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OCEAN Challenge

The Magazine of the Challenger Society for Marine Science

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Ocean Challenge aims to keep its readers up to date with what is happening in oceanography in the UK and the rest of Europe. By covering the whole range of marine-related sciences in an accessible style it should be valuable both to specialist oceanographers who wish to broaden their knowledge of marine sciences, and to informed lay persons who are concerned about the oceanic environment.

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Message from the Editor

Founded in 1903, the Challenger Society is now more than 100 years old, and appropriately, one of the main themes of this issue is the history of oceanography, early and more recent. Other themes are the development of marine science in the Indian Ocean, and the important roles played by individuals in moving the science forward. The legacy of the *Challenger* Expedition is very much in evidence, and the origins of the Challenger Society itself are described by Margaret Deacon on pages 25–31.

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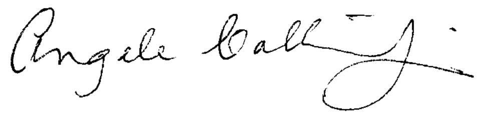

News & Views

Renewable energy from the sea – another look ...

Offshore wind farms, wave energy and tidal power have featured more than once in *Ocean Challenge*, and reports on offshore wind farms frequently appear in newspapers. The North Hoyle wind farm, 7–8 km off the North Wales coast (between Rhyl and Prestatyn), commenced operations last November. It consists of 30 turbines around 150 m high, generating electricity for some 50 000 homes (about 60 MW).

There seems to be less media interest in wave power; while power from tidal currents seems to be largely ignored – though short articles on it appeared last year in *The Guardian*. The principle is extremely simple, and the amount of electricity that could be generated by tidal currents is vastly greater than the output from wind turbines, because water is much denser than air – and tidal turbine blades can be smaller than those on wind turbines (about 20 m diameter as against 60 m), and even for a current speed of 2 m s^{-1}, the power generated would be some three times greater than that produced by a wind of 10 m s^{-1}. Some publicity was given to the topic a year or two ago, and was picked up in these columns (*Ocean Challenge*, Vol.11, No.1, p.11), but that was all. Potential sites include the Channel Islands, the Bristol Channel, North Wales, and the northern Irish Sea. Interference with shipping and fishing could present problems, but 'tidal farms' would be clearly marked by buoys and lights, presenting little danger to marine life (unlike the bird strikes recorded by wind farms), because the turbine blades rotate relatively slowly. A short *Guardian* news item last September reported that Norway's first submarine tidal generator, off Hammerfest inside the Arctic Circle, had begun operation, generating only 300 kW at this early stage of development, because the principal objective at present is to gain experience with the technology.

However, many energy experts predict that renewables cannot fill the 'generation gap' in the foreseeable future, and argue that nuclear power must be part of the energy equation – if new reactors are built, what will happen to their spent fuel, since the Thorp reprocessing plant is to be decommissioned by 2010 (cf. *Nature* 4 Sept 2003, p.7)?

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(MS2004)

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Photographers please note:
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Iceland and the hydrogen economy

Under this heading in the previous issue, we reported that Iceland was about to start using hydrogen in fuel cells powering some of its bus fleet. Reykjavik's first 'hydrogen bus' went on the road last October, but Madrid was actually the first city to use these buses, which now run in others, including Hamburg and Barcelona. Ten other European cities will have fuel-cell driven buses this year, and similar schemes will soon be underway in Australia (Perth), Japan, Singapore, California, and (finally) London.

There are a few snags in this renewably rosy picture: one is that hydrogen fuel for the Reykjavik bus (and presumably the others too) is in liquid form and resides in a roof-tank. Were there to be a leak and a spark, the hydrogen bus would be no more – except that hydrogen is such a light gas that any explosion and fire might well be confined to the roof area, leaving passengers unaffected (perhaps). Another snag is that the hydrogen is not only a petroleum by-product but presently also costs a lot more than diesel, so that to run a hydrogen bus costs around £2.80 per mile, as against £0.25 per mile for diesel. Still, as hydrogen gets cheaper and is obtained from truly renewable sources (e.g. wind- or solar-powered electrolysis of water), hydrogen-powered vehicles should one day become commonplace. Will that include the Icelandic fishing and whaling fleet, we wonder, and if so, by then will there be any fish or whales left for them to catch?

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Sea mammals and sound bites

An item under this heading about five years ago (Vol. 8, No.1, p.12) reported concerns that the hearing of marine mammals could be damaged by loud low-frequency sonar signals used by the US Navy to detect submarines. Naval exercises involving the deployment of military sonar have for some time been linked to cetacean strandings.

A year or so ago, soon after commencement of a naval exercise off the Canary Islands, several whales were stranded on local beaches. Tissue samples from them were found to be 'riddled with holes', lesions believed to result from decompression sickness (the 'bends') consequent upon surfacing too rapidly from deep water, possibly in 'panic response' to the sudden impact of loud sounds from an unknown source. The associated pain and discomfort could have rapidly caused the whales to become disorientend.

The marine zoologists who contributed to this study (*Nature*, 9 October 2003, p.575) note that their findings should 'be taken into account when considering ... the impact of anthropogenic sonar on cetaceans'.

Will the US Navy take notice of these discoveries and their implications for marine mammals and oceanic biodiversity? The outlook is unpromising (cf. *Nature, op cit*, p.549), as the Bush government seems keen to ensure that the Navy's sonar equipment be properly tested.

Ministers can stop dithering

The European Commission has now banned deep-water trawling over the Darwin Mounds, which are major cold-water coral ecosystems off north-west Scotland. The 'dithering' alluded to in the heading referred to British ministers who expressed concern about destruction of the reefs by trawlers but seemed unable to act, cf. *Ocean Challenge*, Vol. 12, No. 3, p.4 (see also *Nature*, 28 August, p.988). The reefs are part of the so-called Atlantic Frontier region of oil exploration, and it remains to be seen what steps the hydrocarbon industry will take to protect the reefs' ecosystems. What happened about the MPA the oil industry was legally obliged to establish over the Mounds?

Interested in sediment?
Then check out the bottom of p.31.

UKHO Ritchie Building opens

In July 2002, Rear Admiral G.S. (Steve) Ritchie, former Hydrographer of the Navy (1966–71), cut the first turf as work began on a new state-of-the-art archive repository for the UK Hydrographic Office (UKHO) at Taunton. The Ritchie Building became operational in October 2003, and the official opening by the Duke of Gloucester took place in November.

As well as producing navigational charts and publications, the UKHO houses a unique collection of charts, atlases and associated material, some of which date back to the 16th century. There are some 2.5 million records: charts produced by the Office itself, and material deposited by surveyors, mariners and explorers. Treasures include early atlases, works by Cook, Flinder's charts first using the name 'Australia', and Shackleton's Antarctic routes and letters. There are animal hides, and a 23-ft long parchment, as well recent surveys on plastic, electronic files and DVDs. Some 40 000 items if new information are received annually. The data are used for products and services, and are available to industry and the public for research.

The new building, which cost £3.5m, has many features enabling charts and documents to be stored safely (temperature and humidity control, and fire-protection systems), as well as studied effectively.

The Duke of Gloucester and Steve Ritchie at the opening of the new UKHO building. During his visit, the Duke was presented with a copy of As it Was: Highlights of Hydrographic History ... *(see book review on pp.33–34).*

Challenger Centenary Event a great success

On 6 October 2003, Challenger Society members gathered in London for the AGM, invited lectures and reception. The location was ideal – HQS *Wellington*, the HQ of the Honourable Company of Master Mariners. *Wellington* is moored in the Thames by the Victoria Embankment, and was converted for the purpose when it was made available by the Admiralty in 1947. Those present were generally not aware they were afloat, but the atmosphere on board is steeped in maritime history. The reception was held in the Model Room, at the bottom of a fine teak staircase (saved from the breaking up of the packet *Viper*). All around are ship models, maritime artefacts and antiques, books, paintings and ships' bells.

The talks and AGM were held in a sizeable lecture theatre. The talks were highly interdisciplinary, very different from what they would have been even ten years ago. They were: 'Progress in Marine Technology', by Gwyn Griffiths; 'They are Ocean Plankton, Jim, but not as we know them ...', by Mike Whitfield; 'The Evolution of Palaeo-climate Research', by Harry Elderfield; and 'Global Biogeochemical Cycles' by Andy Watson.

At the AGM, the President, Richard Burt, proposed Nichola Lane as President elect to take over from him at the next AGM. Jane Read continues as Hon. Secretary, while Sarah Cornell will take up the role of Hon. Treasurer. Roland Rogers, Jonathan Sharples, and Rachael Schreeve were newly elected to Council.

Beginning with the *Challenger*

Steven M. Perry and Daphne G. Fautin

The mission of the three-and-a-half-year *Challenger* Expedition (1872–76) was to confirm the existence of deep-sea life and to document it. During a voyage of 79 300 miles, the six staff scientists on board, under the direction of Wyville Thomson, took depth soundings and measured water temperature, salinity and density at 504 stations across the world (Fig. 1). At 277 of these stations, marine life was sampled with the use of dredges or trawls. The *Challenger* Expedition is credited with discovering more than 4 700 new species.

Published during 1880–95 under the direction of John Murray, the fifty-volume *Report on the Scientific Results of the Voyage of the HMS Challenger* meticulously documented and indexed the scientific findings of the Expedition. Because these were collected into a single, well organized resource that was available to scientists in a broad range of physical and biological sciences, it helped to spur interest in further expeditions and stimulated research in oceanography. It has been said that it was the *Report*, rather than the cruise itself, that provided the foundation for the new science of oceanography.

In its pioneering examination of the global distribution of marine species, the *Challenger* Expedition helped to disprove the hypothesis that the deep ocean was devoid of marine life because of high pressures and lack of light. The information we continue to gather about the distribution of marine species allows scientists to understand patterns of biodiversity, providing insight into the evolution, dispersal, and extinction of species.

The process of collecting distributional data for plants and animals has been boosted greatly by electronic tools, which have allowed the creation of large repositories called biogeographic information systems. Such systems, holding geo-referenced observations of accurately identified organisms, are used by scientists to formulate hypotheses on systematics, evolutionary processes, and the health of ecosystems. Many of these hypotheses concern the interaction of organisms with their environment, and databases containing species observations can usefully be linked to those providing environmental information.

Biogeoinformatics of Hexacorals

'Biogeoinformatics of Hexacorals' (http://www.kgs.ku.edu/Hexacoral/) is such a database; it is served by the Kansas Geological Survey at the University of Kansas, Lawrence, Kansas. Its biological component, Hexacorallians of the World (HoW) (http:/hercules.kgs.ku.edu/hexacoral/anemone2/index.cfm), aggregates data on sea-anemones, corals, and their allies. Its environmental component provides oceanographic data such as salinity, chlorophyll concentration, sea-surface temperature and depth.

To guarantee high quality and auditability of information, each species observation in HoW provides the bibliographic reference to the article in which the observation was initially published. Many of the specimen observations are tied to museum holdings, and a user can search the database for bibliographic data including publication, author, or museum, and for images from the original publication and previously unpublished images of type specimens. HoW also contains detailed taxonomic information for each family, genus, and species. In addition to the basic functionality of allowing a search by current valid taxonomic names, most species records are tied to a comprehensive synonymy that lists all names used for the species and references to the publications in which they appeared. There are also common names for some species.

While detailed taxonomic and bibliographic information for each species makes HoW a useful tool for tracking down all the literature associated with a species, its power as a biogeoinformatics system is apparent when examining species distributions. A user can search for species records by locality in a variety of ways. All the occurrences of a species can be plotted on a world map. Alternatively, a search can be for all the species occurring in a geographical area – by the name of a place, including countries as defined by their Exclusive Economic Zone (EEZ), by Longhurst Biogeographic Region, and by Large Marine Ecosystem (LME). Because HoW is tied to a back-end GIS (Geographic Information System) and is integrated with ArcIMS (Arc Internet Map Server), species records can also be searched for using interactive, clickable maps, including maps of the EEZ, Longhurst regions, LMEs, or areas delimited by rectangles drawn on a map.

Many of the species records in the database are from oceanographic expeditions. HoW therefore also

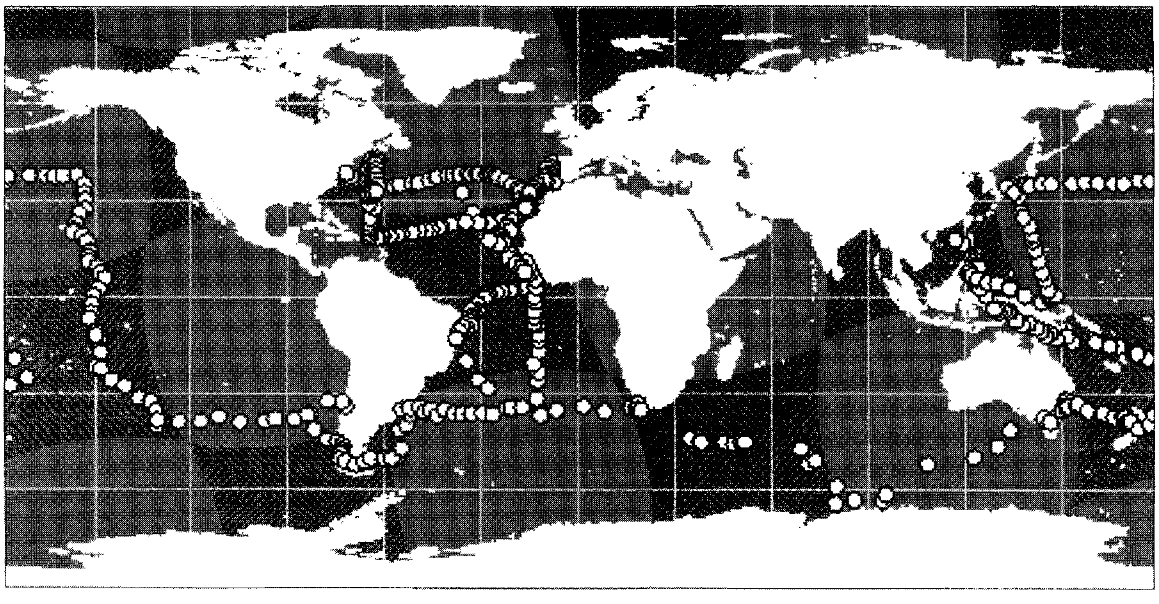

Figure 1 *Map of the 504* Challenger *Expedition stations generated by 'Hexacorallians* of the World'. Clicking on any point will display the data for that station (see Fig. 2).*

*Hexacorallians are members of cnidarian orders Actiniaria, Antipatharia, Ceriantharia, Corallimorpharia, Scleractinia, and Zoanthidea.

Expedition : Challenger Expedition 1873-1876		
Details for station 293		
From Expedition Report	**Chart title:** Tahiti to Valparaiso **This station occurs on chart(s):** 38 **Verbatim date:** November 1, 1875 **Start date:** 1875-11-01 **Latitude:** -38.93 **Longitude:** -104.92 **Depth:** 2025 **Depth units:** fathoms **Depth description:** **Bottom nature:** Globigerina ooze.	**Temperature surface:** 53.7 **Temperature bottom:** 34.4 **Temperature serial:** Y **Specific gravity surface:** 1.02522 **Specific gravity bottom:** 1.02573 **Sounding:** 438 **Method:** Trawled **Tools used:**
Environmental Data	• Environmental Summary • Time series Sea Surface Temperature One-degree weekly Reynolds SST Two-degree monthly Reynolds SST One-degree monthly Hadley SST	
Specimens	• 1 Specimen Observations	

Figure 2 *Information for station 293 in HoW.*

allows searching by expedition. To develop the prototype of the 'search by expedition' functionality, we entered into the database data on latitude, longitude, depth, date, gear, temperature and salinity for all *Challenger* stations (Fig. 2) and linked them to an interactive, clickable map. A user can view the track of the *Challenger* Expedition, and by clicking on a particular station can view a comprehensive record of all the hexacoral specimens that were collected at that station. We also display the expedition charts as published in the *Challenger Report*, and these, too, can be viewed on an interactive world map. We are now adding datasets for many more expeditions.

Census of Marine Life and OBIS

HoW is one of a growing number of biogeographic information systems that aggregate information on marine species. Others include FishBase (http://www.fishbase.org), which covers marine and brackish-water fishes, and CephBase (http://www.cephbase.org), for cephalopods (octopuses and squid). Until recently, scientists who were interested in studying the diversity and distribution of marine life would have to search many books and tediously analyze all the information they contain. More recently, they would have to search multiple databases. Either way, large-scale studies were difficult, because of the expense of data discovery, collection, and analysis.

OBIS, the Ocean Biogeographic Information System (http://www.iobis.org) was developed to facilitate the study of large-scale marine biodiversity. It acts as the data repository for the Census of Marine Life (http://www.coml.org), a global network of marine scientists in nearly 50 countries engaged in a 10-year initiative to assess and explain the diversity, distribution, and abundance of marine life and how it changes over time.

OBIS is an international effort to draw together accurately identified, georeferenced information on marine animals and plants and serve that information through a single, searchable, on-line interface. It provides a user with query tools for searching one or more of its data-providers simultaneously by variables such as taxon, location, depth, and date of specimen collection, plus various environmental parameters. The results can be visualized by a variety of mapping and data modelling services. Because the results of an OBIS query are specimen observations that are taxonomically and geographically resolved, the OBIS mapping and data-modelling tools allow a user to examine species in the context of their environments using physical, chemical and biological oceanographic data (cf. Fig. 3).

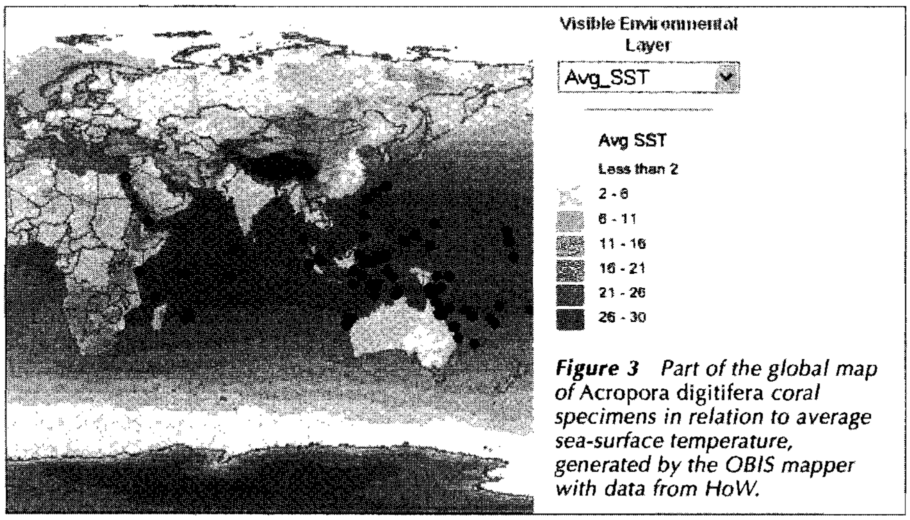

Figure 3 *Part of the global map of* Acropora digitifera *coral specimens in relation to average sea-surface temperature, generated by the OBIS mapper with data from HoW.*

While OBIS allows searches of species occurrences across multiple databases, it is not itself a database. Instead, when someone uses the OBIS query system, member databases are queried, and the information is put in a common format. The databases that serve data to OBIS do not all contain the same type of information in the same format; they are simply able to communicate with OBIS in a common protocol or language. This allows the proprietors of each database the freedom to structure data in the way they find most useful, as long as their system supports the OBIS schema. For instance, the earliest version of HoW was created mainly as a tool for taxonomists and therefore it includes a great deal of information on scientific names, their synonymies, and bibliographic sources. Other marine life databases began as collections of specimen photographs, and some are repositories for museum collection information. However, as long as each can provide well identified, geo-referenced species observations, it can provide data to OBIS.

Challenger Stations On-Line

The first 48 volumes of the *Challenger Report* are much like individual biogeographic information systems because most volumes contain one or more chapters on a subset of related species – such as the corals or the cephalopods. However, the final two volumes of the *Challenger Report* provide a list of species collected at each station. Indexes across species observations by geographical location are very valuable to scientists studying biodiversity, but they are unusual for expedition reports, probably because they require a great deal of tracking and cross-referencing.

The general practice for a marine expedition on which a large number of specimens are collected is for the specimens to be shipped to experts around the world for identification, and for the experts to publish their results in peer-reviewed journals. For some expeditions (e.g. *Challenger)*, taxonomic experts publish their results in a series devoted to the expedition so at least the information is in one place; for others, the results are published in a variety of outlets. However, because those who identify specimens are typically experts in only a few taxa, each publication focusses on a particular taxon, so it is difficult to get a comprehensive picture of the species that might inhabit each place sampled, and so get a sense of the ecology. HoW used the final two volumes of the *Challenger Report* as a model for a system to query marine biogeographic information systems by station. Now it is possible to find, through HoW, which hexacoral species were collected at which *Challenger* stations. With the station data for the *Challenger* Expedition now on line, we are working on the station data for other expeditions.

We hope that, in the future, other marine biogeographic information systems will contain specimen observations tied not only to locality, but also to the expedition and station where the specimen was collected. Those developing such databases need not go through the keyboarding we did to capture the locality and physical attributes for each *Challenger* station (data that are available for download from the HoW website). Nor is it necessary for those data to be incorporated into another database: records for cephalopods collected on the *Challenger* Expedition were entered into CephBase, along with the *Challenger* station number for each, but the details for a station can be obtained by CephBase from HoW through an interactive link. This, too, is a prototype for what we envision will be a service of OBIS: OBIS will have all expedition data and charts, so that any dataset served through the OBIS portal could be searched for records from any expedition station. So a trawl full of deep-sea animals that had been dispersed to taxonomists around the world could be reconstituted virtually, enabling us to know not only where *Challenger* collected (say) sea anemones, but also what shrimps, sea stars, flatworms, etc. lived in the same place as the anemones, thereby providing important ecological information about each site sampled as well as information on individual species.

Acknowledgments
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Steven Perry and **Daphne Fautin** are at the Dept of Ecology and Evolutionary Biology, and the Natural History and Biodiversity Research Center, University of Kansas (Emails: smperry@ku.edu and fautin@ku.edu)

Concrete boats

The raising of a quizzical eyebrow was suggested by the 'sic' that followed 'concrete' in 'Now, there's a funny thing ...' in the last issue of *Ocean Challenge* concerning the creation of offshore cities using concrete tanks for buoyancy. In fact ferro-cement boats were patented by the French in 1855 and they remain one of the most favoured methods for the amateur construction of boats that are more than 25 feet long. The technique is particularly popular in Britain where craft constructed in this manner are referred to as 'concrete' boats. The method involves building a frame for the hull from steel rods and tubes which are bent to shape to form the ribs and stringers and then covered by several layers of wire netting. The netting is held to the steel frame using twists of wire and is built up in layers until it reaches a thickness of a few inches. Then a team of labourers and some skilful plasterers coat the hull with cement (which must be accomplished in a single day) and allow it to dry slowly in a controlled manner over several days to avoid cracking. (I speak from experience. I was one of the labourers when a friend built a 38ft-long sailing boat in 1972. May I never push as many wheelbarrow-fulls of cement across a garden in a single day ever again.)

