Presentation of a replica of the Drake Medal (1589) to

Dr Robert (Bob) L Fisher

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7th July 2004

on the occasion of a meeting of the USA Ocean Studies Board

at Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, USA

- **Citation by Sir Anthony Laughton (Chairman GEBCO 1985-2003)**
- **Presentation of the Drake Medal, on behalf of the GEBCO Community, by Desmond P D Scott (Permanent Secretary GEBCO 1974-1995)**
- **Short biography of Bob Fisher**
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Presentation of the Drake Medal to Dr Robert L Fisher
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Citation by Sir Anthony Laughton

Several of you will have heard my presentation to the Ocean Studies Board on GEBCO, and my references to the role that Bob Fisher, who is here to be honoured tonight, has played.

John Sclater has said something of Bob's achievements in exploring and surveying the great trenches of the world's oceans, and particularly his work in establishing the greatest ocean depth in Challenger Deep in the Marianas Trench. John has also talked of Bob's outstanding contributions to the study of the rocks comprising the ocean floor and the way in which Bob has interpreted his surveys and geological measurements in terms of the geological evolution of the features in the Pacific and Indian Oceans.

I would like to bring to you some of my personal memories of working with Bob over some fifty years.

At the end of the 1950s, the oceanographic world turned its attention to the little studied Indian Ocean. The Special (later Scientific) Committee on Oceanic Research (SCOR) initiated the International Indian Ocean Expedition which later was taken under the wing of the Intergovernmental Oceanographic Commission (IOC). Bob became Director of the Scripps Indian Ocean Programme and himself led several cruises there in R/V Argo – the Monsoon and Lusiad expeditions – collecting geological and geophysical data. Bob created new bathymetric charts of the mid-ocean ridge in the central Indian Ocean, of the Mascarene Plateau and of the 90 Degree East Ridge about which he and his colleagues produced several publications.

This was a period when many countries sent expeditions to the Indian Ocean under the auspices of the IIOE, which officially ran from 1959 to 1965. Altogether forty six ships from thirteen countries took part, many returning to the Indian Ocean several times. The IIOE Sub-Committee on Geology/Geophysics and Bathymetry was chaired jointly by Bob and by Dr P.L. Bezrukov, from the USSR and as a result Bob became very familiar with all the activities in these fields. It was natural therefore that he was appointed one of the Associate Editors, together with Prof Eric Simpson from South Africa, Dr Victor Kanaev and Dr Dina Zhiv from the USSR and me from the UK, to work under Dr Gleb Udintsev as Chief Editor, to produce an all-embracing Geological-Geophysical Atlas of the Indian Ocean bringing together the results of this major expedition.

The preparation of the Atlas, which was published in 1975, brought me into close contact with Bob and I began to recognise his outstanding contributions, not only to the bathymetry of the Indian Ocean but also to the interpretation of its geological evolution, published with John Sclater and Dan McKenzie in 1971. In particular he recognised the NE-SW trends of fracture zones in the central Indian Ocean Ridge which dominated its

structure and which provided constraints on the poles about which the components of the expanding Indian Ocean rotated. An essential element of the Atlas was the creation of an updated bathymetric base splicing together the contributions by various individuals. This laid the foundation of his interest in the bathymetry of the whole of the Indian Ocean which culminated in his major contribution last year to GEBCO.

Bob has been a very long standing member of GEBCO, the General Bathymetric Chart of the Oceans, which was initiated at the beginning of the 20th century by Prince Albert 1st of Monaco. GEBCO had run into hard times in the late 1960s when its products failed to reflect the increasing understanding of seafloor processes and as a result they were not wanted either by hydrographers or marine scientists. But nevertheless there was an urgent need for better contoured charts of the oceans recognised by the IOC in its Long-term and Expanded Programme of Ocean Exploration and Research (LEPOR) , and SCOR set up a Working Group (41) to see how this could be achieved.

From 1969 Bob had been an "Expert Member" of the GEBCO community and was well aware of the limitations of its products. So he was a natural appointee to SCOR WG41, initially under the Chairmanship of Dr Johannes Ulrich of Germany and later under my Chairmanship. Bob's contributions were both powerful and constructive. His letters at the time bore all the hallmarks of Bob's style – pungent, hard hitting, abrasive, witty, convoluted and lengthy. He seldom used one word where five were possible! In 1972 he wrote criticising a report of a GEBCO meeting, at which no oceanographers had been present, as "all unwittingly, a most instructive passage and downright damning indictment of the thinking – if that is the right word – on the part of the GEBCO men that has led the obvious decline and the dodo-like status …of the 1:10,000,000 charts." He describes the GEBCO contours as "timid, wishy-washy, track-sensitive, and amoeboid". He was always scornful of desk-bound bureaucrats pontificating about the oceans.

