on the history of exploration. With the collaboration of the SIO historian Betty Shor, Berger presents us with a series of literate, comprehensive, and historically-informed essays on coastal ecology, oceanic production, geological history, and global warming. Each chapter has an extensive, comprehensive bibliography, and appendices deal with units, oceanic chemistry, groups of marine organisms, the geological time scale, and topographic statistics. Using SIO (which celebrated its centennial in 2003) imparts focus and makes sense, for as Berger says, "in many ways, the developments at Scripps can be taken as representative for all of the ocean sciences. In part, this is so because Scripps is the largest and oldest oceanographic institute in the United States. Mainly, however, it is because trends in research tend to run parallel across the nation, and, indeed, across the world." Despite the absence of some recent historical literature, historians can learn a lot about up-to-date oceanography in historical context from this volume – and so can oceanographers who venture outside their own specialties.

Kitaigorodskii, Sergei A. 2007. **Five Discoveries by Harald Sverdrup. An Introduction to Physical Oceanography.** Translated from Russian by Josef Cherniawsky. Oslo: Kolofon Publishing. 978-82-300-0352-7.

First published in Moscow in 1995, this book, purportedly an introduction to physical oceanography, is really a series of essays on the scientific career of the great Harald Sverdrup (1888-1957). Kitaigorodskii centers his account on five of Sverdrup's contributions to physical oceanography: his doctoral thesis on the North Atlantic trade wind (1917); his work on tides of the Siberian Arctic shelf carried out during Amundsen's *Maud* expedition of 1918-1925; his career as Director of the Scripps Institution of Oceanography (1936-1948),

notably the writing of the magisterial text *The Oceans* (1942 – co-authored with Martin Johnson and Richard Fleming); studies with Walter Munk during the war years on sea and swell that helped to make amphibious landings safer (and opened up the field of wave forecasting); and his remarkable contribution to understanding the gyral circulation of the oceans, "Wind-driven currents in a baroclinic ocean," published in 1947. In the course of these (all presented in non-mathematical terms), we learn something of the history of Norway, Vilhelm Bjerknes's career and physical ideas, early knowledge of the trade winds, north polar exploration, the history of tidal theory, and the development of the Scripps Institution of Oceanography. The presentation is attractive, and there is a good deal of advantage in having a single volume (the *only* volume) devoted to so many aspects of Sverdrup's career. Unfortunately it is marred by uncertainty about where much of the information comes from – the reference list is woefully incomplete – and by a host of historical errors or half-truths. A good scientific editor could have turned this book into an unusually useful contribution to the history of science, and might have avoided attributing much of the information on SIO to "H. Reity and B. Malton, 1967" and "E.H. Shore, 1978".

Pinardi, Nadia. 2009. **Misurare il Mare. Luigi Ferdinando Marsili nell'Egeo e nel Bosforo 1679-1680.** Bologna: Bononia University Press. 83pp. 978-88-7395-416-3.

In the past few years, the remarkable Bolognese natural philosopher, soldier, military engineer, antiquarian, and cartographer Luigi Ferdinando Marsigli (1658-1730) has been rescued from the shadows in a series of works. First came John Stoye's *Marsigli's Europe 1680-1730* (Yale University Press, 1994), followed within that decade by the magnificent translation of Marsigli's *Histoire Physique de la Mer* (1725), with interpretative introduction, by Anita McConnell (Bologna, 1999). More narrowly focused, for a scientific audience, was Bruno Soffientino and Michael Pilson's short essay on Marsigli's work on the two-layered circulation of the Bosporus in 1679-1680 (2005. *Oceanography* 18 (2): 16-23). Then four years later the same authors presented us with an English translation (with extensive notes) of Marsigli's essay of 1688 on the Bosporus, *Osservazioni intorno al Bosforo…*(2009. *Earth Sci. Hist.* 28 (1): 57-83). Now we have Nadia Pinardi's beautifully produced book attempting to put Marsigli's work on the Bosporus into modern terms, and claiming (in an English abstract) that "the measurements that he made and described are perhaps the first scientific treatise of modern oceanography." Marsigli's approach to the Bosporus circulation was threefold, to demonstrate the two-layered circulation in the field, to determine the weight (equivalent to salinity) of the water throughout the water column using hydrometers ("hydrostatic ampoules"), and to demonstrate in the laboratory the consequences of allowing fresh and salt waters to find their proper density levels. One of Pinardi's contributions is to convert Marsigli's "weight" values into density by comparing his measurements with those of fluids of known density, and by establishing plausible temperatures (a variable that Marsigli did not record) for the samples. Marsigli's results can then be reinterpreted in physical oceanographic terms and used for comparisons with modern knowledge of the Bosporus circulation. It would be a mistake to be put off entirely by Pinardi's insistence on making Marsigli into a "precursor" of modern oceanography, when he was, of course, a questing natural philosopher of his own time, the turn of the 17th century. There is a good deal of considered scientific and historical information here that outweighs the Whiggishness, giving a vivid and beautifully illustrated account of the Bosporus and how Marsigli approached its physical characteristics.