Concrete floating structures played a central role in the D-Day landings during the Second World War. Two artificial harbours were created by towing concrete barges across the English Channel to form breakwaters and docks for the British and American forces at Omaha Beach and Arromanche. The code name for the secret plan was 'Mulberry' so that was the name given to the structures. Unfortunately the mulberry near Omaha Beach was destroyed by a storm in the week after D-Day but the other survived and was in constant use by both forces for several months.

Alan Elliott
Menai Bridge

Well, I had (sort of) heard of concrete ships built during World War II, but had forgotten. Your letter provides a fascinating summary of how concrete can be excellent for ship-bulding, and of course it can provide suitable 'floats' for any offshore housing planned in future years.
John Wright

Fishermen are not pests

I hesitate a little to write, but thought I should voice a note of concern. I always read *Ocean Challenge* avidly, and think it has come along greatly from its origins. However, I am worried by some of the 'editorial' that appears under News and Views. In the last issue (Vol.12, No.3), under 'Iceland to save cod by culling whales', you have the phrase 'Fishermen see seals and whales as pests, but from the point of view of the marine environment the real pests are the fishermen themselves ...'

I think this is a bit strong. *Ocean Challenge* should reflect objective science, not personal feelings. Many organizations work very hard to include 'stakeholders', such as fishermen (or more correctly fishers) in discussions concerning marine science. While we personally may hold opinions as members of society, as scientists shouldn't we restrict public comments to scientific aspects of ecological impacts of the fishing industry, rather than labelling fishermen as 'pests'?

I have seen the personal effort and concern with which scientists from this institute enter into long, protracted, heated and stressful negotiations with fishermen, trying to explain the science behind stock assessment and the ecosystem approach. Our colleagues deserve our support in their attempts to reach out to the fishing community, and do not need the misunderstanding that could be caused by ill-judged comments. As happened in Canada, fishing communities in north-eastern Scotland are coming under pressure because of what they perceive to be inaccurate science, and things are very tense between scientists and fishermen just now.

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We hope that, in the future, other marine biogeographic information systems will contain specimen observations tied not only to locality, but also to the expedition and station where the specimen was collected. Those developing such databases need not go through the keyboarding we did to capture the locality and physical attributes for each *Challenger* station (data that are available for download from the HoW website). Nor is it necessary for those data to be incorporated into another database: records for cephalopods collected on the *Challenger* Expedition were entered into CephBase, along with the *Challenger* station number for each, but the details for a station can be obtained by CephBase from HoW through an interactive link. This, too, is a prototype for what we envision will be a service of OBIS: OBIS will have all expedition data and charts, so that any dataset served through the OBIS portal could be searched for records from any expedition station. So a trawl full of deep-sea animals that had been dispersed to taxonomists around the world could be reconstituted virtually, enabling us to know not only where *Challenger* collected (say) sea anemones, but also what shrimps, sea stars, flatworms, etc. lived in the same place as the anemones, thereby providing important ecological information about each site sampled as well as information on individual species.

Acknowledgments

Development of HoW has been funded largely by US NSF grants DEB95-21819 and DEB99-78106 in the Partnerships to Enhance Expertise in Taxonomy program, and supplements in the Research Experience for Undergraduates program. Additional funding was provided by US NSF grant OCE00-03970 in the National Oceanographic Partnership Program. The Challenger Project was funded by a grant from the University of Kansas as part of the Digital Library Initiatives.

Steven Perry and **Daphne Fautin** are at the Dept of Ecology and Evolutionary Biology, and the Natural History and Biodiversity Research Center, University of Kansas (Emails: smperry@ku.edu and fautin@ku.edu)

Concrete boats

The raising of a quizzical eyebrow was suggested by the 'sic' that followed 'concrete' in 'Now, there's a funny thing ...' in the last issue of *Ocean Challenge* concerning the creation of offshore cities using concrete tanks for buoyancy. In fact ferro-cement boats were patented by the French in 1855 and they remain one of the most favoured methods for the amateur construction of boats that are more than 25 feet long. The technique is particularly popular in Britain where craft constructed in this manner are referred to as 'concrete' boats. The method involves building a frame for the hull from steel rods and tubes which are bent to shape to form the ribs and stringers and then covered by several layers of wire netting. The netting is held to the steel frame using twists of wire and is built up in layers until it reaches a thickness of a few inches. Then a team of labourers and some skilful plasterers coat the hull with cement (which must be accomplished in a single day) and allow it to dry slowly in a controlled manner over several days to avoid cracking. (I speak from experience. I was one of the labourers when a friend built a 38ft-long sailing boat in 1972. May I never push as many wheelbarrowfulls of cement across a garden in a single day ever again.)

Concrete floating structures played a central role in the D-Day landings during the Second World War. Two artificial harbours were created by towing concrete barges across the English Channel to form breakwaters and docks for the British and American forces at Omaha Beach and Arromanche. The code name for the secret plan was 'Mulberry' so that was the name given to the structures. Unfortunately the mulberry near Omaha Beach was destroyed by a storm in the week after D-Day but the other survived and was in constant use by both forces for several months.

Alan Elliott
Menai Bridge

Well, I had (sort of) heard of concrete ships built during World War II, but had forgotten. Your letter provides a fascinating summary of how concrete can be excellent for ship-bulding, and of course it can provide suitable 'floats' for any offshore housing planned in future years.
John Wright

Fishermen are not pests

I hesitate a little to write, but thought I should voice a note of concern. I always read *Ocean Challenge* avidly, and think it has come along greatly from its origins. However, I am worried by some of the 'editorial' that appears under News and Views. In the last issue (Vol.12, No.3), under 'Iceland to save cod by culling whales', you have the phrase 'Fishermen see seals and whales as pests, but from the point of view of the marine environment the real pests are the fishermen themselves ...'

I think this is a bit strong. *Ocean Challenge* should reflect objective science, not personal feelings. Many organizations work very hard to include 'stakeholders', such as fishermen (or more correctly fishers) in discussions concerning marine science. While we personally may hold opinions as members of society, as scientists shouldn't we restrict public comments to scientific aspects of ecological impacts of the fishing industry, rather than labelling fishermen as 'pests'?

I have seen the personal effort and concern with which scientists from this institute enter into long, protracted, heated and stressful negotiations with fishermen, trying to explain the science behind stock assessment and the ecosystem approach. Our colleagues deserve our support in their attempts to reach out to the fishing community, and do not need the misunderstanding that could be caused by ill-judged comments. As happened in Canada, fishing communities in north-eastern Scotland are coming under pressure because of what they perceive to be inaccurate science, and things are very tense between scientists and fishermen just now.

You are in danger of opening up *Ocean Challenge*, and the Challenger Society, to criticism from an industry that feels itself under attack from scientists. You may also anger fishery scientists who perceive academia and the physical sciences as naive in terms of how to deal with the fishing industry. As a member of the Society of 20 years standing (and formerly on the Editorial Board), I believe we need to be more objective in publications such as the magazine, and News & Views should stick more clearly to science issues. Please do not turn *Ocean Challenge* into an opinion-led magazine, keep it as representative of objective marine science, much of which is carried out in fisheries institutes whose purpose is to work with industry rather than against it.

Articles quantifying the impact of fishing are great, articles about 'bad fishermen' are not.

Bill (Dr W.R.) **Turrell**
Marine Ecosystems Programme Science Director
FRS Marine Laboratory Aberdeen

We apologise to the Scottish fishing community for the term 'pests' used in the item about Icelandic whaling. We plead mitigation by citing another News & Views item headed 'Cod Wars are different now', a sympathetic tale about the wives of Scottish fishermen whose boats are being scrapped/decomissioned, 'pleading [unsuccessfully] for Government support for their husbands who cannot fish because of the cod ban'. We do not wish to denigrate fishing communities anywhere, but the fact remains that the principal reason for the cod ban has not been predation by seals but human overfishing (which has *inter alia* removed the seals' natural prey).

Nobody should be surprised that fishermen and scientists disagree about the size and availability of fish stocks. On the other hand, it is difficult to deny that nets – including trawl nets – have made a something of a mess of marine ecosystems over the past couple of decades, destroying sea-bed organisms and habitats and causing large numbers of by-catch mortalities. Since fishermen control the nets that cause the damage, it must be true that from the point of view of the marine environment fishing activity can be very destructive. Nonetheless, fishing communities have enough to contend with, especially in Britain, and their hardships don't need the additional burden of derogatory name-calling. Finally, we should stress that in our original piece the term 'pests' was used to highlight the fact that we humans take (naturally) an anthropocentric view of the world.

Eds

Testing for Toxins

The item in *Ocean Challenge* Vol.12, No.1 entitled 'No more cockles ... or mussels' contains a series of inaccuracies and misleading statements.

It is implied that CEFAS has chosen to use an unreliable method for testing or the presence of toxins in shellfish flesh, and that other laboratories have failed to obtain similar results. Neither claim is correct.

The truth is that this test is the international norm, required by European Union law, and used by the official Government testing laboratories in the UK, France, Spain, Portugal, Denmark, Greece, Italy, the Republic of Ireland and Norway, as well as the major shellfish producing countries world-wide, including Canada, New Zealand and Japan. Though a replacement test is desirable, and several laboratories – including CEFAS – are working to develop alternatives, there is currently no better validated test capable of detecting the presence of new or unusual toxins.

CEFAS is not the only laboratory to report problems with toxicity in cockles. The Government laboratory responsible for testing in Northern Ireland has also obtained positive results requiring the closure of cockle fisheries.

Contrary to your assertion, the test results found in cockles have already led to rapid action to assess the validity and standardisation of the test method, and the Food Standards Agency has published the results of an independent audit of test procedures across the UK. Work is in hand to investigate further the cause of toxicity in the samples. Until that is established, protection of public health can only be assured by suspending the consumption of these shellfish.

The article further comments on the assessment of water quality in mussel harvesting areas, also incorrectly. These tests (which are not carried out by CEFAS) are used to detect contaminants derived from sewage, and all UK classification-testing laboratories employ the agreed EU reference method, for which they are accredited and take part in an independent quality assurance scheme. If the alleged reclassification of British-grown mussels in other countries is indeed taking place, it is illegal and potentially harmful to the health of consumers.

Peter Greig-Smith
Chief Executive, CEFAS

Editors' response

We asked the Shellfish Association of Great Britain (SAGB) to comment on our 'No more cockles ...' News item, and they sent us copies of documents prepared for the Environment, Food and Rural Affairs Committee (EFRAC), These documents, which are based on independent reports by Prof. Hugh Makin, the Macauley Institute and Central Science Laboratories (published by the Food Standards Agency in October 2003), dispute the validity of the mouse test bioassay (MBA) as conducted at CEFAS, Weymouth, when the mouse deaths were occurring, and indicate that the mice were probably being killed by carry-over of solvents (ether and acetone) and 'cockle juice'. The methodology which is the 'international norm, required by European Union Law' is designed to remove such carryover. The Home Office has now insisted that no solvent is present in the injectate, and no 'atypical positives' have been recorded since the test was modified.

Problems with MBA methodology with respect to Diarrhetic Shellfish Poisoning (DSP) are well known and have been formally addressed by most countries using it. Germany and Holland no longer use the test on animal welfare grounds, while Scotland (and the UK, pre-devolution), France, Spain, Portugal, Ireland, Italy, New Zealand and Canada have procedures in place to ensure that solvent and cockle matrix material are not injected into mice. New Zealand and Ireland have now converted to non-animal, chemical regulatory testing.

Alluding to the findings of the reports, Dr Peter Hunt, Director of the SAGB, was highly critical of the Food Standards Agency, which closed the cockle beds, referring to its 'misapplication of the precautionary approach, poor science and lack of transparency'. In a submission to EFRAC, Dr Clive Askew (Assistant Director of the the SAGB) writes that the FSA's difficulty in dealing with the toxin-monitoring question arises from the fact that they are "so deeply entrenched in the view that 'we are right' ". He also indicates that the FSA's refusal to accept that there might have been problems with the modified version of the mouse test is in effect hindering a move towards chemical testing, which (apart from avoiding animal suffering) can detect lower levels of toxins than the mouse test, and can provide quicker warnings to consumers if cockles already on the market are not safe to eat.

It is hardly surprising that the cockle industry queried the coincidence of simultaneous contamination in areas as far apart as South Wales, the Thames Estuary and the Wash with transfer of testing to CEFAS, Weymouth (particularly as at the time there were no blooms of the algae associated with Diarrhetic Shellfish Poisoning (*Dinophysis* spp. and *Prorocentrum lima*)). The SAGB comment that duplicate samples sent to FRS Marine Laboratory in Aberdeen, and to laboratories in Holland and France, failed to replicate the atypical results; also that although many tonnes of cockles were harvested and consumed during the periods of 'atypical positive results', there were no reports of illness.

Eds

Advanced lander allows 'in situ' studies in the depths of the Arabian Sea

Eric Breuer, Oli Peppe, Greg Cowie and Tracy Shimmield

Processes occurring in the vicinity of the water–sediment interface in the oceans are of major importance in global cycling and burial of carbon and other biologically important elements; they therefore also affect the make-up of sedimentary records, and act as a coupling between the sedimentary and water-column environments. Organisms living in or on the surface sediments, from bacteria to the largest surface-dwelling and burrowing creatures, strongly influence these biogeochemical processes, and therefore the chemical composition of the sediments. Yet, because the benthic interface is so difficult to access, investigations to date have largely been conducted on recovered sediment cores and, at best, on individual organisms removed from their natural environment. As a result, our understanding of the mechanisms and rates of benthic biogeochemical processes, and especially the roles of benthic communities, remains comparatively poor.

A major constraint on investigating the benthic interface has been the difficulty involved in collecting undisturbed material from the sea bed, and sediment disturbance and changes in pressure and temperature could create sampling artefacts. With the development of remotely deployed instrument platforms – 'benthic landers' – we now have the opportunity to examine these processes under *in situ* conditions.

Although originally developed for deep-sea measurements, benthic landers are now used in a diverse range of environments such as sulphide-oxidizing bacterial mats, anthropogenically perturbed environments, estuarine environments, hydrothermal areas and coastal sediments. SAMS has been involved in lander research since 1994, and its fleet includes two landers equipped with biogeochemical instrumentation. These have been used during the BENBO programme for benthic studies in the north-east Atlantic, in the North Sea MIME programme to investigate drill-cuttings piles, and recently in the Arctic to investigate to what extent benthic faunal composition and size structure determine carbon dynamics and biogeochemical provinces at the benthic boundary.

The primary controls on benthic communities are food supply – the rain of organic debris from overlying waters – and the concentration of oxygen in bottom waters overlying the sediments. In the Arabian Sea, upwelling caused by the monsoon winds means that surface waters show seasonally intense primary productivity and hence strong variability in the export of organic matter to depth. The Arabian Sea is also home to another remarkable phenomenon: the oxygen minimum zone (OMZ) – a mid-water zone, between depths of about 200 m and 1000 m, that is almost entirely devoid of oxygen. Where this layer meets the Arabian Sea's margins, the sediments are essentially devoid of life other than anaerobic bacteria. Moreover, the anaerobic conditions occurring within the OMZ sediments appear to result in accumulations of organic matter. As a result, through its record of sedimentation at sites above, within and below the OMZ and under both inter-monsoon (March–May) and post-monsoon (August–October) periods, the Arabian Sea offers a unique natural laboratory for detailed study of benthic communities and biogeochemical processes under contrasting reduction–oxidation (redox) conditions and food supply.

This issue is being addressed by a project involving biologists and geochemists from the University of Edinburgh, the Scottish Association for Marine Science, Liverpool University and Southampton Oceanography Centre, and funded by NERC and the Leverhulme Trust. In 2003, the team, along with collaborators from the USA, the Netherlands, Pakistan and India, participated in four research cruises to the Arabian Sea on RRS *Charles Darwin*. We hope to report results from these cruises in a future issue of *Ocean Challenge*.

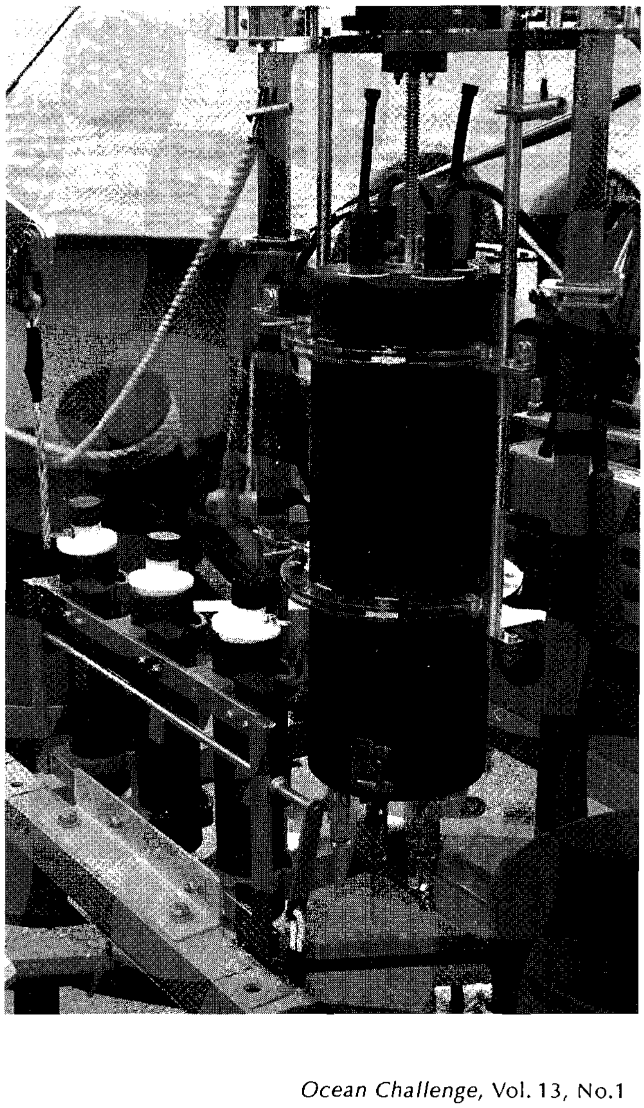
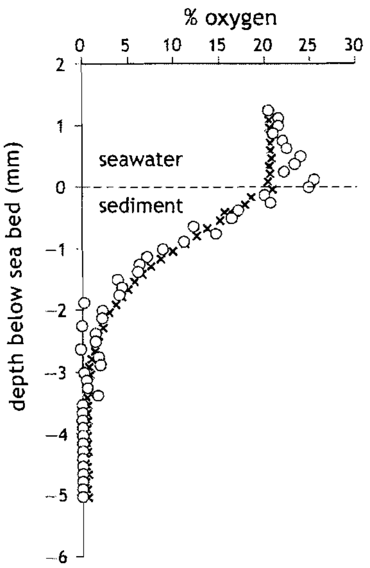


Figure 1 *The micro-electrode module for measuring oxygen concentration in the sea-bed sediment. The electrodes are fitted to the bottom of the large black cylinder, which is then driven towards the sediment by a motor.*
Two of the legs of the lander can be seen either side of the black cylinder.

During the Arabian Sea cruises, 'traditional' surveys were used not only to provide reliable information, but also to act as a vital backdrop for the more novel aspects of the project, which focussed on characterising and quantifying benthic processes and the roles of benthic communities *in situ*, using remotely deployed benthic landers.

The benthic landers, which are designed to settle to the sea floor and there conduct pre-programmed functions before releasing ballast and floating to the surface, were used with two different instrumentation modules. The first module (Figure 1) drives microelectrodes into the sediments to provide high-resolution profiles (variation over tens of microns) of porewater oxygen concentrations. These data will provide oxygen penetration depths, benthic aerobic respiration (by modelling oxygen profiles), redox horizons, and organic carbon flux and remineralization rates. Figure 2 shows preliminary oxygen data collected during our spring 2003 cruise.

Figure 2 *Profile of oxygen concentration in the porewater of sediment at a water depth of 140 m on the Pakistan margin. Note the rapid depletion of oxygen within the top 3 mm of sediment.*



The second module, known as ELINOR (Figure 3), consists of a box which is partially inserted into the sediments to enclose overlying waters, forming an *in situ* incubation chamber. The waters are gently stirred and water samples are collected at pre-determined intervals, whilst electrodes monitor oxygen and pH levels inside and outside the chamber. The water samples and undisturbed sediments are recovered with the lander at the end of the deployment.