The recommendations of SCOR WG 41 resulted in the immediate cessation of the 4th edition of GEBCO, the reorganisation of the GEBCO committee structure to include a scientific input from members appointed by the IOC (in which Desmond Scott who became the Permanent Secretary of GEBCO played a leading part) and the initiation of a 5th edition of GEBCO working to new specifications developed by the WG. Many of these specifications had been used in the preparation of the IIOE Atlas bathymetry and so it was obviously sensible to use this for the first of the 5th edition GEBCO sheets, published by the Canadian Hydrographic Service on behalf of IHO and IOC in April 1975.

Bob was the scientific co-coordinator for Sheet 5.09 covering the Indian Ocean south of the equator which abutted my sheet 5.05 north of the equator. The co-ordinators were responsible for locating and using data from all possible sources, including of course the data collected for GEBCO on the 1:1,000,000 plotting sheets by the Volunteering Hydrographic Offices working through the IHO, and for creating contoured charts which not only reflected the most up to date thinking about seafloor processes, but also any other geophysical data that were relevant. Over the next ten years all the oceans were recontoured as the eighteen charts of the 5th edition, creating the product that is now seen

on the walls of many conference and lecture rooms in marine institutes and Universities throughout the world.

The Joint IOC/IHO Guiding Committee for GEBCO has five members from each of the sponsoring organisations and Bob was appointed by IAPSO to serve as an IOC member. He was also appointed to the Sub-Committee on Geographic Names and Nomenclature of Ocean Bottom Features, which more recently he has chaired under its new name of the Sub-Committee on Undersea Feature Names (SCUFN). It is clearly an essential part of charting to establish names for features that can be printed on the charts. As a preliminary to this, it was necessary to standardise the generic names used, such as trench, seamount and ridge, and Bob worked assiduously on this, justifying them by their usage in publications, not only in the English language but also in French, Russian and Spanish. These standards are now published by the IHB (BP-6).

The process of naming features continues as more and more detailed surveys are made of the ocean floor. Bob has been particularly passionate in researching and submitting for approval by GEBCO, through SCUFN, the specific names for undersea features, ensuring that there was adequate survey data to describe the feature, that no name had already been given to it by others and that names are not given for trivial, personal or political reasons. He exercised considerable erudition in his search for appropriate names, and has campaigned for attention to be paid by editors to ensure that inappropriate new names were not accepted in publications.

Bob is essentially a paper and pencil, old style contourer. It has taken him some time to come to terms with the impact that satellite altimetry has had on portraying the ocean floor, even though the sea surface gravity data which this displayed could give valuable guidance to interpretation and interpolation where there were no soundings. He objected to those who presented bathymetry without the discipline of collecting and analysing seaborne data themselves, and resented the “young turks” who only focussed on “postage stamps” of surveys using the newer multibeam swath echosounders. Concerns such as these led him to resign from the GEBCO Guiding Committee in 1993, although he has remained extremely active until last year as Chairman of SCUFN.

Throughout the 1980s, 1990s and early 2000s, he has been steadily improving the bathymetry of the Indian Ocean working with a group of other oceanographers in what they call the “Alliance Exotique”. He has searched out and used data from sources not generally available to others and has meticulously scrutinised them for consistency and for errors so that his product can be used in the latest versions of the GEBCO Digital Atlas. The Centenary issue of the GDA includes his revised contouring of the whole of the Indian Ocean and parts of the SE Atlantic and the SW Pacific. His colleague, Andrew Goodwillie, has created a gridded data base from his contours, to be integrated into the global gridded data base which is a major new component of the GDA-CE.

Bob is one of a vanishing breed. He is one of those very few who can take an ocean wide view and create an integrated product of a significant fraction of the earth’s surface. It is

hard to know who in the future can take on this sort of role in, for instance, the South Pacific where the data are even more scarce and intelligent interpolation is essential.

Let me finish by saying how much I have valued working with Bob over the last four decades. Although we have at times had our arguments and disagreements, we have shared many of the same values and worked towards a common goal of providing the best possible portrayal of the shape of the ocean floor. His contributions to GEBCO have been inestimable, and it is for this that GEBCO has decided to award him the Drake Medal.