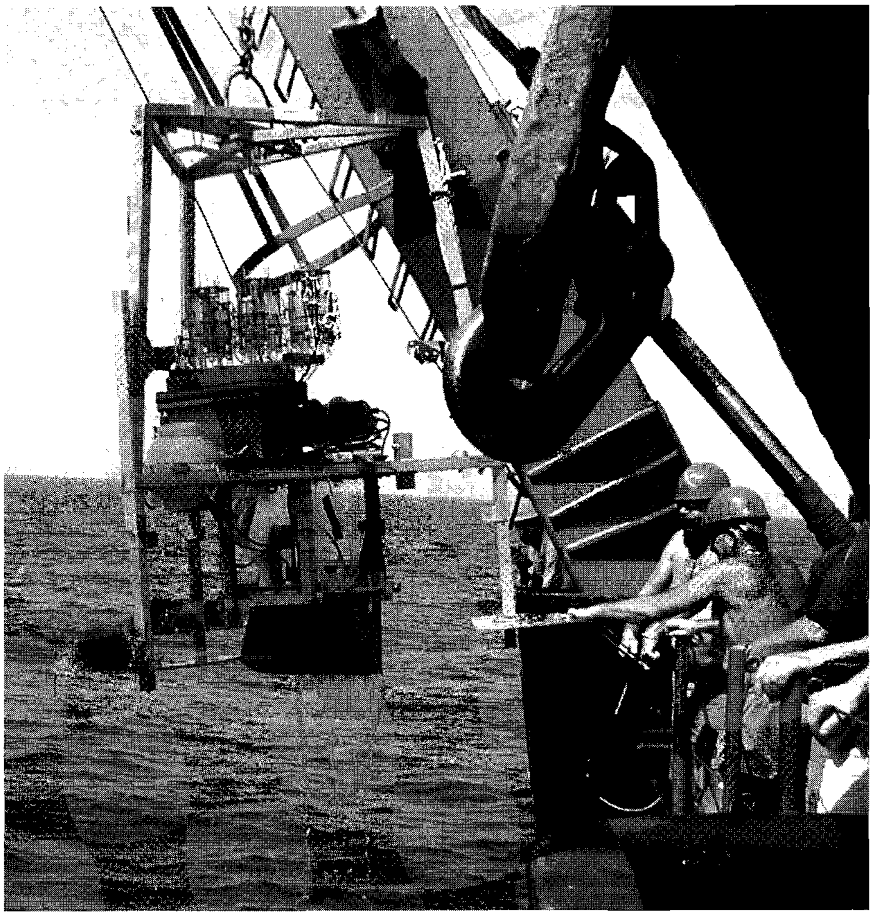


Figure 3 *The ELINOR chamber module being recovered from a mooring in the Arabian Sea. The chamber is at the very bottom of the instrument, with the sediment recovery shovel closed. The syringe water sampler can be seen at the top, above the battery.*

ELINOR was deployed in three modes at each site. In the first mode the incubation chamber was left to go anoxic and dissolved oxygen and nitrogen were monitored to determine rates of oxygen consumption and denitrification. The second mode used a newly developed 'oxystat' system to maintain oxygen inside the chamber at ambient levels. This is achieved by pumping chamber water through gas-permeable tubing in contact with surrounding seawater. Water samples from these incubations were collected to determine fluxes of nutrients, trace metals and dissolved organic matter, analyses which require constant redox conditions. Other studies involved addition of three sizes of fluorescent particles (of different colours) which, after recovery of the sediments, were used (via UV photography and flow cytometry) to assess the extent and rates of mixing and of size-selective particle ingestion by benthic animals. In the last, and perhaps most important, mode, ^{13}C-labelled algal organic matter was added to the chamber at the start of the experiment. Oxygen concentrations were again maintained and overlying waters periodically sampled, but the sediments (and fauna) were also recovered at the end of the deployment. The labelled carbon was tracked into the overlying waters, sediments, porewaters and fauna, and this should, for the first time, permit *in situ* determination of rates and pathways of benthic carbon cycling under different redox conditions.

This combination of biological and geochemical *in situ* analyses allowed a unique opportunity to investigate Arabian Sea benthic communities and processes. The analyses will also provide valuable information on benthic fluxes of trace metals, nutrients and dissolved organics, on benthic–pelagic coupling, and on the roles of benthic communities and other environmental factors in sedimentary carbon cycling and burial.

For more on the Arabian Sea work see: http://www.sams.ac.uk/dml/news

Eric Breuer, **Oli Peppe** and **Tracy Shimmield** are at the Scottish Association for Marine Science, Dunstaffnage Marine Lab, Oban; **Greg Cowie** is at the University of Edinburgh, Department of Geology and Geophysics.

Hussein Faouzi: Pioneer Arab Oceanographer

Sayed Z. El-Sayed and Selim Morcos

During the John Murray Expedition to the Indian Ocean in 1933–34 (see the following article), two men from vastly different backgrounds came together to work on a project dear to both of them. One, Seymour Sewell, worked tirelessly to make the results of the Expedition available to other scientists (see pp.15–16); the other was a polymath whose career was diverse and wide-ranging. This extraordinary man was Hussein Faouzi.

Born in Cairo in 1900, to a modest middle class family, Hussein Faouzi received his formal education in Egypt. After finishing secondary school he attended the School of Medicine at Kasr Al-Ainy, Cairo, where he graduated in 1923. He specialized in ophthalmology and for two years he worked for the Egyptian Ministry of Health. In 1925, the Egyptian Government sent him on a mission to France to study marine science and fisheries. This was a turning point in his life, because it resulted in him abandoning his medical career.

While in Paris, he studied natural science and general physiology; then at the University of Toulouse he took specialized courses in hydrobiology and fish culture, earning himself an advanced degree in aquaculture. He later enrolled in the Department of Comparative Anatomy at the Sorbonne, and while in Paris attended lectures on biological and physical oceanography at the Institut océanographique. Before returning to Egypt he made extensive tours of European marine institutes, visiting laboratories in the UK, France, Germany, Norway, Denmark, Italy and Monaco, establishing professional ties with many of the leading marine scientists of the time.

Upon his return to Egypt in 1931, he was appointed Director of the Institute of Hydrobiology and Fisheries in Alexandria, succeeding R.S. Wimpenny. He was the first Egyptian to hold that position. He also was the first Egyptian to represent his country at the Assembly and Central Bureau of the International Commission for the Scientific Exploration of the Mediterranean (ICSEM). (Egypt had been a founding member of ICSEM in 1919, but until Faouzi's appointment it had been represented by foreign scientists working for the Egyptian Government.)

In 1933 Faouzi and a colleague, Dr Abdel Fattah Mohamed, joined the John Murray Expedition to the Indian Ocean aboard the Egyptian RV *Mabahiss*. During the Expedition, Faouzi acted not only as marine biologist but also as the ship's doctor. After the Expedition, Faouzi returned to his position as Director of the Fisheries Institute until 1941, when he was appointed Dean of the Faculty of Science and Professor of Zoology at the newly established Farouk University (now the University of Alexandria).

In 1948, Faouzi and Mohamed founded the Department of Oceanography, the first of its kind in the Middle East. In 1956, Faouzi was appointed Acting President of the University of Alexandria, a position he held until his final appointment as Permanent Under-Secretary of State in the new Ministry of Culture. He retired from Government service in 1960.

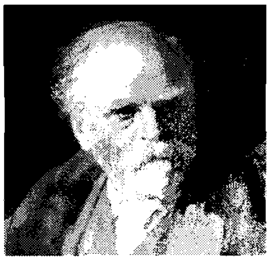
After retirement, he headed the National Academy of Arts, and later became President of the 'Institut d'Egypte' or the Egyptian Scientific Council (known in Arabic as the Al - Magm'a Al-Masri). This is the oldest academic council in the country, established at the end of the eighteenth century, following the French tradition of fostering a broad range of knowledge, including natural and human sciences.

Faouzi was a gifted writer, having authored nineteen books, mostly in Arabic. He was fluent in several languages, and was steeped in Arabic/Islamic culture as well as western culture, and was equally at home in both. He truly personified that erudite breed of Egyptian intellectuals who embodied both eastern and western cultures. He was among those few pioneers who introduced the 'short story' to modern Arabic literature. In his enormously popular 'travelogue' book series, in which he adopted the character of the famed peripatetic Arab traveller Sindbad, he wrote voluminously on his travels to the Indian Ocean (based on his experience during the John Murray Expedition) and to many other far-flung places. For forty years he was a regular contributor to *Al-Ahram* (the leading newspaper of the Arab World) on a multitude of subjects including culture, music, literature, theatre and humanities. But it was history in general, and Egyptian history in particular, that was his foremost interest. He viewed history as a continuum, and argued that contemporary western civilization has deep roots in Thebes, Memphis, Alexandria, Athens, Rome, Cairo and Damascus. He wrote extensively on the Renaissance Period and published a book on the Florentine Renaissance, the first of its kind in Arabic. However, his greatest passion was music. He was a good violinist and was tutored by an Italian music teacher. He wrote widely on the history of music (Arabic and western) and introduced western classic music to his countrymen in his popular radio programme 'The Best of Classic Music'.

His contributions to the fields of oceanography, limnology, fisheries and fish culture were no less significant, though by comparison not as immense or prodigious as those in literature, art, music and history. His greatest contribution to oceanography was his founding of the Department of Oceanography at Alexandria University. There is no doubt that this Department has had a great impact on the development of the science of oceanography, not only in Egypt, but also throughout the Arab world, as its pioneer graduate students followed their mentor's example, and established similar departments in many Arab countries. Several others served in African universities and institutions. Although Faouzi received several national and international awards and honours for his literary and scientific contributions, none could have given him more pride and greater satisfaction than the accomplishments of his own former students, several of whom have held prominent positions in such organizations as FAO, UNESCO and UNEP, and many others who have served with distinction in academic institutions in the US, Germany, Canada and elsewhere.

Professor Hussein Faouzi, pioneer Arab oceanographer, died in Cairo in 1988.

Sayed Z. El-Sayed is Professor Emeritus at the Department of Oceanography, Texas A&M University; **Selim Morcos** was formerly Professor of Oceanography at the University of Alexandria, Egypt. In 1973 he joined UNESCO, Paris, as a senior specialist in marine sciences.



70 years on ... The John Murray *Mabahiss* Expedition to the Indian Ocean 1933–34

Selim Morcos

It is now seventy years since the John Murray Expedition to the north-west Indian Ocean (1933–34) on the Egyptian Research Vessel *Mabahiss*. The John Murray *Mabahiss* Expedition (JMME) lasted nine months from September 1933 to May 1934 (so including both South-West and North-East monsoon seasons), and covered the Red Sea, Bab el Mandab Strait, the Gulf of Aden, the Arabian Sea and the Gulf of Oman (Figures 1 and 2). A good cruise plan provided a detailed picture of seasonal change in the first three regions, where the oceanographic stations were repeated on the outward and return voyages. With its 10 legs and 209 stations, the expedition was the longest and most detailed survey to be undertaken before the International Indian Ocean Expedition (IIOE). With the decline of oceanographic exploration during World War II, the observations of the JMME were unique in being the only dataset to be produced in the three decades between the limited observations of *Dana* (1928) and *Snellius* (1929), and the beginning of the IIOE in the early 1960s.

The Expedition had a scientific team composed of five British and two Egyptian scientists (Figure 3). With the exception of the Captain, Chief Engineer and wireless operator, the ship's staff – including the naval officers, engineers and crew – were all Egyptians.

The Expedition was led by Lt-Col. R.B. Seymour Sewell, and the ship's doctor and the representative of the Egyptian Government was the marine biologist Dr Hussein Faouzi.* These two, who got to know one another over the course of nine months, later became leading figures in their communities, Sewell through his enduring accomplishments as editor of the results of the Expedition, and Faouzi as a messenger of tolerance with a towering intellect, who passionately embodied both eastern and western cultures.

This Anglo-Egyptian expedition was the first of its kind in the history of oceanography, an extraordinary example of large-scale scientific cooperation between an advanced country and a developing nation. The Expedition not only laid the foundation of modern knowledge of marine science in the north-west Indian Ocean but also, by stimulating interest in the subject in Egypt, contributed indirectly to the Expedition's two Egyptian scientists establishing the Department of Oceanography at the University of Alexandria in 1948, and to further development of what is now the National Institute of Oceanography and Fisheries of the Egyptian Academy of Scientific Research and Technology. One direct result of the Expedition was the launch, one year later, of the Egyptian Expedition to the Red Sea 1934–35 (see Further Reading).

Named after Sir John Murray† and paid for by the funds left in his will, the Expedition was exceptional in the ways in which it was financed, organized, put together and followed up. The privately funded project was planned within the £20 000 budget set aside from the accumulated bequest of the 250 shares in Murray's Christmas Island Phosphate Company. Organization and management were mainly in the hands of Stanley Gardiner, Professor of Zoology at Cambridge University and Secretary of the John Murray Committee. As a result of a scarcity of research vessels in Britain at that time, Gardiner turned to the Egyptian ambassador in London, proposing a joint expedition on the research vessel *Mabahiss,* recently built in 1930 in the United Kingdom.

The Murray Committee, chaired by J.C. Murray, the son of the benefactor, met for the first time in June 1932 and disbanded a few months after the return of *Mabahiss*. The follow-up was to some extent the responsibility of Stanley Gardiner, but fell mainly to Seymour Sewell.*

*For more details, see the articles about Faouzi and Sewell on pp.10 and 15–16.

†John Murray, one of the naturalists on the *Challenger* Expedition, had taken over the herculean task of editing the Reports of the *Challenger* Expedition after the death of Wyville Thomson in 1882. The Christmas Island Phosphate Co. had come into being as a result of Murray's interest in sediments and coral reefs, which he pursued during the *Challenger* Expedition.

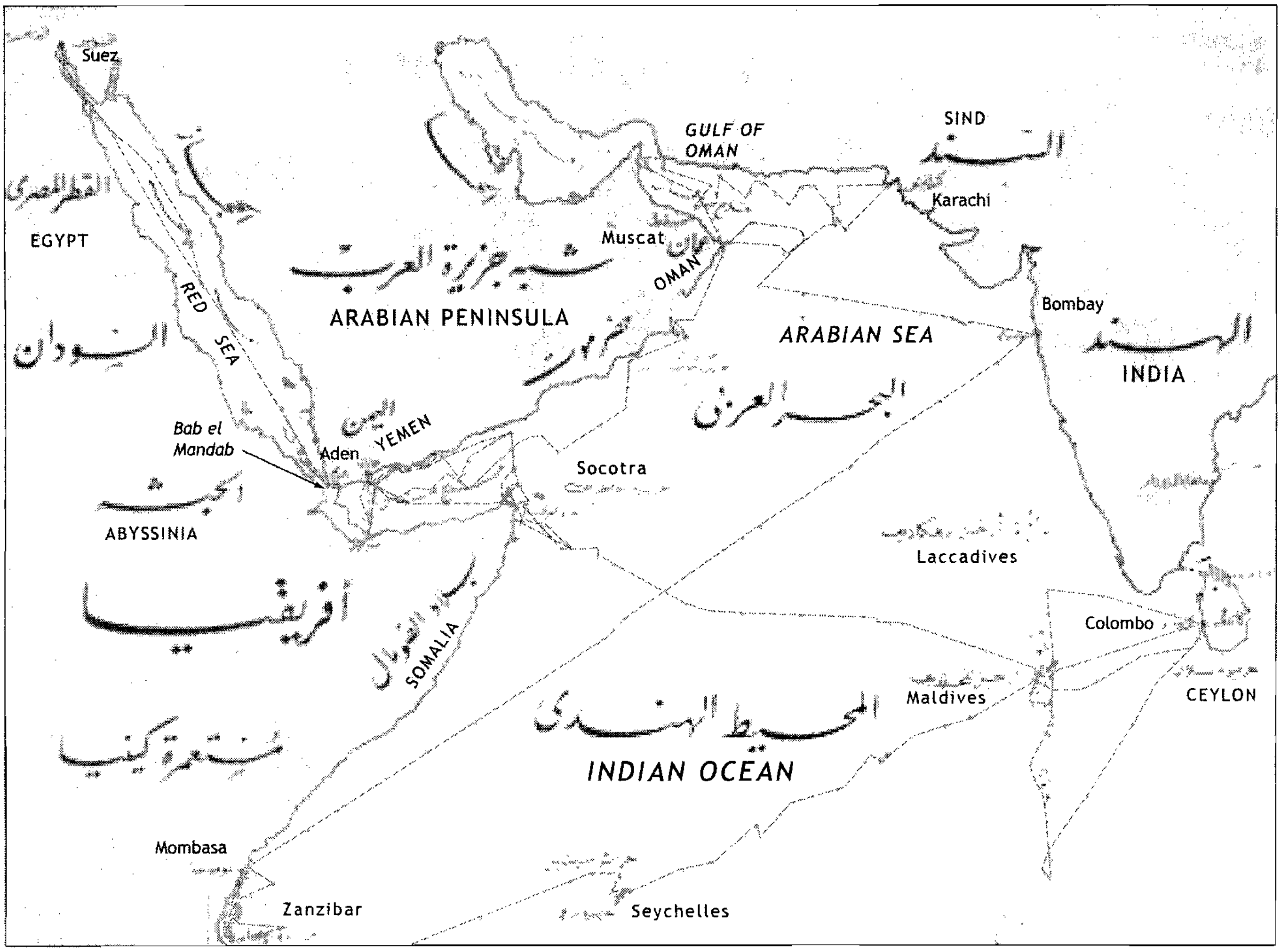


Figure 1 *Track of RV* Mabahiss *during the John Murray Expedition, from a contemporary map by the Department of Survey, Egypt (taken from the commemorative book by Hussein Faouzi, published in Cairo in 1939).*

The JMME cruise plan provided particularly good coverage in the Red Sea, the Gulf of Aden and the Bab el Mandeb Strait

Apart from Sewell and Faouzi, the scientific staff on the ship (Figure 3) were relatively young – new graduates aspiring to be Ph.D candidates on their return from the Expedition. In his narrative, Sewell explained the recruiting of the scientific staff: 'Owing to the comparative recent birth of the science of oceanography, the number of trained oceanographers in England is but small, and those who were fully acquainted with the necessary techniques and especially those which deal with the chemical and physical branches of the subject ... were not available for a prolonged cruise.'

The post of Deputy Leader and Senior Chemist was offered to E.F. (Ernest) Thompson; two other appointments, for a biologist and a chemist, were given to T.T. (Kit) Macan and Hugh Cary Gilson. In fact, the three of them were from Cambridge University's Zoological Laboratory (later the Department of Zoology) which was headed by Stanley Gardiner. Looking back, one questions the wisdom of recruiting three young scientists from the same department. This may have deprived the Expedition of some of the diverse experience found in various other British institutions. Physical and chemical oceanography were more advanced in other universities (such as Liverpool) and laboratories (such as Plymouth). The fourth young scientist came from Cairo University. He was the physical chemist, Abdel Fattah Mohamed.

In allocating its budget the committee made a small provision of £2000 to ensure the availability of the participating scientists to work up and publish the results of the cruise. However, the main support came from their employers, the Cambridge and Cairo universities, which maintained the momentum generated by the rich results of the Expedition.

The data and preserved material bought back by *Mabahiss* were to form the basis of a long series of reports in 11 volumes entitled *The John Murray Expedition 1933–34, Scientific Reports*, edited by Sewell and the Keeper of Zoology of the British Museum (Natural History), and published by the British Museum between 1935 and 1967. Sewell published the 'Introduction and List of Stations' in Volume I in 1935.

As the 50th anniversary of the Expedition approached, several consultations with British and Egyptian scientists took place at UNESCO in Paris, followed by a meeting in November 1982 at the Royal Society in London. It was decided to celebrate the 50th anniversary of JMME as a model for international cooperation in oceanography. A 'Symposium on the Arabian Sea and Adjacent Regions' was convened in Alexandria, *The Mabahiss was built on the lines of a large steam trawler*

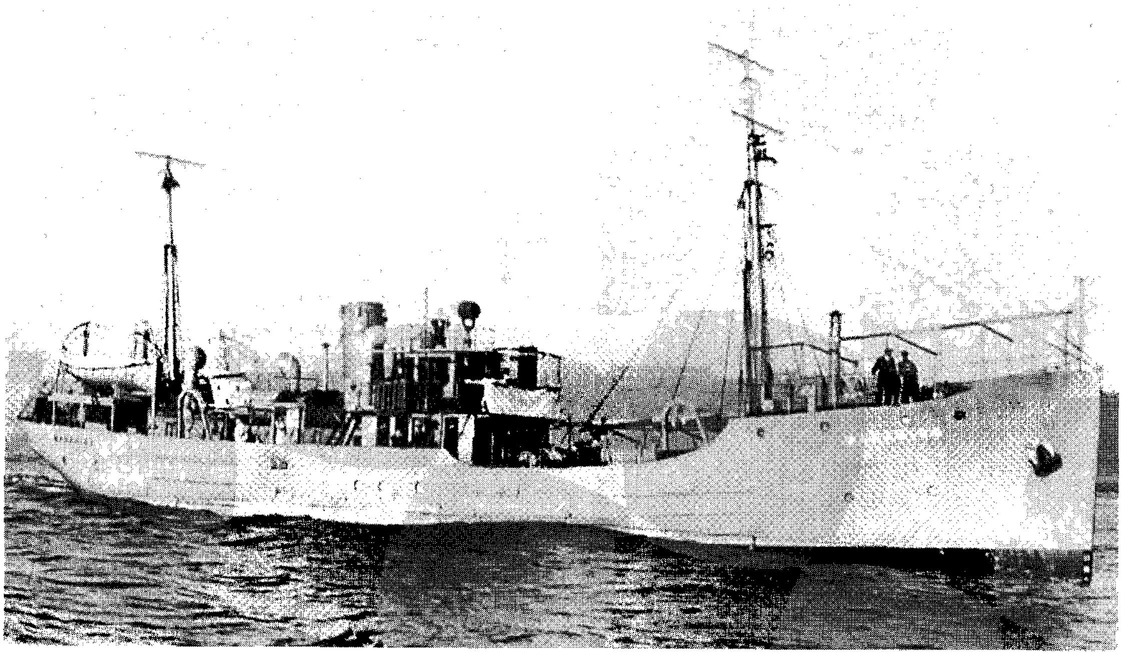
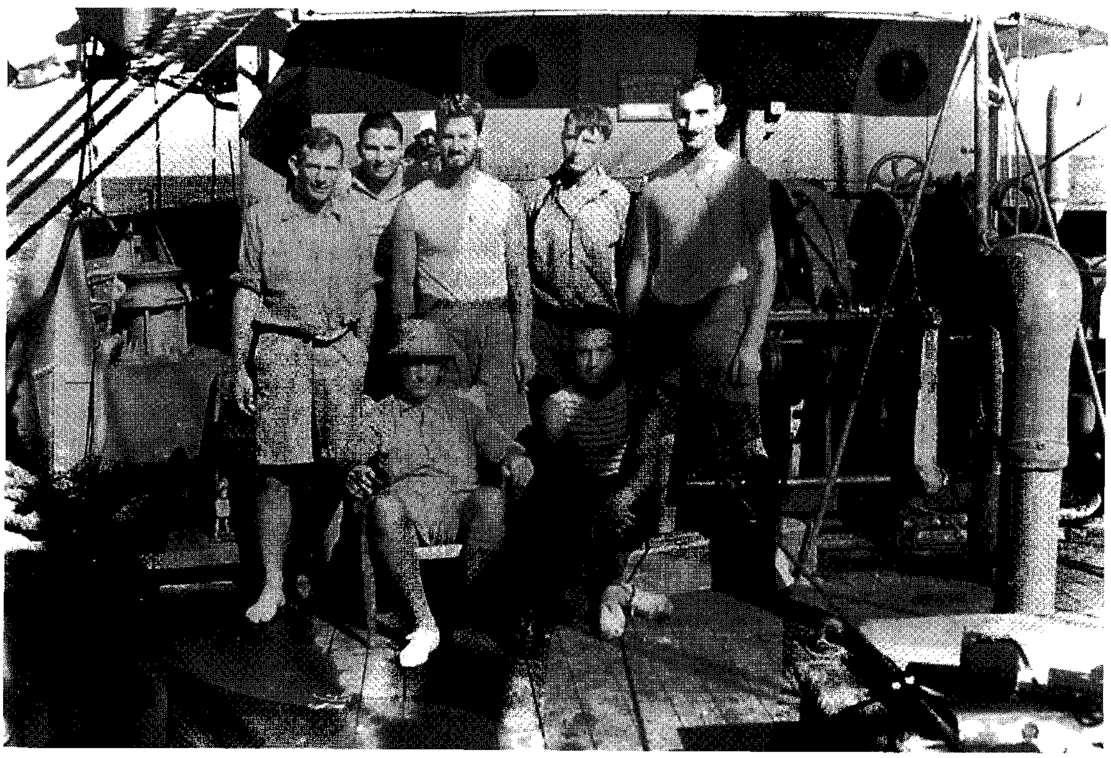


Figure 2 *The* Mabahiss *undergoing trials shortly after her launch in 1930. (Courtesy of Swan Hunter Shipbuilders Ltd.)*

September 1983. The proceedings of the Symposium were edited by Martin V. Angel (1984) and published as a special volume of *Deep-Sea Research.*

During the years leading up to the 50th anniversary, Tony (A.L.) Rice, of the (then) Institute of Oceanographic Sciences (IOS) at Wormley, Surrey, had used his base near London to contact scientists and personalities with interest and knowledge of the JMME. The only surviving members of the Expedition's scientific staff were H. Cary Gilson and T.T. Macan, who were living in England, and Hussein Faouzi who was in Egypt. Rice was also successful in tracing, mostly in the British Museum (Natural History), now the Natural History Museum some interesting manuscripts relating to the Expedition. These included the narrative of the Expedition for which Sewell had failed to find a publisher before he died in 1964. On the occasion of the 50th anniversary, UNESCO decided to rescue this narrative and published it in a commemorative volume entitled *Deep-sea Challenge, the John Murray/Mabahiss Expedition to the Indian Ocean, 1933/34.* The book, edited by Tony Rice and published in 1986, is of special interest to historians of oceanography; in 1988 it was selected by the American Library Asso-

Figure 3 *The scientific staff on the* Mabahiss *off Bombay in December 1933. Standing at the back are (left to right) Farquharson, Mohamed, Thompson, Macan, Gilson; seated are Sewell and Faouzi.*



Apart from Sewell and Faouzi, the scientists on board were all young graduates, yet to embark on Ph.Ds

Laboratory space on the **Mabahiss** *was very limited, as it was assumed that much of the work would be carried out on deck*

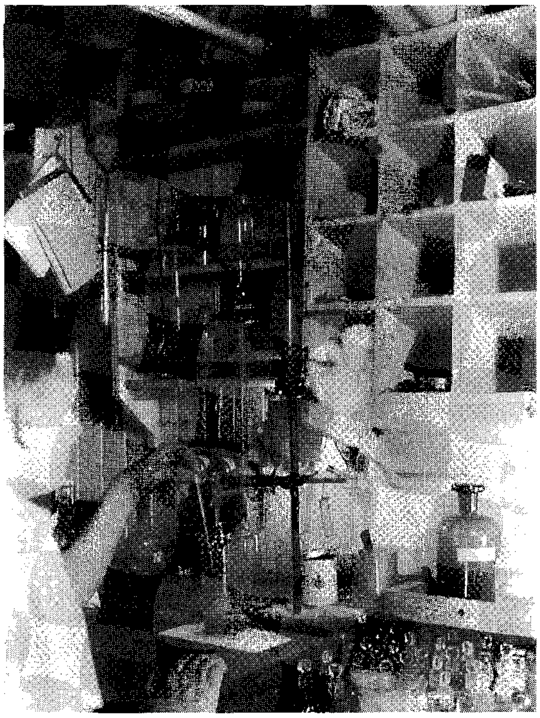


Figure 4 *Mohamed titrating salinity samples using a Knudsen burette, in the chemical laboratory onboard* Mabahiss.

ciation as one of the twenty most outstanding international documents published in the three-year period 1985–87. An Arabic translation was published in 1988.

Now, seventy years after the JMME, it may be appropriate to examine its accomplishments more closely than we did on its 50th anniversary. Despite a strict budget, and the private nature of the undertaking, the Expedition was well planned and successfully concluded. Unfortunately, however, its work was not fully utilized. The John Murray Committee disbanded after the Expedition and was not replaced by a responsible authority or institution. The persistent efforts of Sewell, acting in his personal capacity of Editor, failed to get Expedition member Ernest Thompson (then at Yale University) to submit his outstanding contributions. These were the results needed to complete the dataset (including phosphate and silicate measurements), and his oceanographic results for three of the five regions covered by the JMME (the Gulf of Aden, the Arabian Sea and Gulf of Oman), which remained hidden in his unpublished Ph.D thesis in Cambridge. A large part of the investment in the JMME in terms of money, ship-time, scientific planning and effort was lost as a result. This prompted Sir George Deacon and Tony Rice (1984) to argue, 'It is intriguing to speculate on whether the John Murray Expedition would have had a greater impact on the development of knowledge of the physical oceanography of the Arabian Sea if Sewell had managed to encourage Thompson to write up the results!' Moreover, Sir George Deacon and others questioned the accuracy of some aspects of the data, particularly with regard to the thermometric depth and salinity (Figure 4). I myself have recently evaluated the Expedition's results and management (see Further Reading).

The image of the Mabahiss *used in the title graphic is taken from the cover of* Deep-Sea Challenge ... *(see Further Reading) published by UNESCO, Paris. The artist was John Belderson.*

Access to the unpublished data was very limited. In an era when no oceanographic data centres existed, the station list was held by Seymour Sewell, as Expedition Leader. Just before he died in 1964, he gave it to Sir George Deacon who in 1982 decided to entrust it to me. Tony Rice handed me the station list at UNESCO, Paris, with a letter from George Deacon stating that '... as the station list is a historical document it should ... be available to Egyptian oceanographers, and I believe it might well be a fruitful exercise to make a more detailed comparison with more recent data.'

Seventy years on, the John Murray Expedition is still regarded as a pioneering study of one of the least known oceans of its time, as well as an early and unique experiment in oceanographic cooperation between two nations. Its impact in Egypt was profound, but it also had a significant secondary effect, in spreading the science of oceanography and institutions of marine sciences to many countries of the Mediterranean, Red Sea, Persian Gulf and Africa, via students of the two Egyptian scientists of the John Murray Expedition.

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The Saga of Seymour Sewell and the *Scientific Reports* of the John Murray Expedition

Selim Morcos

It is perhaps because of my present involvement with the editing of the proceedings of the International Congress on History of Oceanography (ICHO VI, Qingdao, 1998) that I feel a particular sympathy for those scientists who toiled for many years to edit the eleven volumes resulting from the John Murray Expedition to the Indian Ocean (see previous article). The Egyptian research vessel *Mabahiss* carried the Expedition to investigate the Red Sea, Bab el Mandab Strait, Gulf of Aden, Arabian Sea and Gulf of Oman, and I was interested to know why these volumes included the oceanography of only two out of these five regions. This interest led me to the long series of files kept in the Natural History Museum.* Here, I found an answer to my question, but learned also of the pleasure and pain involved in editing multi-author volumes of such magnitude.

Stanley Gardiner, Professor of Zoology at Cambridge University and Secretary of the 'John Murray Committee', had been instrumental in launching the Expedition, and as a result received a visit from Colonel Seymour Sewell, the Leader of the Expedition, upon his return from Alexandria. Gardiner was impressed and wrote (June 1934), 'I have had Sewell the week-end. ... Personally, I am of opinion that this Expedition is likely to be second in importance only to the *Challenger* for it is going to bring forward so very very much that requires further investigations in the next 25 or 50 years.'

At its final meeting on 17 October 1934, the John Murray Committee discussed the publication of the results of the expedition, after its return. The Committee requested their Chairman, J.C. Murray (the elder son of Sir John Murray), to approach the Trustees of the British Museum (Natural History) in this respect. Stanley Gardiner reported later that 'arrangements have now been completed whereby the British Museum (Natural History) will undertake the publication of the reports of the Expedition in a series of volumes; these they anticipate will be spread over a period of ten years ... The final decisions will necessarily be in the hands of the officers of the Museum, but I understand that all publications will pass through the hands of Colonel Sewell so as to secure uniformity ... In the British Museum, publication has been placed in the hands of Dr Calman ....' In this way, Sewell and the Keeper of Zoology (Calman and his successors) became the co-editors of the publications, although this is not clear from the reports themselves.

*Previously known as the British Museum (Natural History).

The 42 files in the Museum chronicle the exchange of letters, mainly between the Keeper of Zoology and Sewell and the contributors, over a period of almost 35 years. They trace the progress of the editorial process but also provide a vivid picture of important incidents and problems, and the way they were dealt with in the style and spirit of that generation. As a byproduct, the reader occasionally comes across information of historical interest.

The editors started with drafting a 'Notice to Contributors', and a 'Proposed Free Distribution List' which included the Murray Family, the members of the Murray Committee, the scientific staff of the ship, and a number of bodies in Egypt and UK in recognition of their help. More important was the implementation of the preliminary plan of publication, as suggested by the Committee, in which the first three volumes were set aside for the non-biological aspects of the investigations, while the following seven volumes (4–10) were for biology (mainly zoology). Volume 11 was added later.

The travails of an editor

Correspondence flowed freely between London and Cambridge, where Sewell was stationed in the Zoological Laboratory (later the Department of Zoology). Sewell's letters to 'My dear Calman' would include contributions, corrections, figures etc., such as the paper by Gilson on the 'Nitrogen cycle', suggesting a referee, either Mathews of the Admiralty or, for preference, Harvey of Plymouth. The following day Calman complained that 'Gilson, like so many of our contributors, has not evidently done me the honour to read the instructions I gave for bibliographical references.'

The first three volumes took shape quickly. The first volume containing the narrative, and the basic list of stations, topography and atolls, was completed within a year, in 1936. Moreover, the first five parts of Volume 2, on physical and chemical investigations, and Volume 3 on 'Geology and bottom sediments', all appeared between 1936 and 1940. Both volumes were kept open in anticipation of additional contributions, but were inadvertently closed in 1950. Despite this, the British Museum offered to publish the pending papers by Ernest Thompson on the oceanography of the Gulf of Aden, Arabian Sea and Gulf of Oman as a supplement to Volume 2 or as an additional Volume 11. However, Thompson left Cambridge for America in 1937 after the acceptance of his Ph.D dissertation, which was based on his Expedition results, and despite his leader's best efforts, never produced an official report. In desperation Sewell wrote to the Keeper of Zoology in 1949 that the expected report of Thompson 'is long overdue and it is worse than trying to get blood out of a stone to get anything out of Thompson, I will write to him again and also to his 'Boss' in the Bingham Oceanographic Laboratory at Yale and try to get the report sent in.' It wasn't!

Another casualty was the station list relating to the oceanographic dataset that should have been published as part of Volume 2 (see Further Reading, p.14). Sewell continued to struggle to get these publications out, but failed. In 1957 he finally wrote that 'He [Thompson] undertook, when he threw his hand in some many months ago, to send back all the data that he had, as well as his preliminary efforts at a Report on the salinity of the Arabian Sea, and Dr Deacon [George Deacon, the Director of the National Institute of Oceanography] very kindly undertook to collaborate with Thompson and give a combined report but neither Deacon nor I have been able to get anything further out of Thompson, so presumably we must write off all such data of Phosphate, and also Silicate, observations.' As late as October 1961, when Sewell expressed his desire to retire, the Keeper of Zoology reported to the Director of the British Museum that the situation of publishing the hydrographic results was not very satisfactory: 'This aspect of the work is in the hands of the National Institute of Oceanography [with George Deacon as its Director] and I tried to push it ahead but up till now without much success.' On the 50th anniversary of the Expedition, Sir George Deacon and Tony Rice argued that it was intriguing to speculate on whether the John Murray Expedition would have had a greater impact on the development of knowledge of the physical oceanography of the Arabian Sea if Sewell had managed to encourage Thompson to write up the results! (See Further Reading, p.14.)

As anticipated, the reports on the taxonomic groups were also slow in coming. As early as June 1934, following the return of the ship, Gardiner had warned that 'The collections and material of the Murray Expedition are going to turn out infinitely better than we conceived ... It is going to be a very big affair and beset with difficulties.' He then gave a list of separate groups of animals with names of responsible people inserted. In addition to the members of the Expedition '... it is anticipated that members of the staff of the British Museum will examine and report on other groups which are being catalogued and which we expect to deliver to the Museum before Christmas.'

The outbreak of hostilities in 1939 must have made publication more difficult, especially as communications between scientists in Britain and those in Europe were greatly disrupted. However, three volumes on the biological collections were published before, and one during the war (Volumes 4 to 7). After the war, in October 1945, Sewell had sent the Keeper of Zoology a list of the reports that had to be received on different taxonomic groups, some of them from Sweden, India, and Denmark. He then added, 'I have heard that Gran [who was responsible for the phytoplankton] is alive but is not doing any work and Dr Braarud has been appointed to succeed him in Oslo.' He wrote again in September 1946 that several reports were due from members of the British Museum staff and requested him to expedite their production. Eleven years later, he wrote again, in August 1957, on the reports due from the BM: 'Whether we shall ever be able to get all these I must doubt, but if you can ginger up any of the B.M. people to finish their reports I should be extremely grateful.' So persistent was Sewell in pursuing his goal that he wrote once more to Fraser, the new Keeper of Zoology in December 1957: 'I can only hope that you will have better luck than either I or Parker, as far as our efforts to get Authors to cough up their results are concerned.' Another four volumes (Volumes 8 to 11) were produced after the war. The last number of Volume 11 was issued in May 1967.

In a Memorandum dated 7 October 1961, the Keeper of Zoology had informed the Director of the British Museum that: 'The John Murray Reports published by the Museum were under the joint editorship of the Keeper of Zoology and Colonel R.D. Seymour Sewell ... I have had a sad letter from Sewell ... indicating that his physical condition is such that he is giving up his work and confining himself for the most part to his bed-sitter.' He went on to say, 'I consider the Reports are so near completion that it is unnecessary for another joint editor to be appointed ... I think it would be a nice gesture if the Trustees were to make some acknowledgement to him for the work he has done in connection with the reports which are now in their tenth volume.'

From 1934 to 1961, the post of Keeper of Zoology, British Museum (Natural History) was occupied by five scientists: W.I. Calman, A.C. Hinton, N.B. Kinnear, H.W. Parker, and F.C. Fraser. Seymour Sewell worked closely and in a very cordial way with all of them. His patient work for 27 years in editing the Scientific Reports makes his contribution as an editor as significant as his contribution as a successful leader of the nine-month John Murray *Mabahiss* Expedition.

Seymour Sewell died in 1964 at the age of 83.

A complete list of the contents of the *Scientific Reports* can be found in *The John Murray/*Mabahiss *Expedition to the Indian Ocean 1933–34* by Tony Rice, published in 1986.

Acknowledgments
The author wishes to acknowledge the help of Tony (A.L.) Rice and Gary Wright for their help in preparation of this article.

Letters and memoranda from 1932 to 1961 were used by permission of the Trustees of the Natural History Museum, London (Files DF 215/1 to 22).

For Further Reading see the end of the previous article (p.14).

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Life on *Discovery* ... forty years ago

Peter Herring

On 1 June 1963 RRS *Discovery* sailed from Plymouth on her maiden science cruise, providing the main UK contribution to the International Indian Ocean Expedition (IIOE) (see following article). Cruise 1 was to the Arabian Sea to study the upwelling driven by the South-West Monsoon, and Cruise 2 was a geology and geophysics cruise to the north-west Indian Ocean (Figure 1, p.19). The ship returned to the UK in December 1963 and came out again in February 1964 for more physics, chemistry and biology on Cruise 3, finally returning to Plymouth on 28 September 1964.

Forty years later some of us involved in this cruise programme met for a reunion lunch at the Naval Club in Mayfair. It had not been possible to track down some of the personnel, both scientific and shipside, and at least 20 had died during the intervening years (among them Henry Charnock, Ron Currie, Maurice Hill, Drum Matthews, Dave Rochford, John Swallow and Paul Tchernia). Nevertheless we made contact with 52 ex-colleagues and shipmates, and 29 of them were able to join the lunch party on 11 June. Some of us had not met since those formative days yet the faces remained surprisingly familiar. Others had later shared the agonies and ecstasies of further cruises and seen *Discovery* develop from that smart white-gowned debutante to today's more sombrely-clad and wrinkled (but much face-lifted) granny. It was an occasion for nostalgic mining of the memory banks, together with the recognition that the Old Days were not always the best, particularly where the catering and accommodation were concerned (on your mess bill, charged at 5/6d [27.5p] per week, Arthur Fisher reminds me). By a remarkable coincidence there was an elderly Naval Club member in the bar who observed our noisy group with interest. When we explained the nature of our reunion he was most intrigued and said that he, like several of us, had sailed on *Discovery*'s predecessor, *Discovery II*.

Our party included a very distinguished set of 'ex-'s, covering Directors of Institutes, Laboratories and international science agencies, editors of prestigious journals, captains and chief engineers, and a few, who though technically retired, haven't quite managed to give up the day job yet (like the ex-ship's doctor who is now consultant to the British Equestrian Society, though hopefully faced with rather different syndromes).

Several of those who could not be there sent reminiscences of their time on the early cruises. Younger readers may be surprised to hear that jacket and tie were required dress for meals, matched in style by stewards and silver service – but not by the victuals (the Radio Officer's personal survival kit included a large wooden tuck-box of palliative delicacies). Cabin stewards would wake us in the morning with a mug of tea (rumoured to be dosed in army style). For a small charge the bosun would do scientists' laundry, but his vigour with a washboard ensured that no garment lasted more than a few circuits of the system. Hard hats, no smoking areas and bar quotas would each have caused a mutiny. A brave lady microbiologist came for the first cruise but otherwise the ship's company was exclusively male. Films were shown twice a week (at a cost of 1 shilling [5p] a week on the mess bill, if I remember correctly) and gin was 3d [1.25p!] a shot. Five of us were were taken on for the whole 16-month period as Ph.D students on Royal Society John Murray Travelling Studentships (now sadly defunct) and the ship really did become our home.

Discovery was the first purpose-built research ship, and one of her innovations was plumbing that was designed to keep the ship's solid effluent out of the biologists' trawl nets. This involved a sea-going septic tank system, the Biogest. Its ferments were effective but faulty valves and foreign bodies blocked it all too easily and it was the unenviable task of the engineers to ease its constipations. On one occasion an isolating ball valve had been fitted ashore, but somehow its ball had been omitted, and when the 'isolated' line was opened the unfortunate engineer caught the lot!

Winches were often a problem. On the shakedown cruise (April 1963) John Moorey recalls that: '*Discovery* had serious problems with all the winches. The cheeks of the trawl winch were inadequate and bowed out when hauling in from 4000 m. The electronic winch was designed to pay out on gravity only, but there was so much friction it didn't work and was never used. The coring winch was underpowered and presented major recovery problems from 5000 m. The hydrographic winch jammed and was abandoned. Finally the wire of the trawl winch contained so much grease that messengers jammed on it and many hours had to be spent hauling in and out just to scrape vast amounts of grease off the wire.' Sounds familiar? *Plus ça change, plus c'est la même chose ...*

The science was wonderfully exciting, particularly to us novices, and the sampling was greatly dependent on the remarkable skills of the ship's officers, who kept station with sometimes three sets of wires out at once, a for'ard water-bottle cast, midships CTD and current meter, and aft vertical nets to 1000 m, which never (well, hardly ever) became entangled. We wrote letters home and used sextants and steam-driven winches. For most of us 'computing' still meant 'reckoning', while chips were part of lunch. We didn't have videos, safety boots or satellite navigation, but the biology kit did include a shotgun – for sampling seabirds. It was hardly ever successfully fired in anger and was accidentally left behind on a rocky island inhabited only by boobies. The officers' views of the scientific activities were often pithy. One ex-chief engineer summed up his memories by saying affectionately 'You were a daft lot!' He was probably right, and going by the lunch party I don't think we've changed much.

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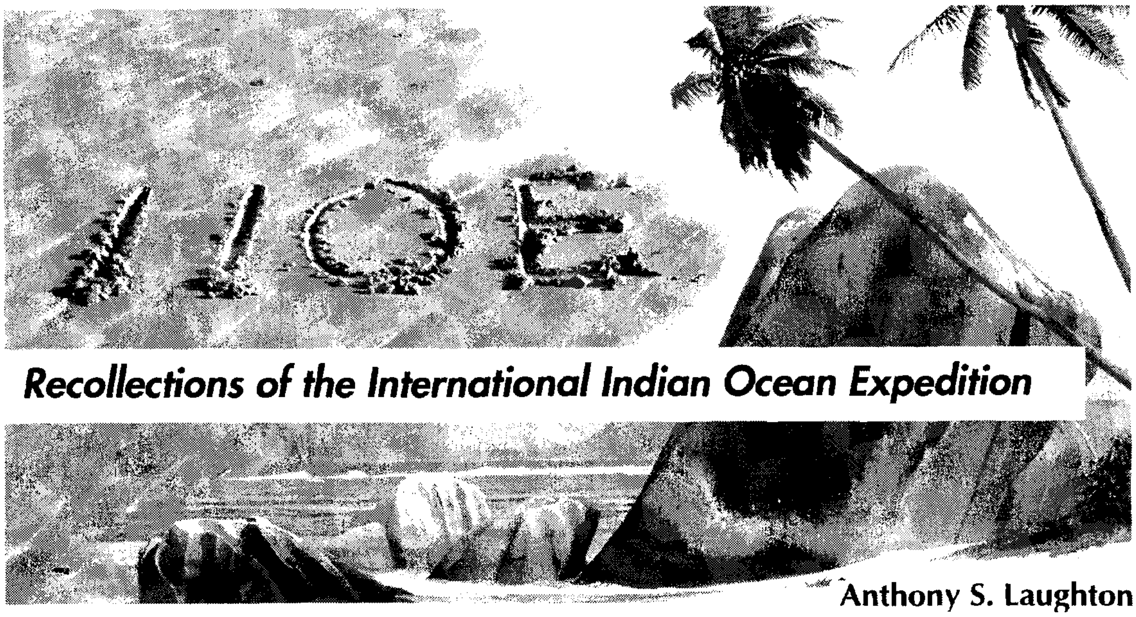
Those present at the reunion were: Martin Angel,* Tony Ashby, Eric Anstead, Arthur Baker, Bob Belderson, Ian Bennett, Derek Bishop, Tony Boxell, Alan Cooper, Jim Crease, David Davies, Arthur Fisher, Peter Foxton, Tim Francis, Peter Herring,* Fergus Hinds, John Jones, Peter Jones, John Jopling, Tony Laughton, Mike McCartney, Alasdair McIntyre, Nigel Merrett, John Scott, John Shorthouse, Graham Topping,* Tim Vertue, Fred Vine and Bob Whitmarsh. (Those marked *, plus Peter Brewer and Roger Bailey, were John Murray students on the IIOE *Discovery* cruises.)