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Extract from the Presentation statement

The History behind this award starts when Bill Menard in his 'The Ocean of Truth-A personal history of global tectonics', in 1986, recorded that: '... Bob Fisher who has been active at sea from 1951 to the present (1986), may hold the record for scientific exploration, anytime, anywhere.' Then John Sclater, when Chairman of the OSB, proposed in December 1990, together with Roger Revelle, that Bob Fisher should receive: 'some well merited recognition for (his) work in helping to prepare the latest editions of GEBCO which the Board described as being 'of outstanding quality and ... of lasting importance.'

This started us investigating possibilities but it was not until much later that we came across the DRAKE Medal of 1589 which was struck to commemorate Drake's round-the-world voyage 1577-1580, and we were able to obtain a replica which has now been incorporated into this booklet, together with other relevant material. I'm sorry it is not solid silver, but Drake was most likely in a position to supply the silver himself, and we didn't feet we could ask either Scripps or Bob himself for a silver ingot for this purpose. Having obtained our medal for the award, we circulated our proposals to members of the GEBCO community and received almost unanimous support, together with signatures and comments from some 30 persons from 10 countries.

This medal is presented to you, Bob, as a token of appreciation from the GEBCO Community.

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Robert L Fisher: A Short Biography

Bob Fisher, Research Geologist Emeritus at UCSD's Scripps Institution of Oceanography, has directed scientific field exploration of the world's ocean floor and sub-oceanic crustal-structure since the early 1950s. Following Naval service in the Western Pacific in WWlI and a B.S. in Geology from Caltech, he joined SIO in 1950. He received a doctorate in Marine Geology in 1957, on the seafloor topography and crustal structure (by seismic refraction) of the Middle America Trench.

Some years earlier Bob had begun. directing geological-geophysical explorations of the Pacific's deepest trenches, in 1952 establishing by bomb-sounding and echo-train analysis the deepest point in the Southern Hemisphere, Horizon Deep in Tonga Trench, at 10,800 ± 10m. His similar studies in 1959, augmented by newly-developed precision depth recorders, established definitively the greatest depth in the oceans, 10,915 ± 10 m * in Challenger Deep, south-west of Guam. That .figure was confirmed by manometer on the bathyscaph *Trieste* in early 1960. These collaborative trench studies in the 1950s early contributed to demonstrating the process of subduction characteristic of Pacific margins and, in 1960, at the Sunda Trench in the north-east Indian Ocean.

Bathymetric surveys in the Gulf of California on SIO's VERMILLION SEA Expedition, and Fisher's resulting topographic chart of 1960-61, clearly demonstrated the plate tectonic framework for that region's structural development; that portrayal still pertains. Similar surveys of the Central Indian Ridge and Southwest Indian Ridge likewise made Obvious the Plate tectonic interpretation for those complex previously misinterpreted elements. His 1960s and early 1970s expeditions throughout the Indian Ocean identified the lower crust and dredged exposures at the seismically active median ridges. These late 1960s dredge hauls for the first time recovered fresh, well-located 'ground truth', i.e. specimens of the Earth's lower crustal and upper mantle ultramafics: lherzolites and varied peridotites, exposed at the ultra-slow-spreading Southwest Indian Ridge. Such mid-ocean plutonic occurrences complemented the even fresher ultramafics Fisher had dredged in 1967 at 9,000-10,000m on the offshore flank of Tonga Trench, rocks immediately overlying seafloor pillow basalts transported from the offshore flank as a direct demonstration of subduction.

Throughout Bob Fisher's career international collaboration has been a major theme. Between 1954 and 1985 he planned and led all, or a major part of, 16 complex expeditions, three going round the world. The longest of these, LUSIAD in 1962-63 on *R/V Argo* during the International Indian Ocean Expedition 1960-1965, traversed more than 83,000 nautical miles. In the year 2000 Bob completed a 40-year bathymetric compilation and topographic interpretation of the greater Indian Ocean, northernmost shores to Antarctica, a region encompassing almost one quarter of Earth's oceanic expanse. This update is the comer stone of the 2003 Edition (gridded digital) of the General Bathymetric Chart of the Oceans (GEBCO) under the auspices of the International Hydrographic Organization and UNESCO's Intergovernmental Oceanographic Commission.

Bob Fisher's scientific credentials include Geological Society of America (1960) and American Geophysical Union (1991) fellowships. He is an Honorary Member of the Explorers Club (1988) and a Foreign Honorary Member of Great Britain's Challenger Society for Marine Science (1998).

* Subsequently agreed with the Japanese as 10,920 ± 5m.

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The contouring process

Bob Fisher's bathymetric contour compilations for the Greater Indian Ocean cover almost one quarter of the world's oceanic area. The data set extends longitudinally from 12°W in the Atlantic to 170°E in the Pacific, and from Africa, India and Australia south to Antarctica.