Recollections of the International Indian Ocean Expedition

Anthony S. Laughton

'Tony, what do you know about the Indian Ocean?' George Deacon, Director of the National Institute of Oceanography, had wandered into the large open office which I shared with John Swallow, Dave Parkin and several others. 'Can you think up some problems on the geology of the ocean as part of an international programme?' he asked, adding as he left the office, 'Don't work too hard!'

In 1958 the leading oceanographic scientists of the world had formed the Special Committee on Oceanographic Research – SCOR – which later became the Scientific Committee on Oceanographic Research. SCOR was chaired by Roger Revelle, Director of the Scripps Institution of Oceanography, and George Deacon was its Vice Chairman. This Committee brought together the many disciplines which were represented by their own Unions in the International Council of Scientific Unions, and which had the common interest of studying the oceans. European laboratories and east coast laboratories in the USA had long studied the Atlantic Ocean, and the west coast US labs and those of the Far East had worked on the Pacific Ocean. But the Indian Ocean had received rather little attention.

SCOR plans to study the Indian Ocean were initially to look at the ocean water, its temperature and salinity, and its circulation and meteorology. The impact on the Somali Current of the reversing winds of the monsoons provided a natural experiment for physical oceanographers. Very soon marine biology was added, as well as geology and geophysics. The International Indian Ocean Expedition, or the IIOE as it began to be called, eventually lasted for six years from 1959 to 1965, involved forty-six research vessels under fourteen different flags, and covered all parts of the Indian Ocean (cf. Figure 1). Later, as it increased in size and in political importance, its organization moved from SCOR to the Intergovernmental Oceanographic Commission (IOC).

*For more about the John Murray Expedition, see the articles on pp.10 and 11–14.

The UK contribution in geology and geophysics

The major UK contribution to the IIOE would be carried out by a new research ship, as yet unbuilt, which would replace the aging *Discovery II*. Indeed the justification for a new vessel was in part that the old *Discovery II* could not cope with the climate in the Indian Ocean.

It was decided that the UK should operate in the north-west part of the ocean, which was most accessible through the Suez Canal. This area presented many interesting problems in all fields of oceanography. My task was to formulate a plan for the Earth Sciences. Little geological work had been done in this area before. John Wiseman of the Natural History Museum had taken part in the John Murray Expedition* to the Indian Ocean in 1933–34 and had collected basaltic rocks from the Carlsberg Ridge. H.G. Stubbings had collected and described the sediments of the Arabian Basin, but little else had been done in the region until the Swedish Deep-Sea Expedition after the war. The 1948–49 world-encircling cruise of HMS *Challenger*, led by John Swallow and Tom Gaskell, had made some seismic refraction studies to determine crustal structure.

With the evolving theory of sea-floor spreading and improved understanding of the role of mid-ocean ridges in sea-floor evolution, attention focussed on the Carslberg Ridge, named after the Danish brewery which had financed the pre-war expedition that had mapped the ridge. It runs NW–SE across the Arabian Sea and apparently continued through the Gulf of Aden and up the axis of the Red Sea, providing an exciting feature to study (Figure 2, overleaf).

In 1960 I was invited to join the Geology, Geophysics and Bathymetry Sub-Committee of the SCOR Indian Ocean Working Group, which was chaired by Bob Fisher with whom I was destined to work on and off over the next forty years. In the UK, I worked with a group of fellow marine geologists to put together a coherent plan of work for the IIOE. The Hydrographer of the Navy, Admiral E.G. Irving (known to his friends as 'Egg'), was extremely cooperative, making available two of his survey ships, HMS *Dalrymple* and HMS *Owen*, for two seasons in the Arabian Sea. The work of HMS *Dalrymple* and of the two HMS *Owen* cruises was to lay a solid foundation for the subsequent UK contribution to the geological part of the IIOE.

Between October 1961 and March 1963, HMS *Dalrymple* made reconnaisance magnetic and topographic surveys of the Murray Ridge in the northern Arabian Sea (Figures 1 and 2, overleaf), the data from which were analysed by Peter Barker of Birmingham University. In the winters of 1960–61 and 1961–62, HMS *Owen* made long sections of bathymetry, gravity and magnetics across the Carlsberg Ridge, and detailed studies of selected typical areas. Drum Matthews, Bosco Loncarevic and Fred Vine, all from the Department of Geodesy and Geophysics in Cambridge, made up the scientific party.

The early *Owen* sections across the Carlsberg Ridge and the adjacent basins provided an excellent basis for choosing the sites for detailed surveys. One of these, site 4a, was a seamount just south of the axis of the Carlsberg Ridge (cf. Figure 2), over which a network of anchored radar buoys was laid for navigation purposes. The distance between them was measured by the taut-wire method. A series of parallel tracks was used to define both the shape of the mount and its magnetic signature. Fred Vine worked on this feature for his Ph.D thesis, intending to deduce the magnetic susceptibility of the basaltic rocks of which it was made. He was astonished to discover that the magnetic signature was totally opposite from that which would have been expected had the rocks been cooled and magnetised in the present magnetic field. To explain his observations it was necessary to assume that the Earth's field at the time of cooling was of opposite polarity – in other words, that the positions of the North and South Poles were then reversed.

In fact, work in Cambridge by Keith Runcorn, Jan Hospers and others, on magnetic data from layers of volcanic lava, was showing that the Earth's magnetic field had oscillated in polarity over tens of thousands of years. Combining this fact with the emerging ideas on sea-floor spreading, Fred Vine and Drum Matthews developed the thesis that the rocks of the sea floor either side of a spreading mid-ocean ridge would preserve a record of reversals of the Earth's magnetic field.

Vine and Matthews published this thesis in *Nature* in 1963 and initially it made rather little impact on the geological community. But as

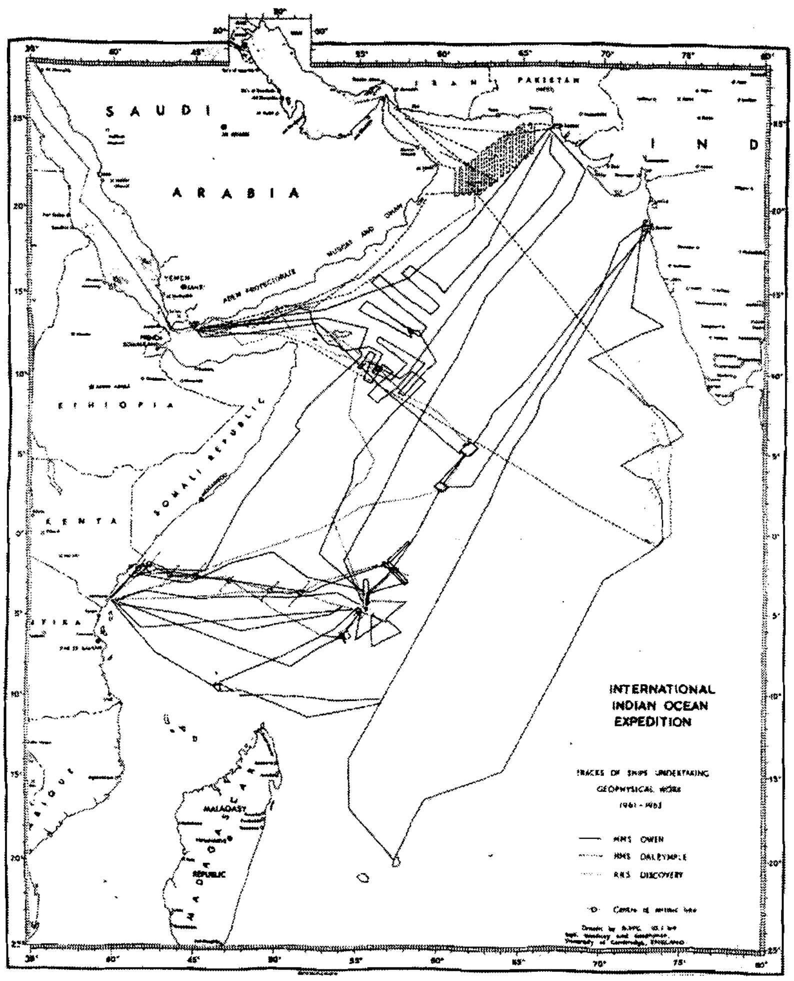


Figure 1 *Map from the original geophysical UK IIOE cruise report showing the tracks of HMS* Owen, *HMS* Dalrymple *and RRS* Discovery. Note the high density of tracks over the Murray Ridge and the Owen Fracture Zone.

The UK IIOE cruise plan combined large-scale coverage with opportunities for detailed surveying

geophysicists from the Lamont Geological Observatory looked back over their magnetic records it became evident there was a symmetry in the magnetic anomalies either side of every mid-ocean ridge, which not only gave support to sea-floor spreading but also could be used to quantify the rate of spreading. The contribution by Vine and Matthews to the developing ideas of what is now known as plate tectonics was immensely significant and has been recognized by national and international awards.

In late August 1963 I flew with the geophysical party to Aden to join RRS *Discovery*, and we soon took over from the scientists of the first cruise who had been studying the upwelling off the Arabian coast under Ron Currie. Our cruise was to be led by Maurice Hill, and its chief objectives were to sample and photograph rocks in the areas on the Carlsberg Ridge that had been surveyed in detail by HMS *Owen*, to make a series of seismic refraction measurements between the coast of Kenya and the Seychelles (cf. tracks on Figure 1) to determine the crustal structure, to make heat flow measurements, and to take sediment cores. I was responsible for all the underwater photography, which meant that I usually had to work throughout the night, as the other operations had to be carried out during the day.

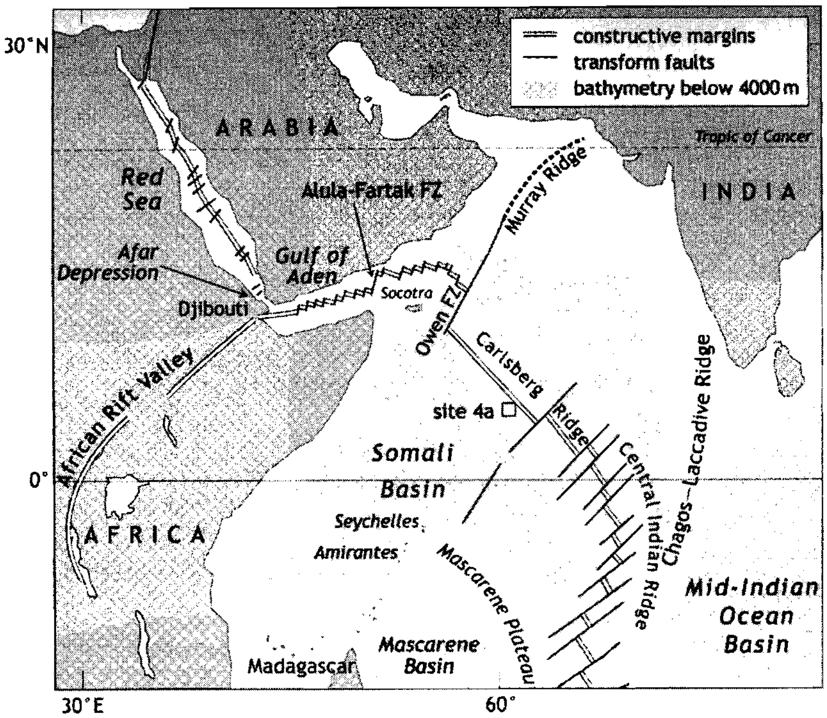


Figure 2 *Plate tectonic map of the north-western Indian Ocean, showing tectonic features and locations mentioned in the text. See the key for tectonic features; FZ = fracture zone.*

The sea-bed topography of the north-western Indian Ocean reflects its complicated tectonic history

It is worth reflecting on the instrumentation that was available to us at this time. For example, there were no navigation satellites, nor were there any ocean-wide radio aids, although some experiments were being made with VLF (very low frequency) radio waves. All passage tracks were navigated using celestial or coastal navigation aids, and when detailed surveys were being made, buoys with radar reflectors had to be laid in deep water. At the start of the IIOE, all ships were encouraged to use precision depth recorders, rather than the inaccurate echo-sounders that depended on motors for timing. Proton magnetometers had just become universally available and so continuous observations could be made of the total magnetic field. Shipborne gravity meters were less common, as was continuous seismic reflection profiling, which in those days used explosive charges as the sound source, so the amount of data that could be collected on the sediment structure was limited. On the other hand, seismic refraction techniques for studying the deeper crustal structure were extensively used. Dredges and corers were not significantly different from today's instruments, and some corers carried heat-flow measuring probes to measure heat flow up through the sediment. Deep sea cameras were also used extensively.

Work initially concentrated on sampling and photographing those areas of the Carlsberg Ridge that had been surveyed by HMS *Owen*, and we found that the basaltic rocks were heavily coated with manganese oxides, and there were fields of manganese nodules (Figure 4). Refraction seismics between Kenya and the Seychelles showed a steady thinning of the oceanic crust towards the continental rocks of the Seychelles.

Sometimes HMS *Owen* acted as firing ship for the longer seismic refraction lines, which used naval depth charges. On one occasion, after the radio message of 'Charge away!' we heard an enormous bang over the radio. The charge had gone off prematurely, deluging *Owen* and shaking her engine room. Luckily, no significant damage had been done!

While *en route* for a shallow non-magnetic bank south-east of Socotra, to get samples of the rocks and make more seismic refraction lines, I gave the Captain a position to head for overnight. Unfortunately I had made an error in the position and the following morning we were way off-course. As a result, we named the seamount Mount Error, a name found on the charts to this day.

Figure 3 *RRS* Discovery *off the Seychelles. The four legs of the cruise, lasting from August to December, included two stops at Mombasa, one at the Seychelles and one at Aden (cf. Figure 1).*

The new* Discovery *was designed so that she could cope with tropical weather and support improved technology (She was later painted black for work in the Atlantic)

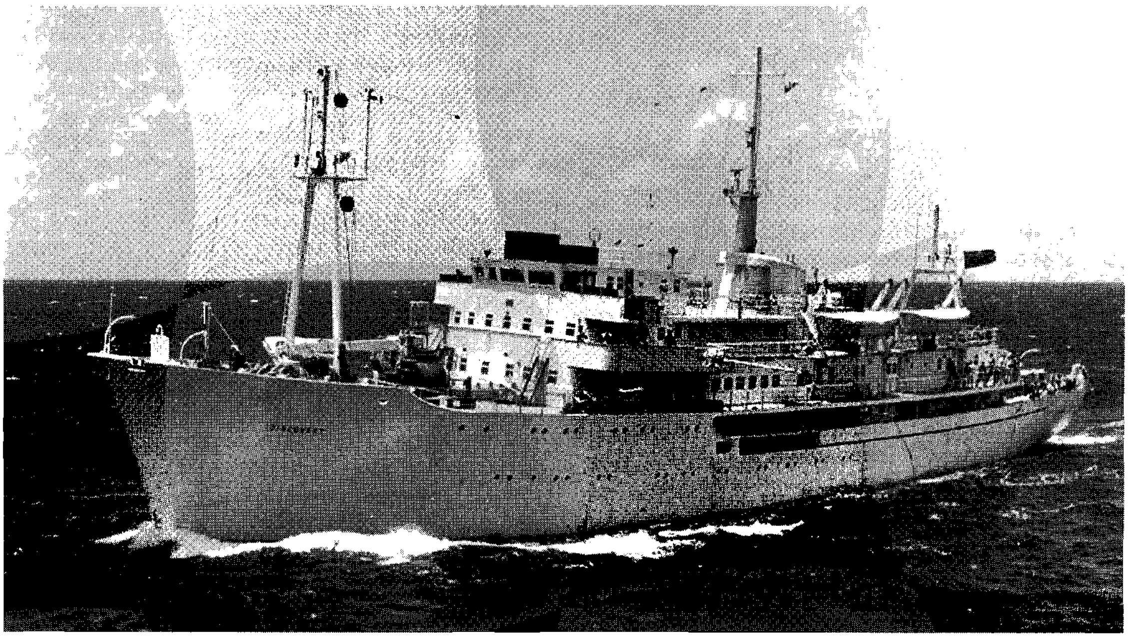


Photo by courtesy of Peter Herring

After more work in the Gulf of Aden, and a short visit to Aden to drop off some personnel, we headed up the Red Sea doing more geophysics on the way, and then through the Suez Canal, into the Med, and back home after three-and-a-half months away. In all, we had made some thirty seismic refraction stations (including some with bottom receiving gear) to provide the section across the Somali Basin from Kenya to the Seychelles, twenty-six dredge stations, thirty-three core and heat-flow stations and twenty-two camera stations. Also, echo-sounding and magnetic measurements were made on all passages. This was enough to keep us busy in the lab for some years to come. It was a very happy cruise, and Maurice Hill, as ever, maintained a high morale on board.

Geological evolution of the Gulf of Aden

It was during this 1963 cruise that I began to think seriously about the geological origins of the Gulf of Aden. It had already been established that the Carlsberg Ridge was a spreading axis at which new ocean crust was being created and along which there was a line of earthquake epicentres. The NW–SE-trending Carlsberg Ridge appeared to head towards the Gulf of Aden (Figure 2). Already there was evidence from the Red Sea that this had been created by a split between Africa and Saudi Arabia, so it was reasonable to suppose that Somalia and Arabia had also split apart.

Tuzo Wilson in Canada had just developed the concept of transform faults, which offset the spreading axes of mid-ocean ridges along

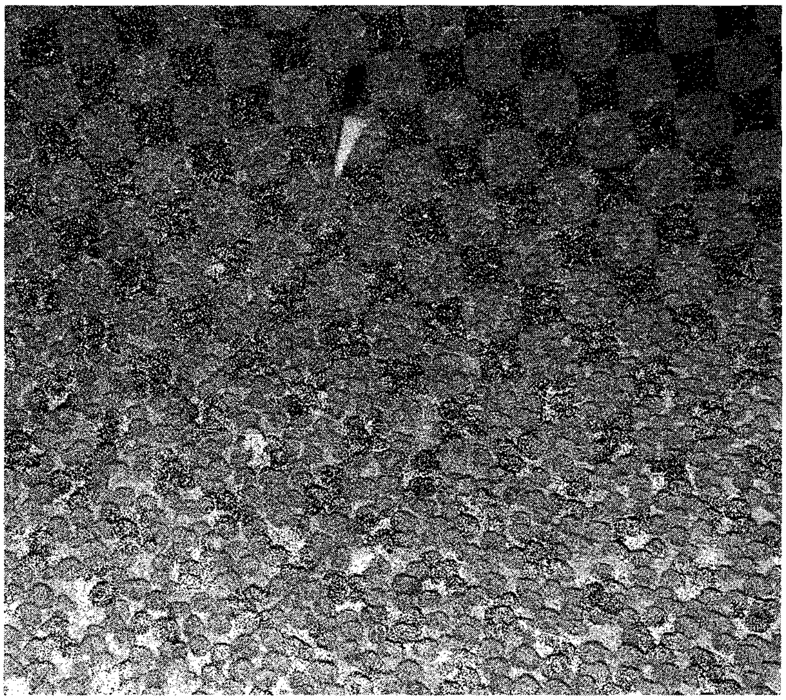


Figure 4 *Underwater photograph of a manganese nodule field on the flanks of the Carlsberg Ridge. The nodules are about 5 cm in diameter; in the middle distance is a sea-lily (crinoid).*

During the IIOE rich manganese nodule fields were found on the Carlsberg Ridge and in the Somali Basin

linear features. These were active shear zones along the offset section of spreading axis, outside of which they were passive and provided a trace of earlier spreading directions. The whole of the feature, including both the active and the inactive parts, was called a

Bird-collecting Interlude on the Ile des Noeufs

During the cruise, we enjoyed some visits to out-of-the-way places. One of these was the uninhabited Ile des Noeufs in the southernmost part of the Amirantes island group. Our ornithologist, Roger Bailey, wanted to collect some sooty terns to examine their stomach content and determine their feeding habits.

The island was surrounded by coral reefs on which the surf beat incessantly. The outer ridge was perilously shallow and we made several approach runs to find a way in. The Captain nosed *Discovery* through a gap in the reef and anchored a mile or two offshore. We launched the Zodiac rubber dinghy with outboard, and set off against a strong wind. The plan was for two of us to jump out and run the boat in when the water was shallow enough, but at the critical moment we were caught by a cross-surf and ended up riding the surf sideways, with Eric Anstead, the Third Officer hanging on to the outboard. Amazingly, we arrived on the beach the right way up amidst the foam, grabbed the boat and hauled her up.

Sooty terns on the Ile des Noeufs

The inner saucer of the island was almost devoid of vegetation, and was covered with sooty terns and their fledglings. Above, many thousands were wheeling and screeching so that we could hardly make ourselves heard. The ground was littered with addled eggs so the smell was overpowering. We advanced cautiously, preparing to be attacked, but the terns kept their distance. Roger shot some, along with some noddies, which were there in smaller numbers.

We came across two well cared-for graves, possibly those of egg collectors drowned while landing during the South-East Monsoon. We later learnt that the natives of the nearby islands were allowed onto the island for a limited number of days each year to collect eggs for eating but that otherwise no landings were allowed; we had been given special permission for this ornithological collection trip.

Such trips ashore made a very pleasant change from the long days of research on the ship.

'fracture zone' (cf. Figure 2). My work on the topography of the north-west Indian Ocean showed that there was a major fracture zone which offset the axis of the Carlsberg Ridge by some 300 n.m. – I named this the Owen Fracture Zone. At its north-east end the Owen Fracture Zone merged with the Murray Ridge. The mid-ocean ridge continued westward into the Gulf of Aden via several other offsets, and eventually penetrated the Afar Depression at the western end of the Gulf (Figure 2).

Analysis of the bathymetry, the magnetic anomalies, the seismic structure, the earthquakes, and the geology on either side of the Gulf of Aden, led me to conclude that, following initial uplift and block-faulting of the continental mass during the Miocene (20 million years ago), the Gulf had opened in two phases of sea-floor spreading. This resulted in a relative rotation of Arabia away from Africa by about 8°. Opening of the Gulf clearly had to be tied into the development of the Red Sea and of the African Rift Valley, both in geometrical terms and in timing. Initially, it was not clear how this could be done, as there seemed to be considerable discrepancies in the timing of the spreading.

The first results of the IIOE by UK and American workers were presented in November 1964, at a Royal Society meeting, 'A Discussion Concerning the Floor of the Indian Ocean', organised by Maurice Hill. They were eventually published in a volume of the *Philosophical Transactions of the Royal Society* in 1966.

The Kashmir adventure

The first chance of international exposure of this increased understanding of ocean floor geology was in December 1964 at a meeting of the International Geological Congress in New Delhi. As a result of pressure from the British National Committee for Geology (a Royal Society committee of which I was a member), the IGC had decided to include a session on marine geology, which had hitherto not been included as one of their session topics! As both Drum Matthews and I were planning to attend the Congress we had each prepared three papers on results from the *Discovery* cruise in the Indian Ocean. One of these was on my Gulf of Aden work, the others were on underwater photographs of the Carlsberg Ridge, and the crustal structure of the ocean floor as revealed by the seismic refraction section between Kenya and the Seychelles.

The trip to India turned out to be an extraordinary adventure for me and for many others, and in some ways a disaster for the Congress itself. Scientific aspects apart, the story is worth telling because it illustrates the ability of geologists – and their wives – to cope with adversity.

I had arrived in New Delhi some five days ahead of the Congress to take part in a field excursion to the Himalayas to examine some of the interesting rock formations that indicated a connection between India and South Africa. On the flight to Kashmir, I found myself sitting next to a distinguished British geologist with whom I was to share a room. By curious coincidence he happened to live in the village next to my own in Surrey. In this way I met Norman Falcon (formerly Chief Geologist of BP), and got to know him very well.

The eighty or so geologists on the excursion were housed in 'Nedou's Hotel' in Srinagar, which had been kept open especially for us. It was not really a winter hotel because the accommodation was in two annexes either side of the main building and the rooms were arranged with extensive balconies and poorly fitting doors and windows. The rooms which I shared with Norman comprised a sitting room, heated with a temperamental and somewhat ineffective wood stove that had been hurriedly installed, an unheated bedroom and a chilly bathroom.

Over three days of brilliant sunshine and crisp mountain air, the field trips organized by the Indian Geological Survey took us to interesting outcrops in the hills above the Kashmir Valley, overlooking the brown and grey countryside punctuated by leafless poplars. Geology alternated with sightseeing trips to the surrounding villages, to the Dal Lake and to the 17th century Moghul Shalimar water gardens fed by the mountain streams and built by the Emperor Jehangir for 'his beloved Nur Jehan'.

On the fourth day it started to snow, and the snow continued for forty-eight hours, blanketing both town and countryside two feet deep. The temperature dropped to 15 °F and remained there for days. The electricity and telephones were cut off because of fallen lines, and the water froze in the pipes. The storm and the cold were the worst experienced in Kashmir and northern India in living memory, and took their toll of life. At the airfield, no planes could take off until a runway was cleared. After a few days, clearance of the deep snow became 'mechanised' when they started using a wheelbarrow! Even after a week they had only cleared 900 yards of the runway, not enough for the Viscount passenger planes to take off.

The road, which wound for a hundred miles over the mountains to the northern plains of India, was impassable due to avalanches and landslips, and the mountain pass was effectively blocked by ten-foot snow drifts. The road down the Jhelum Valley was closed by the armed conflict between India and Pakistan arising from the 1947 allocation of the predominantly Muslim Kashmir to Hindu India, a conflict that still rumbles on today. So we were well and truly stuck!

It was fascinating to see how a group of eighty scientists from all over the world reacted to the prospect of being confined in Srinagar and missing the Congress. We had amongst us some of the world's leading geologists, including the top Russian delegate, whose wife (who had never travelled outside the USSR) was expecting to be met in Delhi. The distinguished Himalayan geologist from Switzerland, Professor Gansser, was there with his wife, as well as the head geologists of several oil companies. Many of these had important commissions and committees to attend in Delhi and the prospects of getting there in time were poor.

The excursion leader, from the Indian Geological Survey, had a very difficult time as he was not particularly senior and did not have the authority to get things going to ease the situation. So members of the party appointed various committees to investigate, and to push things along. There was the 'airfield committee' who went every day to report on the progress of clearance, the 'roads committee' who met with the army, the 'communications committee' to cope with the radio-telegram problem, and to make sure that Delhi was fully aware of our problem, and the 'finance and supply committee' (which I joined) to find out how to pay our hotel bills in Srinagar and what to do about reservations in Delhi. A great bureaucratic system sprang up. The ladies of the group, some of whom were in their late sixties and seventies, circulated a daily paper and typed notices, others looked after the health of some of the party who had become ill.

In Delhi, delegates and organizers continued to wait in vain for key speakers to turn up, and were coping with committees and commissions whose chairmen were stranded. Meanwhile, we passed the time with impromptu talks and lectures, using newspapers and marker pens instead of a blackboard. With an audience captive around the big wood stove in the hotel lobby (the only source of heat), the talks and discussions could continue at length. I vividly remember Norman Falcon's talk on the very early discoveries of oil in Persia, which occurred when he was field geologist in charge. At that time, drilling was by percussion bit, on the end of a wire, repeatedly dropped to the hole bottom. On one occasion, they hit a pressurised oil pocket which blew the bit up the hole, compressing the wire above it until it effectively sealed the hole, neatly averting a disastrous blowout.

Norman was a fund of knowledge about the geology of the Middle East and was extremely helpful to me in a presentation I made on the evolution of the Gulf of Aden by sea-floor spreading, an idea that was then new to most land geologists, who thought that continents moved only vertically, not horizontally. Rather than the twenty minutes I would have had in Delhi, I was able to go on for an hour or more with a long discussion afterwards.

I also had the chance to show photographs of the ocean floor of the Arabian Sea, which I had brought for my talk in Delhi. None of the group had ever seen sea-floor images before and they made a big impression. While Drum struggled to give some of my talks at the Congress, I was able to present much of the work of our Indian Ocean cruise in *Discovery*.

Finally, after fifteen days and several false starts, I travelled over the passes with half the party in a convoy of buses, accompanied by two army lorries clearing the road of other vehicles. The remainder of the party flew in an old Dakota, which could take off from a short section of the runway that had been cleared, but which barely had enough power to get over the mountains. We all eventually met up at Jammu in a rest camp in the warm sunshine of the Indian plain – such a contrast to what we had left.

This was now the last day of the Congress and many of us who had been trapped in Kashmir had flights to catch. Those with the earliest flights were driven at breakneck speed to a military airfield at Pathankot seventy-five miles away where we were told a plane would meet us to fly to Delhi. We were deposited with our baggage in the middle of the deserted airfield at 4.30 p.m. and told to wait. I had just five hours before my flight to Teheran where I was to spend Christmas, and I made it with only an hour to spare.

The second geophysical cruise of *Discovery* to the Indian Ocean

There were many aspects of my work on the Gulf of Aden which still needed to be addressed, so it was fortunate that George Deacon agreed I could have another expedition there in *Discovery*. This time I was Principal Scientist, working with people from both NIO and Cambridge, as well as some other university scientists.

Our main objectives were to study the structure and evolution of the Red Sea and Gulf of Aden, although we had various other projects that took us as far afield as the Seychelles. When the distinguished French geophysicist, Xavier le Pichon, whom I had known well at Lamont, suggested that I had already cracked the problem of the Gulf of Aden, I had to reply that many of my ideas needed further hard evidence to back them up.

We sailed on *Discovery* cruise 16 from Plymouth in January 1967. Through the Red Sea we zigzagged from shore to shore, at one time turning away from the coast only when the Captain saw a shepherd lighting his pipe on the shore. Our aim was to get profiles of the gravity field to try to determine how much of the Red Sea was underlain by ocean crust and how much by continental crust. Seismic refraction stations were made to determine crustal structure.

After two weeks at sea researching the rocks and the structure of the floor of the Gulf of Aden and the Alula-Fartak Fracture Zone which crosses it at its eastern end, we berthed in Djibouti at the extreme western end of the Gulf, where the Gulf of Tadjura penetrates the Afar Depression. This region, which lies at the junction of the Red Sea, the Gulf of Aden and the African Rift Valley, is one of the hottest parts of Africa, and was populated by the primitive Danakil tribe. Much of it lies below sea level, and it is one of the few places in the world where newly formed ocean crust, with its volcanic outpourings and its fractured and tilted ridges, actually lies exposed, not covered by the sea. We made a brief expedition to the edge of this area to collect drilled volcanic samples, carefully oriented for subsequent palaeomagnetic measurements.

The cruise then took us to work on the Carlsberg Ridge, before berthing at Port Victoria in the Seychelles, where we made a short expedition to the remote and extremely hot Silhouette Island to collect more oriented rock samples for palaeomagnetic analysis. The final leg of this cruise was somewhat curtailed by repeated failures of the main engines, necessitating a short stop at Aden, and then a passage home to Plymouth, arriving on 6 May after three-and-a-half months away.

Interpretation of the new results from the Gulf of Aden were presented at a two-day Discussion Meeting on 'The Structure and Evolution of the Red Sea, Gulf of Aden and Ethiopia Rift Junction' at the Royal Society in March 1969, and later published in the *Philosophical Transactions of the Royal Society* in October 1970 under the title 'The Evolution of the Gulf of Aden'. With Bob Whitmarsh and Meirion Jones (both of NIO), I was able to give a much more detailed analysis of the phases of the growth of the Gulf of Aden, identifying the magnetic patterns and the topographic trends, as well as publishing new bathymetric and magnetic charts of the Gulf in colour.

The IIOE Atlases

My involvement with the Indian Ocean did not end with completion of the Gulf of Aden work. One of the outcomes of the IIOE was the preparation and publication of a series of atlases to summarise the achievements in physical oceanography, marine biology and meteorology, and in marine geology and geophysics.

I was invited to be one of four associate editors for the *Geological–Geophysical Atlas of the Indian Ocean*, together with Bob Fisher of Scripps, Eric Simpson of South Africa, and Victor Kanaev and Dina Zhiv of the USSR Main Administration of Geodesy and Cartography, which actually printed and published the *Atlas*. We were working under the Chief Editor, Gleb Udintsev of the Shirshov Institute of Oceanology. There were seven other members of the Editorial Board covering all the relevant disciplines and geographic areas.

For ten years or so after the formal end of the IIOE, the Editorial Board had numerous meetings to assemble and collate the results into a series of charts and maps – a monumental and seemingly endless task. The bathymetric contour charts formed an essential base for all the other observations and it was on these that I spent much of my time. I had already contoured much of the north-west part of the Indian Ocean for the benefit of our own expeditions, and Bob Fisher had done much of the central and south-western section, so we had to work closely together to ensure a seamless match between our efforts.

The *Atlas* was finally published in Moscow in English and in Russian in 1975, comprising over 150 pages in an extremely large format to accommodate the large charts. Although we were trying to be as up-to-date as possible, inevitably such a long lead time in publication meant that by the time the *Atlas* was out, many felt that it was already out-of-date and did not reflect the advances that had been made over the ten years. The argument about the value of scientific atlases continues to this day, with similar atlases being prepared for the Atlantic and Pacific Oceans.

The significance of the IIOE

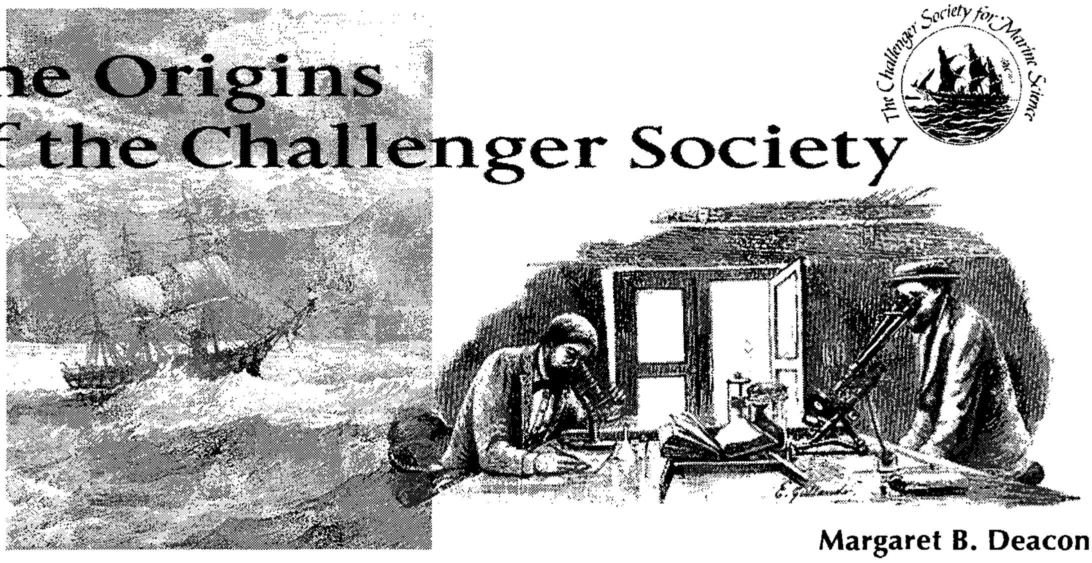
The International Indian Ocean Expedition had set out not only to increase our knowledge of this least known ocean, but also to encourage the growth of research in the developing countries surrounding the ocean and to improve the local fisheries economies. One of the direct outcomes was the creation of the Indian National Institute of Oceanography in Goa, which today flourishes as one of the leading marine institutes in the world. The IIOE was the first major international oceanographic expedition to involve nearly all countries with marine facilities, and from it many lessons were learned for future cooperation. Although it started with an organized plan, Warren Wooster was to comment that it 'was the greatest uncoordinated expedition in the history of oceanography. I ought to know, I was its coordinator part of the time. It was the only way to explore such a region. Scientists with curiosity would not come in if it had been done in any other way.'

The geological history of the Indian Ocean was found to be extremely complex, as a result of the detachment of the Indian subcontinent from Antarctica and its movement northwards to collide with the Asian continent, raising the Himalayas and leaving behind scattered fragments of microcontinents, such as the northern part of the Mascarene Plateau, and uplifted and fractured oceanic crust, as at the Ninety-East Ridge.

As a result of the Expedition, the Indian Ocean became one of the most systematically studied oceans of the world and revealed a large variety of geological features and processes not seen in the Atlantic or the Pacific. The Expedition's success must be considered to be one of the major achievements of SCOR and of the IOC.

Anthony (Tony) Laughton joined the National Institute of Oceanography (later the Institute of Oceanographic Sciences) in 1955, researching the deep ocean floor and the evolution of ocean basins. He was Director of IOS from 1978 until he retired in 1988. Since then he has been actively involved in several marine projects, especially GEBCO (the global ocean mapping project), and the Shoals of Capricorn Programme focussing on the Mascarene Plateau.

The Origins of the Challenger Society



Margaret B. Deacon

The idea of a society devoted to marine science was, it seems, first mooted in a conversation between G. Herbert Fowler and R.N. Wolfenden, and their discussion led to the foundation of the Challenger Society in 1903. Fowler and Wolfenden also took a leading part in a number of projects undertaken under the Society's auspices during its early years. Nevertheless, by the mid-20th century both men had become rather shadowy figures, almost forgotten by the oceanographic community, even though both had written on marine science, and Fowler had edited, as well as contributed to, the Society's influential publication, *Science of the Sea,* which appeared in 1912.

The lack of later publications in scientific journals, not to mention obituaries of Fowler and Wolfenden themselves, was therefore puzzling. In the early 1980s, during a search for further information about Fowler, I learned that a collection of his papers was held at the Bedfordshire Record Office, and that the then County Archivist, Patricia Bell, had already published a short account of his life which explained why he is now better remembered in this very different setting of local history and archive management. Meanwhile, David M. Damkaer* of Seattle had for some years been researching Wolfenden, whose work on copepods had initially attracted his interest. Similarly struck by the dearth of information on Wolfenden, he embarked on a more extensive biographical study and had the good fortune to discover a family member in North America, through whom he gained access to Wolfenden's surviving papers. I am grateful to both Dr Damkaer and Miss Bell for their generosity in sharing their findings with me over the years.

Their researches have made it possible to obtain a much clearer understanding of these two figures, who played such a key role in establishing the Challenger Society and yet have faded from its collective consciousness. Why this has occurred becomes clearer with more extensive knowledge of their careers which, in both cases, changed course not once but several times. It turns out that marine science occupied only part of their working lives and that both achieved reputations in other fields. Knowledge of how they came to take up marine science, and equally abruptly to leave it, helps to explain how, during their active period as marine scientists, both were concerned to promote the science of the sea over and above their own personal researches, and why they regarded the Challenger Society and its work as so important in this context, and persuaded others to join them in the enterprise.

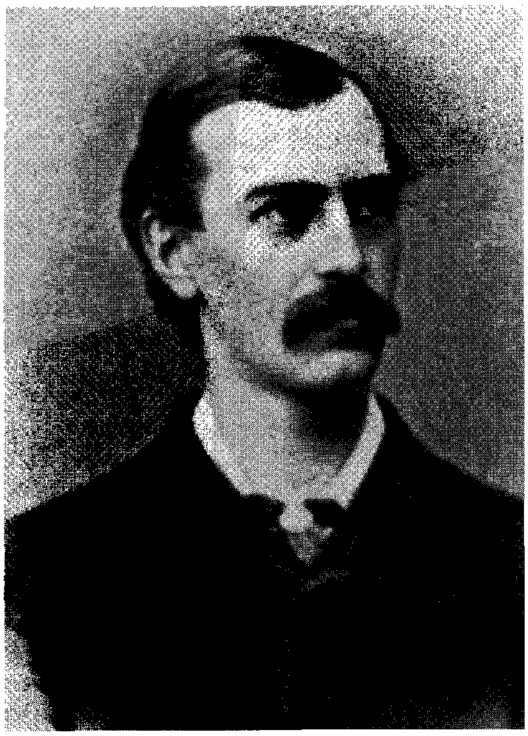
*Dr Damkaer at that time was a Life Member of the Challenger Society. As he remarks in a recent publication on Wolfenden, 'It is not often that one can say he is an ex-Life Member of anything.'

The Founders

G. Herbert Fowler

George Herbert Fowler was born in 1861. His father was a Church of England clergyman and headmaster of Lincoln Grammar School, and his mother, Martha, was a sister of the architect G.F. Bodley. He was educated at Marlborough and Eton before going up to Oxford in the autumn of 1880. In 1883 he attended a lecture by Henry N. Moseley, recently appointed to the Chair of Anatomy and one of the scientific team that had sailed in HMS *Challenger* on her oceanographic expedition of 1872–76. This made such an impression on Fowler that a year later he abandoned his existing studies for zoology and obtained his BA in Natural Science, with the ambition of following his mentor. Between 1884 and 1887 he held a Berkeley Fellowship at Owen's College, Manchester, and also studied for his Ph.D at Leipzig. There followed several teaching and other posts, including Acting Director of the Plymouth Laboratory of the Marine Biological Association in 1890. For a while he was assistant to E. Ray Lankester at University College, London, and in 1891 he returned there to work for W.F.R. Weldon, the newly appointed Professor of Zoology.

George Herbert Fowler c. 1982



At UCL Fowler became Assistant Professor of Zoology but narrowly lost out to E.A. Minchin when he applied to succeed Weldon in 1899. Departmental duties absorbed much of his energy, but he had a strong practical bent and became interested in the attempts being made to develop plankton nets with closing mechanisms which could be deployed at specific depths – equipment not available to the *Challenger*. Alexander Agassiz's claim to have shown that there was no midwater fauna acted as a stimulus to those who distrusted his results. Fowler experimented with nets of his own design in cruises of the survey ship HMS *Research* in 1896 (see opposite) and 1897, and again in 1900. However, he was frustrated at the lack of opportunity to carry out the fieldwork necessary to develop his ideas on plankton distribution. This, together with eyesight problems and failure to gain promotion, may have played a part in his resignation from UCL in 1909. He had married as a young graduate, but the the marriage had broken down so he had no family to support and was able to retire to a house in the country, bought some years earlier.

Richard Norris Wolfenden

Both photos by courtesy of David M. Damkaer

Richard Norris Wolfenden

Richard Norris Wolfenden was born in Lancashire, in 1854, the eldest son of an accountant who was twice mayor of Bolton. Wolfenden took a degree in Natural Science at Cambridge, before embarking on medical studies. He trained at the London Hospital and was appointed senior house physician there after obtaining his Cambridge MD in 1884. During the next few years he held appointments at several London hospitals, including lectureships in physiology, and published papers on medical research. Of particular significance in the present context was his association with Morell Mackenzie who had founded the Hospital for Diseases of the Throat in 1863. Wolfenden joined Mackenzie's staff in 1885, and two years later, together they founded the *Journal of Laryngology*, with Wolfenden acting as editor. Mackenzie's career was blighted when he failed to cure Queen Victoria's son-in-law, Frederick, on whom high hopes had been pinned for a new era of liberal reform in Europe, but who died of throat cancer shortly after succeeding as Emperor of Germany in 1888. The scapegoating of his mentor so disgusted Wolfenden that he abandoned his medical career soon after Mackenzie's death in 1892.

Wolfenden also had problems of his own, including the breakdown of his marriage and eventual separation from his wife. However ample private means enabled him to fulfil long-term ambitions, including buying a farm in the Tillingbourne valley in Surrey. The family spent the winter of 1894–95 in the Orkneys and this seems to have been the beginning of Wolfenden's active involvement with the sea. In 1895 he took a house on the south coast of England and shortly afterwards bought a sailing yacht, the *Walwin*. Yachting was a popular leisure activity of the Victorian upper classes but Wolfenden, like others before him, also looked for a more serious dimension to the pastime. His background meant he was well qualified to join the ranks of the dredgers, and he spent the summers of 1896 and 1897 working in the seas around Orkney. At this period he was experimenting with X-rays in medical research, and made use of them in identifying and describing his marine specimens.

Between June 1899 and August 1900 he made periodic cruises to scientific stations in the Faeroe–Shetland Channel, carrying out both biological sampling and hydrographic observations. He visited the area again in the summers of

Photograph of the scientists and crew onboard HMS* Research, *taken in 1896.
Fowler is seated at front left, and is holding a large plankton-sampling net. To his left, partially obscured by the kneeling figure, is the first version of his mesoplankton net, which was opened and closed by a propeller-driven device; in the 1987 version, he replaced this with messengers (i.e. weights which were sent down a line to trigger the mechanism). (Challenger Society archive)

1901 and 1902, on the latter occasion in a new and larger vessel, the *Silver Belle* (130 tons). Wolfenden's intention here was to carry into operation the idea shared by many marine scientists since the *Challenger*, that the way forward in research was a more detailed investigation of promising areas. However, from 1902 onwards the Fishery Board for Scotland included his stations in the observations it was making as part of the network organized by the International Council for the Exploration of the Sea (ICES), so in 1903 Wolfenden began working west of the Faeroe–Shetland Channel. For the next few years his voyages ranged more widely, some to the Azores, Madeira and Gibraltar, looking at the impact of the Mediterranean outflow, while other cruises in more northerly waters were designed to link in with ICES projects.

In his work on marine organisms Wolfenden specialized in radiolarians and copepods. This work, and his wider interests in marine research, brought him into contact with others in the same field both at home and abroad, and he joined the relevant scientific societies (Linnean, Zoological, Microscopical etc.). It was their shared experience of such meetings that gave Fowler and Wolfenden the idea of establishing yet another society. Fowler later recalled that 'when we read papers to one of the established Societies, we had the feeling that no one present seemed to care about marine work; we felt like two little Babes on the Beach picking up seaweed and dead shrimps.' At the meetings held by such bodies marine scientists were generally in the minority and it was difficult to generate any discussion of developments going on in oceanography.

Foundation of the Challenger Society for the Promotion of the Study of Oceanography

Both Fowler and Wolfenden were active members of the Marine Biological Association (MBA), the latter serving as a Council member from 1902 to 1908, but this existed primarily to support the Plymouth Laboratory. They therefore invited like-minded colleagues to a meeting at Fowler's London home on 28 January 1903 where they proposed the establishment of:

A small informal society ... for the study of Oceanic Zoology and Botany, at the meetings of which papers should be read, specimens exhibited and so forth, bearing on the faunistic, systematic, practical, and other aspects of oceanic zoology, and on oceanic physics, chemistry, and meteorology, in their biological relations.

Four others were present at this inaugural meeting: E.J. Allen (Director of the Plymouth Laboratory since 1895, and MBA Secretary), E.T. Browne, L.W. Byrne and E.W.L. Holt. Browne was a distinguished amateur zoologist who spent much time at the Plymouth Laboratory and materially aided its progress; both he and Allen had been mature students and worked under Fowler at UCL in the early 1890s. Holt had studied natural history after being invalided out of the army. His first post was as assistant naturalist during the trawling survey off Ireland under the Rev. W. Spotswood Green in the early 1890s. He subsequently worked for the MBA, taking charge of their North Sea investigations. In 1898 he returned to Ireland to undertake a programme of investigation of food fishes. In 1899 this work was taken over by the Department of Agriculture and Technical Instruction for Ireland, and Holt succeeded Green as Chief Inspector of Fisheries. Lucius Byrne was a lawyer and amateur zoologist who published in association with Holt and was also an MBA member.

These six elected themselves, and nine others, as the first members of the Challenger Society for the Promotion of the Study of Oceanic Zoology and Botany. However, at the Society's first general meeting the following October there was a small but significant change of emphasis in its title which then, following a proposal by Fowler and Allen, became the Challenger Society for the Promotion of the Study of Oceanography. It is not difficult to understand why it was decided to commemorate the voyage of the *Challenger* in this way. Sir John Murray, one of the two surviving scientists of the Expedition (the other was John Young Buchanan who never joined) was one of those elected at the first meeting. The rest of the Society's scientific membership had on the whole been too junior even to have contributed to its report (completed in 1895),* but the Expedition's impact had dominated the training of their generation of marine scientists. In the case of Fowler, as we have seen, the link was also a personal one, through the teacher who had inspired him in his early days.

At the second ordinary meeting of the Society, in October 1904, it was decided that the surviving officers of the Expedition could be proposed as honorary members, as might 'foreign gentlemen distinguished in Oceanographic Research'. Years later Captain Herbert Swire, formerly navigating sub-lieutenant in the *Challenger*, became a member under this rule, but Alfred Carpenter, one of the lieutenants, became an ordinary member in 1913. The 'foreign gentlemen' elected to honorary membership during the first twenty years were Karl Brandt, Carl Chun and Max Weber (all in 1905), Prince Albert of Monaco (1910), G.O. Sars (1915) and Johan Hjort (1921–22).

*An exception was H.R. Mill who in the mid-1880s had been on the staff of Murray's Scottish Marine Station at Granton and, like the young assistants employed at the *Challenger* Office, had contributed to the preparation of the volumes.

Meetings and officers

The first ordinary (scientific) meeting was held on 29 April 1903. Thereafter, such meetings took place four times a year in London, in the Royal Society's rooms, normally in January, April, June and October, in the evening of the same day as MBA Council meetings (usually 8.30 p.m.), thus facilitating attendance for those involved with both bodies. Whether informal dining arrangements existed is not recorded in the early minutes but on several occasions (as on 29 April 1908) Murray invited members to dinner beforehand, and the later custom of dining together presumably evolved in this way.

The format of the scientific meetings typically included Society business and one or more papers on current research by members (such as Fowler's 'destructive test of Hensen's theory of the uniformity of plankton over large areas' on 27 June 1906), followed by discussion. Members could also exhibit apparatus, data and specimens. Reports of proceedings regularly appeared in *The Athenaeum*.

Fowler was appointed Secretary at the first meeting, and continued in that position until 1910. His role was the more influential because the in those days Society had no President. Originally, there had been the intention to have one but, according to H.R. Mill, this was not done because appointing one of the two oldest and most eminent figures in the Society – Sir John Murray and E. Ray Lankester – could well give offence to the other. The custom then adopted, of choosing a meeting chairman from those present on the day, continued until the 1980s. In the early years, the Society's affairs were run by the Secretary, an Auditor or Treasurer, and a Committee; other committees were set up from time to time for specific tasks connected with the Society's activities.

Publications

The provision of a forum for marine science was important, but this was not intended to be the Society's only function. Both Fowler and Wolfenden took seriously the Society's stated aim of promoting oceanography, and during the early years they were at the forefront of several initiatives designed to encourage ocean science. The first was the publication of a blank working chart of the world, undertaken as a result of a proposal by Fowler, who had been keen to carry out such a project but unable to afford it on his own. The first two sheets were published during the Society's first full year and all six had appeared by the time of the 1906 annual meeting, together with a blank chart of the world on one sheet, and six smaller charts showing mean annual isotherms of all oceans and seas (the committee acknowledged the assistance of Gerhard Schott of the Deutsche Seewarte with the latter). Fowler persuaded the Society to finance the work by raising the annual subscription from five to ten shillings. Not everyone was happy about this, but the charts sold well overseas and actually paid their way.

At the first scientific meeting, Fowler had suggested that the Society might sponsor the compilation of a card index of publications on oceanic zoology and botany between 1846 and 1900. A committee set up to report on this proposal became the publications committee the following autumn, when it was also charged with overseeing the blank charts. On its recommendation the Society decided to go ahead with the project, but work on the catalogue did not begin in earnest until 1907 when L.A. Borradaile, a Cambridge zoologist who had sailed with Fowler in the *Research* in 1900, was appointed editor. The project was financed by Sir John Murray but it was still in progress when he died in a motor accident in 1914. Loss of his support and rising prices after the First World War meant that the intention of printing the catalogue in book form had to be abandoned, but the original card index, which by completion extended from 1758 to 1907, is in the National Oceanographic Library, located at the Southampton Oceanography Centre.

The third major project undertaken by the Society in these early years was the publication of *Science of the Sea* (1912). However it was not the first book to appear under the Society's imprint. This was Wolfenden's volume, *Scientific and Biological Researches in the North Atlantic*, which appeared as the first (and only) memoir of the Society in 1909. This was an account of the results from his own voyages and, as Damkaer points out, though Wolfenden himself did not contribute directly to *Science of the Sea*, 'his work reflected the essence of the book's viewpoint', i.e. belief in the value of the role of individuals in making scientific observations at sea and supplementing the work done by official organizations and expeditions.

Science of the Sea consisted of chapters on different aspects of marine science and the equipment and methods employed in their study. Most were written by Society members,* and the whole was designed to be useful to people not necessarily trained in science: travellers, sailors, yachtsmen and the like, who had opportunities for making observations at sea. Work on the book began in 1906 but it was not published until 1912, a measure of the difficulty that Fowler, as editor, had in getting some of the contributions completed. He nevertheless felt that the effort had been worthwhile and that the book had succeeded in arousing a wider interest in oceanography. One person who later acknowledged the impact it had made on him was Henry G. Maurice,† an influential figure in government scientific patronage between the wars. He was sent a copy by Lucius Byrne (an old schoolfellow and the Society's Auditor and later Treasurer) when he was appointed Head of the Fisheries Division of the Board of Agriculture and Fisheries in 1912. The continued need for a work of this kind led to a revised second edition, edited by E.J. Allen, which appeared in 1928.

At the time of its first appearance, however, some members felt that there was also scope for a rather different kind of book, one that would serve as a more general introduction to marine phenomena. The idea first arose because Fowler had turned down the proposal for a chapter on ornithology. Alfred Carpenter and David Wilson-Barker (who had had a career in sailing-ships and as master of cable ships before becoming commandant of the training ship HMS *Worcester* in 1891), jointly wrote *Nature Notes for Ocean Voyagers*, published in 1915 and illustrated with Wilson-Barker's photographs. This too went into a second edition in 1926.

Overseas contacts and major projects

During these early years, as well as pursuing its own projects, the Society also had interesting contacts with scientists overseas, some of whom attended its meetings as guests. Fowler corresponded with officers of the French Société d'Océanographie du Golfe de Gascogne (see Further Reading). At their suggestion, the Society organized the British exhibit in the oceanography section of the Exposition coloniale at Marseilles in 1906. Fowler also represented the Society at the opening of Prince Albert's Musée océanographique at Monaco in 1910. Another contact was Charles Atwood Kofoid, Professor of Zoology at the University of California, Berkeley, and closely associated with W.E. Ritter in setting up the Scripps Marine Biological Laboratory. He was anxious to see the establishment of an international journal for oceanography and hoped that the Society might take an active role in this. Fowler was keen, but at that time he was struggling to make progress with *Science of the Sea* and it was clearly unrealistic, given the limited resources of the Society, both in money and manpower, to take on such a major project unaided.

Why were Fowler and the others so anxious to undertake these and similar projects, and to make the Society more than an after-dinner discussion group, even though the need for this had been the initial reason for its foundation? Fowler's own experience in finding it hard to get the opportunity to work on oceanographic problems was far from being unique at that time. While a considerable number of members held posts in government departments, universities, museums and the like, there were relatively few openings available, particularly for work in physical oceanography. The diversity of members' backgrounds and occupations reflected not only the Society's broad appeal, but also the fact that some members, such as H.R. Mill and H.N. Dickson, had found it necessary to pursue careers in different, though related, fields. Government funding for science was still relatively unusual in the late 19th and early 20th centuries. Sending an expedition to

*However one, the chapter on algae, was written by Mme Anna Weber-van Bosse, wife of one of the honorary members.

†H.G. Maurice joined the Challenger Society in 1916. For more information about him, and the text of his address 'Where the Society Stands', given in 1945, see *Ocean Challenge*, Vol.7, No.2, 1997, pp.3–7.

observe an eclipse, or even a *Challenger* expedition was one thing; regular support, whether for a research programme at sea or a laboratory on land, was quite another, unless it was clearly linked to fishery problems which successive governments could not ignore because of the economic importance of the industry.

It had proved harder than expected for private enterprise to fill this gap, and the Society did not attempt to initiate large-scale projects, which would have been totally beyond its capability. Rather, the emphasis was on efforts to stimulate interest among the wider scientific and maritime communities and to give practical assistance where possible. It is difficult to gauge just how successful these efforts were but the Society clearly was effective in its deliberately modest objectives, acting as a focal point for the British marine science community in the lean years following completion of the *Challenger* work and before the gradual improvement in resources between the two world wars.

Rivalries, discipline groupings and sexism

From the beginning, Fowler intended that the Society should cover all branches of oceanography, though the emphasis was bound to be on marine biology as physical oceanography was so under-represented in Britain at this stage (although its significance was appreciated). The final choice of title was both succinct and inclusive, and the young Society had a diverse membership united by a common interest in the sea. Nevertheless, in some ways the membership was unrepresentative, to some extent deliberately so as it restricted its numbers and excluded women altogether. In addition, some of the senior figures in British marine science never joined and it is interesting to speculate why this should have been so.

It is not surprising that there were tensions within the marine science community at that time. In the context of the Challenger Society itself, too much should probably not be made of the divisions caused by personal antipathies, differences in viewpoint, and rivalry due to competition for scarce resources, but there is no doubt that, outside, strong feelings were engendered. These may have been at least partially responsible for the fact that, for example, W.A. Herdman never joined and, with one brief exception,* neither did any of his associates in the various organizations active in the north-west of England and the Isle of Man. Likewise W.C. M'Intosh of the Gatty Laboratory at St Andrews held aloof, though his Dundee colleague and eventual successor, D'Arcy Thompson, joined in the first year. Of the recognizable groupings that *were* represented in the Society, the most obvious is that of staff of the Plymouth Laboratory, together with associates and supporters such as G.P. Bidder and E.T. Browne. E.W.L. Holt, one of the most active early members, fell into this category, but he also formed part of another grouping, as he clearly encouraged the staff of his research team in Ireland to become members. These included the young Stanley Wells Kemp (elected 1905) who would become Scientific Director of *Discovery* Investigations in the 1920s.

*This was I.C. Thompson, a member of the Liverpool Marine Biological Committee, who joined in 1903 but died the same year.

Other notional groupings can be identified, such as Cambridge zoologists, or staff from the Natural History and other museums, though whether they acted in any sense collectively is not apparent. There was also a degree of association by occupation or subject. Marine biologists formed by far the most numerous section of the Society, but there were a few physical oceanographers, in particular H.R. Mill and H.N. Dickson. Another distinct group was the seafarers: naval surgeon–naturalists like P.W. Bassett Smith and surveyors such as H.P. Douglas and J.D. Nares. Some individuals who joined, such as the early geneticists Reginald Punnett and Leonard Doncaster, stayed only briefly as their main interests lay elsewhere. Others remained active supporters for many years.

The notion that membership numbers should be limited was not part of the original design of Fowler and Wolfenden, but was proposed soon after the Society's establishment. The idea of exclusivity obviously appealed to enough members for them to carry the day and it was agreed to restrict the membership to thirty. Whether this affected the growth of the Society by preventing others from joining, or by putting them off, is not clear. In practice, within a couple of years, when the number of ordinary members had risen to 29, the limit was increased to 40 on Fowler's urging, and in 1911 to 50. Membership did not exceed this number till the mid-1920s, by which time the limit had presumably been abandoned.

The admission of women took rather longer. Their exclusion had been deliberate from the start, in spite of the fact that (with the exception of ocean-going cruises) they were active in all aspects of marine science, and especially in marine biology. Most other scientific societies had women members; even the Linnean Society, where the Society sometimes held its meetings, admitted them from 1905. The Challenger Society, however, maintained its policy of exclusion until the Royal Society (where it customarily met) itself lifted its ban after the Second World War. The effect of this hurtful policy, which seems to have stemmed principally from the desire for more informality at meetings than would have been possible under the rules of Edwardian etiquette if both sexes had been present, was to some extent mitigated by the introduction of joint meetings in the 1920s.

Such developments are, however, beyond the scope of this article whose purpose has been to look at both the immediate and the underlying reasons for the foundation of the Challenger Society and how the Society and its founders went about carrying out its objectives in its early years.

The archivist and the fruit farmer: the later careers of Fowler and Wolfenden

The initial momentum provided by Fowler and Wolfenden was in fact of comparatively short duration. Wolfenden had been extremely active in the Society's early years, publishing not only his *Challenger* memoir but also the results of his plankton studies. However in 1910 he gave up this work and moved to Canada where he and his second wife bought a fruit farm near relatives in Grimsby, Ontario. He died there in 1926.

Fowler's withdrawal from the management of the Society, which happened at about the same time, was not so abrupt or final. Though he resigned as Secretary in 1910, and thereafter lived mainly in the country, he continued to attend meetings and take an interest in its progress. However, oceanography soon came to occupy less of his time because of his growing passion for local history and its sources. This interest stemmed from restoring his new home, 'The Old House' at Aspley Guise in Bedfordshire. Not content just to pursue his own researches, following election to the County Council in 1912 he was appointed to the County Records Committee, becoming its chairman six months later. He immediately began transforming the existing muniment collections into what in 1930 became the first County Record Office, an example soon after adopted by other counties. He continued to oversee its work until shortly before his death in 1940. He also established the Bedfordshire Historical Record Society in 1912, acting as general editor for many years, and also as editor of many of the texts that Society printed.

Though Fowler's principal energies during the last thirty years of his life were devoted to these new interests, establishing a more permanent reputation for himself both as archivist and mediaeval historian, there is a coda to his involvement with marine science and the Challenger Society. During the First World War he was back in London as a volunteer at the Admiralty, where he was employed in the Hydrographic Office compiling charts of oceanographic and other relevant data for use by submarines. Mindful of his earlier work for the Challenger Society, in 1916 he produced a pamphlet *Charts: their Use and Meaning* under the Society's imprint. It was, he said, written for the general public to help redress 'our national ignorance of the sea on which our existence mainly depends'. His continued sense of the importance of oceanography also led him to propose that research should be carried out by the navy after the war was over. Though these suggestions enjoyed only limited success, they did result in some useful work being done during the inter-war period.

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SedTalk Awaits Your Contribution!

SedTalk is a new internet forum started by the folks at Sediment Services in Sussex, UK (manufacturers of specialist sedimentological equipment). It's rather like a scientific chat room, and its aim is to stimulate and encourage interaction, and to share knowledge and experience, amongst geologists, oceanographers, hydrologists and engineers (and anyone else for that matter) actively involved with sediment. Members from academia, industry and other bodies are welcome and can register simply and easily by visiting www.sedtalk.co.uk.

The site is organized into sections (e.g. instrumentation, publications, software), and navigating it is pretty easy. It also has more general features like the option to post questions, or ask an expert. Sediment Services have also invited the manufacurers of oceanographic and other equipment to put a notice up too. So, there are lots of things happening. If you've got an idea or something to say, or know of a meeting or project going on, log on to the site now and register yourself. And remember, it's good to talk, even if about smelly mud!

Book Reviews

Pioneering Scottish Polar Oceanography

William Spiers Bruce – Polar Explorer and Scottish Nationalist
by Peter Speak (2003). National Museums of Scotland Publishing* (2003) 144pp., £9.99 (paperback, ISBN 1-901663-71-X).
*Tel./Fax +44-(0)131-247-4026/4012
www.nms.ac.uk/bookshop/

Almost coincident with Captain Robert Scott's well known *Discovery* Expedition to the Ross Sea in the Antarctic (1901–1904) there was a much less publicised venture led by an avowed nationalist Scot, William Spiers Bruce, who sailed to the Weddell Sea for oceanographic and hydrographic exploration in his vessel *Scotia* (1902–1904). In his book, Peter Speak describes how, as a student, Bruce entered the Medical School at the University of Edinburgh where he found himself deeply involved with the natural sciences and how, working at weekends in the Challenger Office, where Sir John Murray was working on the Report of the *Challenger* Expedition (1872–76), he decided to devote his life to polar exploration. Having given up medicine he was able to inveigle himself into a number of polar voyages. These are described in detail by the author, together with the highlights, one of which was meeting Prince Albert I of Monaco at Tromsø in Norway. The Prince invited him to sail with him back to Monaco in his yacht *Princesse Alice,* which was superbly fitted out for oceanographic research. William Bruce could not have found a more exceptional mentor.

After such voyages, Bruce considered himself a competent oceanographer who had presented several well received papers on the work he had been able to achieve. Embittered by his failure to be accepted by the Secretary of the Royal Geographical Society, Sir Clements Markham, as a member of Captain Scott's expedition, he decided to mount his own entirely Scottish venture.

An important chapter in the book deals with the many disparate preparations which Bruce had to make for his expedition. An auxiliary screw vessel *Hekla* was purchased in Norway, renamed *Scotia* and brought to the Clyde for fitting out as an oceanographic vessel along the lines Bruce had observed in *Princesse Alice*; stores had to be purchased; a crew was recruited largely from the Scottish east coast ports and harbours; a team of volunteer scientists was brought together; but above all, funds had to be raised, and in this respect the Coats brothers, threadmakers in Glasgow, were particularly generous.

On the morning of 2 November 1902 *Scotia* sailed from Troon for the Antarctic. Peter Speak describes the work of the Expedition in some detail: two summers and one winter, frozen in at Laurie Island in the South Orkney Islands where Ormand House, a meteorological station, was stonebuilt.

During the summer of 1903–1904 a party was left at Laurie Island while *Scotia* was in Buenos Aires, where the Argentine authorities were extremely generous, providing free docking for the vessel and other facilities. During the visit to Argentina it was arranged that the meteorological station that the Expedition had built at Laurie Island should, even after *Scotia's* return to Scotland, be maintained by a joint Scottish/Argentine team. The station continued to operate in this way for many years and today is maintained by the Argentine Government.

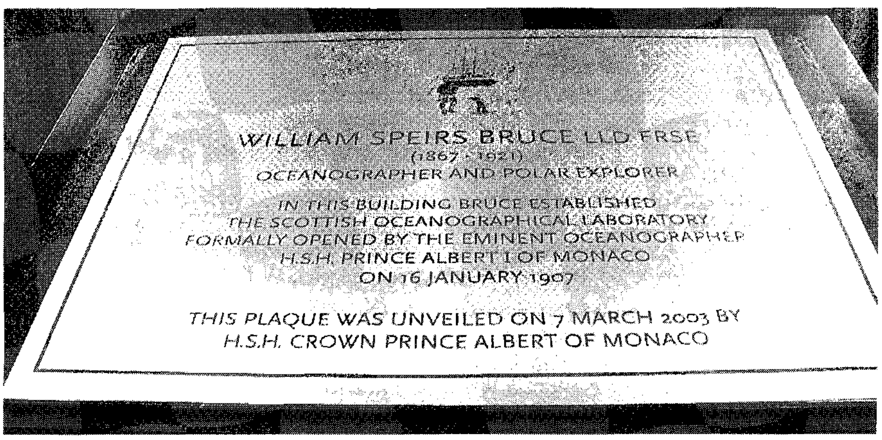
A very substantial scientific and explorational programme, including the 'coastlining' of 'Coats Land', cannot of course be fully described in a book of somewhat modest proportions, but the author is able to explain how well the whole project went under the leadership which this dedicated Scot was able to provide throughout the entire expedition, which finally returned to the Clyde on 2 July 1904.

Oceanographers will be interested to read that *Scotia* carried a Lucas wire sounding machine, together with instruments provided by Prince Albert for taking water samples and temperatures at depth. Bruce took a considerable number of such soundings in the newly named 'Scotia Sea' between the South Orkney Islands and South Georgia. On 23 March 1904, only a couple of miles from where James Clark Ross had claimed '4000 fathoms – no bottom', Bruce was able to bring a sample of glacial clay from 2660 fathoms.

Back in Edinburgh Bruce set about setting up the Scottish Oceanographical Laboratory to work up the results of the Expedition; this was opened by his old friend and teacher Prince Albert of Monaco. However Peter Speak informs us that funds for preparing the Reports were always in short supply, to such an extent that William Bruce's 'Log of the *Scotia*', in which he wrote a personal account during the morning watch every day of the happenings in the life and labour of the scientists and crew during the previous 24 hours, long remained unpublished. In 1992, Peter Speak edited this immensely detailed work which was published by the Edinburgh University Press; to read this beautiful book adds greatly to one's understanding of Bruce's unique leadership. Sadly it is now out of print.

Nevertheless, the new book contains a great number of interesting contemporary photographs, together with track charts and maps, which bring to life Bruce's many endeavours. There is a nominal list of the scientists and crew of *Scotia,* and a chronological record of national

Plaque unveiled at the site of Bruce's Oceanographical Laboratory in Edinburgh in 2003.



expeditions during the Heroic Age of Polar Exploration, among which is William Bruce's voyage in *Scotia*.

The publication of *William Spiers Bruce – Polar Explorer and Scottish Nationalist* in 2003 formed part of the Centenary celebrations in Edinburgh, which included the mounting of an excellent exhibition during May 2003 at the Royal Museum, opened by the Princess Royal; and most appropriately His Serene Highness Crown Prince Albert of Monaco came to Edinburgh to unveil a plaque (*see opposite*) in the Hall of the Royal College of Surgeons in Nicolson Street, the former site of William Bruce's Oceanographical Laboratory.

Steve Ritchie
Collieston, Scotland

Hydrographic 'Plums'

As It Was; Highlights of Hydrographic History, from the Old Hydrographer's Column in 'Hydro International', Volumes 1–6 by Steve Ritchie and Fellow Writers (2003). GITC bv, Lemmer, The Netherlands 118pp. 34 euros (flexicover, ISBN 90-806205-5-6).

Hydro International is an independent magazine for professional marine surveyors and hydrographers. In general it is, of course, very forward-looking, devoted to keeping its readership informed of the latest developments in all aspects of maritime surveying technology. But it is also proud of the long and distinguished international history of hydrography and is anxious to make modern practitioners aware of their rich heritage. To this end, since the first issue appeared in February 1997, every *Hydro* has carried a feature under the title 'As it Was – by the old Hydrographer', this particular 'old Droggie' being the eternally young-at-heart Admiral Steve Ritchie who retired from the post of Hydrographer to the Royal Navy in 1971 after 35 years in the surveying service.

Based on his unrivalled hands-on experience of marine surveying, and a fascination with hydrographic history, Steve was charged with the task of informing modern readers something of '... how things were done before the advent of such aids as electronic ship-fixing, GPS and side scan sonar etc.' He has achieved this admirably – and single-handedly, apart from contributions from half-a-dozen guest contributors – by writing a series of self-contained and beautifully illustrated little articles, rarely exceeding a couple of pages in length and therefore easily read over a cup of coffee. As a result of an inspired realization by someone on the *Hydro* editorial board that the magazine is a touch ephemeral, the 48 articles from the first six volumes have been salvaged and reproduced in this book.

Instead of publishing them in the somewhat haphazard order in which they first appeared, they have been reproduced in the chronological order of their topics so that they can be read with some semblance of logical continuity. They begin with a fascinating item about the 'Periplus of the Erythraean Sea', one of the very earliest sailing directions, for the Red Sea and the western Indian Ocean, produced in Alexandria around 100 AD. They end with a couple of guest contributions on precision surveying of oil rigs and pipelines in the North Sea in the late 20th century. The intervening roughly two millennia of hydrographic history are inevitably covered somewhat patchily and erratically, with Steve Ritchie admitting in his introduction to having '... picked out the highlights, like plums from a pudding'. He has certainly chosen some treats.

Take, for example, his delightful little item on 'Views' of various aspects of the land seen from vessels at sea, originally published in sailing directions and later to appear fairly routinely on navigational charts to help sailors establish their position when approaching a shore. These little pictures ranged from extremely simple outline sketches of steep headlands with their characteristic off-lying geological needles to the elaborate and often beautiful watercolours produced by generations of talented ship's officers, particularly in the eighteenth and nineteenth centuries. But the practice lasted well into the twentieth century, and one of the delights of the book is to have Steve's personal recollections linking us with the past, in this case with his '... memory of the old days when on a sunny day in the tropics, on deck and under an awning, the junior surveyors were gathered together with their sketchbooks, pens, brushes, paints and inks to make a carefully structured view.'

Similarly, in an article on sea-bed samplers Steve introduces his readers to the classic sounding rod with its detachable cannon ball weight invented in 1852 by midshipman John Brook of the US Navy, and then to the greatly improved version devised by Lieutenant Charles Baillie of HMS *Sylvia* in 1872 and eventually supplied to the *Challenger* for her pioneering circumnavigation. But then, in a nice final twist, he takes us on eighty years to his own experience as Captain of the much later *Challenger* in the Pacific in 1951 when, after three attempts, a sample of sediment was retrieved from the bottom of the Challenger Deep in the Marianas Trench with – surprise, surprise – a still standard Admiralty issue Baillie Sounder!

There are articles on the history and use of hydrographic instruments such as station pointers, the Tavistock theodolite, the 45° astrolabe and the Somerville sounding machine; on people, including Lucas Janzoon Waghenaer of Enkhuizen (Steve's personal hydrographic hero), Ferdinand Hassler of the US Coast Survey, and Prince Albert I of Monaco; and on organizations like ICES and GEBCO, whose centenaries are upon us. And very often there is a Ritchie-esque twist, such as his personal recollections of using a particular instrument or technique, or his memory of an official or unofficial visit to some especially important locality or building.

Although there are many interconnections between the articles, they were not written with the intention of telling a continuous story. As a result, the book is definitely not a textbook of hydrographic history, and a reading of the articles alone would provide a very strange and disconnected view of the subject. Moreover, they could have benefited from a little light editing, if only to make the cross-referencing between articles refer to page numbers in the book (rather than issue numbers of *Hydro*, as in the originals). But notwithstanding these minor criticisms, and the fact that at 34 euros it's a touch pricey, it gets a definite thumbs-up from me since, apart from their inherent readability, each article carries one or more references to suitable further reading for the enthusiast who wants more information. I shall certainly follow up my favourite article, the story of Ripple Rock in the Seymour Narrows between Vancouver and the mainland. With only 9 feet of clearance at low water, the rock had claimed many ships, and lives, before Steve Ritchie and HMS *Challenger* almost joined them as a result of meeting a vast raft of logs while negotiating the eastern passage in 1953. Not, I think, as a direct result, on 5 April 1958 the Canadian Government financed the 'greatest ever non-atomic explosion' of 1375 tons of Du Pont Nitra-max in a tunnel drilled under Ripple Rock from nearby Maud Island. When the dust had settled, the minimum depth in Seymour Passage had been increased to 47 feet. Now that's what I call hydrography!

Tony Rice
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Prince Albert's legacy to Monaco and the scientific world

Albert Ier Prince de Monaco, des Ouvres de Science, de Lumière et de Paix edited by Jacqueline Carpine-Lancre (1998). Monaco, Palais de S.A.S. Le Prince, 205pp., 28 euros plus postage (hardback, limited edition).

La Pratique de l'Océanographie au Temps du Prince Albert Ier by Christian Carpine (2002). Monaco, Musée océanographique, 331pp., 45 euros plus postage (hardback, ISBN 2-7260-0225-0).

Both books are available from 'La Boutique', Musée océanographique de Monaco, Avenue Saint-Martin, MC 98000 Monaco.
Email: musee@oceano.mc

These two handsome volumes, from a husband-and-wife team, reflect the fact that Monaco is extremely proud of Prince Rainier's great-great-grandfather, Albert I, who ruled the tiny Principality from 1889 until his death in 1922. And no wonder, for Albert pretty well single-handedly put Monaco on the map culturally, socially and scientifically.

He was born in 1848, the year of European revolution, when Monaco and the ruling Grimaldi family were more or less on their uppers. But by the time he succeeded his father, Charles III, things had changed dramatically. Charles had improved his financial situation by doing a series of deals with the French Government, including selling them the ancient towns of Menton and Roquebrun and allowing the railway between Nice and Genoa to pass through his territory. But the real clincher, which set Monaco on the road to becoming the gambling capital of Europe, if not the world, and at the same time secured the financial prosperity of the Principality and the Grimaldis, took place in 1861. For this was the year when a French entrepreneur and casino owner, François Blanc, took over the ailing casino in Monaco and began the process of turning it into the magnet for the rich, famous and foolish that it remains today.

With the punters' money rolling in, the teenage Albert could easily have slipped into the role of playboy, but he didn't. He certainly used his personal wealth to indulge his eclectic interests in the theatre and the arts, in the emerging technologies such as automobiles, aviation and electric power, in human prehistory, in medicine and science, and particularly in oceanography. But he managed to combine these interests with his strong sense of duty towards his Monegasque subjects, with his expressed determination to give the Principality a modern profile out of all proportion to its small size. As a result, by the time he died, Monaco could boast some of the most up-to-date medical facilities and water- and waste-treatment plants in Europe, together with excellent theatres, art galleries, museums and public gardens, and a deep-water port to welcome cruise ships and millionaire's yachts that was not significantly altered until two years ago. And, most important from the viewpoint of *Ocean Challenge* readers, it had the magnificent building of the Musée océanographique perched on the cliffs of Monaco Ville and housing the Prince's oceanographic collections, archives, library, museum and aquarium. These have attracted generations of marine scientists and tourists ever since.

Jacqueline Carpine-Lancre's volume, published by the palace on the 150th anniversary of Albert's birth, sets out unashamedly to celebrate his multifarious achievements. The text is based almost entirely on his own writings, carefully selected, edited and annotated by Jacqueline, and accompanied by a superb series of illustrations which are wonderfully evocative of the era leading up to the Belle Epoque. The five main sections, dealing respectively with Albert's personal life, his official role as ruler, his involvement in improving his beloved Monaco, his passion for nature and particularly for the sea, and finally his interest in human history, are each introduced by pieces written by Prince Rainier, Princess Caroline and Albert's namesake, the heir apparent. With this background, it inevitably looks a bit like a turn-of-the-century Grimaldi family commonplace book where the sun is always shining and the darker aspects of Albert's life, such as his less than successful marriages, are somewhat glossed over. Nevertheless, it is a beautifully produced and extremely attractive volume which, despite being entirely in French, should find a welcome home in any oceanographic library, not least because of the superb sketches and paintings of oceanographic subjects by Louis Tinayre, Prince Albert's personal artist. And it should stand next to Christian Carpine's volume, which has an even greater claim to shelf space because it is pure oceanography from beginning to end.

Christian spent a large part of his working life at the Musée in Monaco curating the institution's superb collection of oceanographic instruments and models, which were mainly collected during Prince Albert's own lifetime. Between 1987 and 1999 he published a catalogue* comprising almost 1300 pages in seven separate papers in the *Bulletin de l'institut océanographique, Monaco,* in which each of the instruments was described, together with its dimensions, the materials from which it was made and how it was employed. But in many ways this enormous work was just the tip of Christian's research 'iceberg'. For in accumulating the material for the catalogue he had uncovered much more about the people and ideas behind the instruments, the personal interrelationships involved, sometimes of co-operation, sometimes of competition, along with stories about what actually happened in practice when the instruments were used at sea, rather than what *should* have happened. In this new volume, which Christian refers to as the conclusion to his catalogue, he has woven this previously unused information into a fascinating tapestry, in which the inanimate and impersonal instruments are seen against the very human background which led to their conception, design, manufacture, use and often rejection or loss!

Inevitably, not all the instruments in the catalogue find a place in this book. Instead, Christian has concentrated on those bits of kit that were of particular significance in the development of oceanography and even more especially on those that were employed by Albert during his cruises on his four yachts. So after a short introduction, he deals with the development of oceanographic technology with a series of chapters, each based on some aspect of the Prince's own activities or those of his oceanographic pals. These include the relatively simple techniques used during the cruises of his first

*For Steve Ritchie's review of this catalogue, see *Ocean Challenge*, Vol. 7, No.1, p.47.

yacht, the sailing vessel *Hirondelle*, between 1885 and 1891, and the increasingly complex and lavish arrangements on his three purpose-built engine-powered research vessels *Princesse-Alice, Princesse-Alice II* and, finally, the *Hirondelle II*. Further chapters deal with the technologies associated with the remarkable careers of Albert's boyhood friend, the pressure physiologist Paul Regnard, and his scientific amanuensis Jules Richard, as well as the many collaborators invited to participate in his cruises, including the somewhat dour Scottish ex-*Challenger* chemist John Young Buchanan.

After fascinating sections on the building of the Musée in Monaco, the activities of some of the engineers and technicians who actually built the instruments in the collection, and Albert's forward-looking interests in atmospheric physics, the book ends with an attempt to assess the Prince's influence on oceanography during his lifetime and subsequently. Alongside the well-documented help or inspiration which he gave to, for example, Jean Charcot and the hapless King Carlos I of Portugal, Christian justifiably sees Albert's influence in a whole range of undertakings including the voyages of the European ships *National, Valdivia, Planet, Scotia, Belgica* and *Siboga*, and even the pioneering cruises of the American steamer *Blake*. All are accompanied by wonderful illustrations of instruments, ships, people, buildings and documents, making the book a joy to flick through, whether you read French or not. If I hadn't received a review copy I would have bought one.

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Sediment Stories

Western North Atlantic Palaeogene and Cretaceous Palaeoceanography by Kroon, D., Norris, R. D. and Klaus, A. (eds) (2001). Geological Society, London, Special Publication No. 183, 328pp. £79 (£35 Geol. Soc. members) (hardback, ISBN 1-86239-078-9).

This publication comprises a series of papers describing key results from Ocean Drilling Program (ODP) Leg 171B, fulfilling much the same role as the now defunct ODP Scientific Results publications. Leg 171B is of real interest for palaeoceanography since it recovered sediment sequences that span key periods in the Earth's history: the Late Palaeocene Thermal Maximum (LPTM), the Cretaceous–Palaeogene (K–P) extinction, the mid-Maastrichtian event, and several episodes of sapropel deposition documenting the late Cenomanian, late Albian and early Albian warm periods.

Moreover, core from Leg 171B (~30° N) may be crucial for resolving the debate as to the role of the tropics in driving climate change. While the most outstanding results from the Leg have unsurprisingly been published elsewhere (for example, in *Nature* and *Geology*), climate modellers, palaeoceanographers, geochemists and palaeontologists will find much of interest in this present collection.

A description of the core recovered and a useful summary of the highlights of the post-cruise research is provided by the editors and their co-workers in the first chapter. This is tightly written and well-researched, and it is good to see that the editors have ensured that this standard is maintained throughout the remainder of the book. The biostratigraphy of the core material is documented in a number of careful studies, and several new taxa and species are described. Of particular interest is a study of benthic foraminiferans through an oceanic anoxic event; species diversity is shown to be lower when conditions are anoxic, but no major extinctions were noted, suggesting that the event was fairly localised. Stable isotope analyses of foraminiferans preserved within sediments recovered during Leg 171B have largely been documented elsewhere (of particular significance is the large carbon isotope excursion recorded at the LPTM), but Wade *et al.* present a high-resolution oxygen isotope record for the mid-Eocene. This period was previously thought to be a time of stable climatic conditions, but this study indicates that this was not the case; large shifts in $\delta^{18}O$ values of surface waters are observed over short time intervals.

Cretaceous–Tertiary boundary sediments recovered on Leg 171B record mass extinctions, preserve debris blasted from the Chicxulub crater, and provide further evidence for a meteorite impact at Chicxulub. The geochemistry of these sediments, and associated impact-generated spherules, is presented in two fascinating articles by Martínez-Ruiz *et al.* These demonstrate that the mass extinction led to massive accumulation of organic matter on the sea-bed, resulting in suboxic or reducing conditions within sediments, and remobilization of the redox-sensitive elements. Leg 171B sediments also provide a good record of another period of profound global climate change: the LPTM event. The sediments reveal an abrupt drop in carbonate $\delta^{13}C$ of −2.5‰ at c. 55Ma, followed by a more gradual return to near-initial values. These variations in $\delta^{13}C$ are modelled by Dickens in terms of a pulsed injection of methane at the LPTM, followed by enhanced carbon burial of organic matter. The mechanism of methane injection is explored by Norris *et al.* using seismic profiling techniques. A prominent seismic reflector c. 55Ma in age is interpreted to relate to an abrupt increase in the strength of the deep western boundary current in this region, due to increased outflow of warm Tethyan waters; the authors speculate that this warming of bottom waters may have triggered the failure of gas hydrate reservoirs.

The studies described above provide only the briefest glimpse into this fascinating book. However, given its list price of £79, it's maybe one to convince your library to purchase.

Rachael James
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Fish: Conserving and Serving

In a Perfect Ocean: The State of Fisheries and Ecosystems in the North Atlantic Ocean by Daniel Pauly and Jay Maclean (2003) Island Press, 175pp. flexicover ($25/£14, ISBN 1-55963-324-7); hardback ($50/ £27, ISBN 1-55963-323-9).

This book contains the results of analyses performed as part of the Sea Around Us Project, using both pre-existing data and those gathered through studies performed specifically for the Project, which began mid-1999. The Project aims to present a picture of the current state of global fisheries and the resulting impact on the world's oceans, along with recommendations for action to prevent further decline of the marine environment.

This publication concentrates on the Project's first case-study area, the North Atlantic, and looks at both the past and present state of the fisheries industry and marine ecosystems, the reasons for their decline, and what we need to do in order to restore the health of the ocean.

The emphasis is on the need to act *now* and the introduction highlights this by means of a brief, simple but hard-hitting summary of the state of the ocean today. Chapter 1 then provides a history of the North Atlantic, using archaeological evidence, records and personal accounts to describe the abundance and physical size of different marine species as they were before human intervention led to their decline.

The description of the past is included not simply to gain reader support for the measures put forward to combat overfishing (introduced later in the book), but also to introduce the 'shifting baseline syndrome'. This is where each generation identifies the state of the ocean they witnessed when they were younger to be as the ocean 'should be'. For us to appreciate the full scale and rate of destruction, the reduction in fish populations responsible for the decline of the North Atlantic fisheries, as detailed in Chapter 2, need to be compared with data as far back as evidence will allow, and not just with data collected by the last generation.

As well as the economic implications of reduced fish populations, the chapter also recognizes the environmental effects of increasing fishing effort to gain ever-decreasing catches: pollution from increased fuel consumption, damage from intensive fishing methods, and the restructuring of food webs, all of which have a detrimental effect on the health of the ocean.

Chapter 3 deals with the reasons for overfishing: subsidies; poor governance and ineffective regulations that either cannot be enforced or contain loopholes in favour of increased catches. The comparison of small- and large-scale fisheries is well summarised in the form of a simple table containing figures relating to catch, fuel consumption and landed value.

As well as pointing out what is wrong with the current state of the North Atlantic fisheries, the authors present possible solutions to the problem, and begin Chapter 4 by suggesting that the culling of marine mammals is not one of them. They identify the need to reduce fishing effort and suggest how this could be achieved, recognizing the need for improved legislation and governance to create more responsible fishing practices, and to stamp out illegal fishing, a major threat to sustainability of many fish populations. This final chapter also recognizes the need to make consumers more aware of what they are buying and the impact that their choice has on the marine environment.

In a Perfect Ocean does not provide all the answers, or even cover all the environmental issues relating to the North Atlantic fisheries, and it acknowledges this fact in the substantial chapter notes at the end of the book. However, numerous references to books, reports and websites provide the reader with the means to follow up on specific issues.

The book can be a bit dry and sometimes rather heavy going for the non-scientist /economist, but the clear and colourful figures help to explain some of the more difficult concepts and even if the book cannot be understood in its entirety, the simple facts and figures that do come across make this book definitely worth reading.

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The Open University

The Good Fish Guide by Bernadette Clarke (2002). Marine Conservation Society, 192pp. £10 (including p&p) (flexicover, ISBN 0-948150-31-9).

Available from the Marine Conservation Society (now in its 2nd edition)
Tel. +44-(0)1989-566017.
Email: info@mcsuk.org

Fish 'n chips must surely rank as one of Britain's better contributions to world cuisine, even though it began life wrapped up humbly in yesterday's news. One of the many questions tackled by *The Good Fish Guide* is whether we can continue to enjoy our original takeaway meal before it becomes yesterday's news itself.

With species decimation firmly on the menu, it therefore came as a surprise to find that this guide is printed in a jolly, almost lurid, format more suggestive of children's bedtime reading than a scientific text. Perhaps the intention is to make marine resource management accessible to a wider audience but the reader with a more serious interest shouldn't be deterred by the book's trendy design. In fact, as you might expect from the Marine Conservation Society, *The Good Fish Guide* is actually crammed full of useful information about modern-day commercial fishing, and the book's structure makes that information relatively easy to find. Although there is no index and the glossary is rather short, this is compensated for by the way in which topics are divided into nine distinct chapters.

After an introductory overview, there is a useful chapter on labelling to assist consumers in purchasing from sustainable sources. Most of us have seen 'dolphin-friendly' logos on tins of tuna but I was surprised to find a fish logo by the Soil Association! In fact, the proliferation of logos is in danger of confusing consumers and this must surely be a fertile area for European standardization.

Chapter 3 provides an alphabetical listing of commercial species, including shellfish, covering everything from Linnean classification to methods of capture. There are a few omissions from the list, not least because the commercial fishing industry is constantly seeking new species to exploit, but it generally works very well as a comprehensive look-up table. Chapters 4 to 6 cover the fishing industry itself, looking at both 'free range' fishing and aquaculture, as well as the management of fisheries through international agreement. I found the coverage of aquaculture particularly interesting, as I have always harboured a dream that it might lessen the pressure on natural fisheries; unfortunately, the problems and environmental impacts described in the guide probably outweigh any benefits to date. Finally, Chapters 7 to 9 look at the broader issues of health, environment and economics. Some interesting little facts emerge from this part of the book: for instance, how many of you knew that goitre is rare in fish-eating human populations because of the ready availability of iodine?

So, the *Guide* manages to cover a surprising amount of ground, not least the acronyms at the end which tell me that a TED is a turtle excluder device (not my wife's other bedtime companion) whilst ASP is amnesic shellfish poisoning (and not the poisonous snake that killed Cleopatra). If the Guide has any fault, then it is one shared with other areas of modern life, namely that it remains unclear what the individual can *do* about overfishing, short of refusing to eat fish products. Logos and labelling can help, along with applying the concept of food miles, but arguing with the young counter assistant at Waitrose on Friday evening that he shouldn't be selling exotic and endangered species such as snapper has so far produced no change on the ice slab.

The success story of Icelandic cod proves that fisheries can be improved by strictly controlled management, and we should be able to achieve such levels of protection in European waters. Consumer education from sources such as *The Good Fish Guide* must be the first step towards effective governmental action, so why not put it on your list of suitable presents for your friends?

Gerry Bearman
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