Work on the contour compilation was begun by Bob in 1987 as part of the International Indian Ocean Data Compilation Project (IODCP), a major joint venture between scientists at Scripps Institution of Oceanography (SIO) and L'Ecole et Observatoire de Physique du Globe, Strasbourg, France. In 1997, this work formed the backbone of a special volume of the journal Marine Geophysical Researches dedicated to tectonics of the Southwest Indian Ridge.

The data source used for the bathymetric contouring was the compilation of echo-sounding data maintained by Bob Fisher at SIO on a set of hard copy sheets, plotted on a Mercator projection at a scale of four inches per degree of longitude (approximately 1:1.1 million). A total of over 250 sheets are needed to cover the Indian Ocean and its Environs, and, for each bathymetric contour sheet there was an accompanying trackline control sheet. This echo-soundings compilation contains essentially all available soundings collected by numerous academic research institutions and governmental agencies between 1950 and 2001.

Based upon decades of geological expertise, the sounding data were hand contoured by Bob sheet by sheet, using multiple overlays of cruise sounding data as required for legibility and clarity. The contours were drawn at 500 metre intervals in deeper waters. In shoal regions, the 200 metre contour was drawn and, where scientifically justified, also the 100m depth contour. The contouring work was completed by Bob in 2002.

The echo-sounding contour interpretation was constructed with the aid of satellite-derived gravity maps, plotted at the same oceanic scale and underlain beneath the soundings sheets. This permitted structural trends and lineations to be more accurately portrayed in the bathymetric contouring.

The hand contoured sheets were duplicated at SIO and sent to the British Oceanographic Data Centre (BODC), Merseyside, UK - a total of some 250 pairs of sheets. The contours and tracklines were digitised at BODC. For this, the sheets were raster scanned and vectorisation software was on the resultant raster image used to capture the bathymetric contour and trackline control lines in digital form. These digital data were checked and corrected for any digitisation and labelling errors. Finally, sections of digitised charts were edge-matched to form one seamless data set.

The bathymetric contouring and digitising work was ongoing for a period of 15 years. As the project progressed, additional sounding data were acquired by Bob and incorporated into his bathymetric contouring. As a result of this continual inclusion of newly-acquired soundings data, over 600 updated sections of charts were delivered by Bob to BODC for digitising, in addition to the 250 'first version' pairs of sheets. The digitising work was concluded at BODC in September 2002.

The completed data sets, comprising digitised versions of Bob Fisher's bathymetric contours and control tracklines, were incorporated into the most recent release of the GEBCO-Digital Atlas (GDA), published on CD-ROM in April 2003. Bob's data sets form the largest contribution to the updating of the GEBCO Digital Atlas and represent a major personal achievement of considerable benefit to GEBCO and the earth sciences user community.

Andrew Goodwillie, Pauline Weatherall

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Reproduction of the DRAKE MEDAL 1589

The original silver medal was struck to commemorate Sir Francis Drake's voyage round the world, 1577-1580, in the *Golden Hind.* The map on both sides of the medal shows the state of knowledge of the world at the end of the sixteenth century. It was on this voyage that California, which appears on the map, was visited and first named.

Presented to Dr Bob Fisher by his friends in the GEBCO Community as a token of their respect, and appreciation for the outstanding and unique contribution he has made, over many years, to the General Bathymetric Chart of the Oceans (GEBCO), in particular for his meticulous, high-quality, contouring of the greater Indian Ocean and his erudite input as Chairman of the GEBCO Sub-Committee on Undersea Feature Names.

We thank you, for your input and for the shining example of diligence you have set us.

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Honors

Robert L. Fisher has been awarded the inaugural Drake Medal by the General Bathymetric Chart of the Oceans (GEBCO) organization. This medal was created specifically to honor Fisher, and is a replica of the one given to Sir Francis Drake by England's Queen Elizabeth I in 1589. Fisher was presented with the medal in recognition of his extensive and meticulous work in ocean-bottom cartography over the past six decades. Among his many accomplishments, Fisher is celebrated for his use in the late 1950s of innovative sounding technologies to firmly establish that Challenger Deep in the Mariana Trench is the deepest point in the world's oceans. He also identified Horizon Deep in the Tonga Trench as the second deepest point in the oceans and the deepest spot in the southern hemisphere. Fisher is a fellow of the Geological Society of America, and an honorary life member of the United Kingdom's Challenger Society.

Fisher is research geologist emeritus at Scripps Institution of Oceanography, University of California, San Diego. He is an AGU Fellow and has been a member (Ocean Sciences) since 1962.

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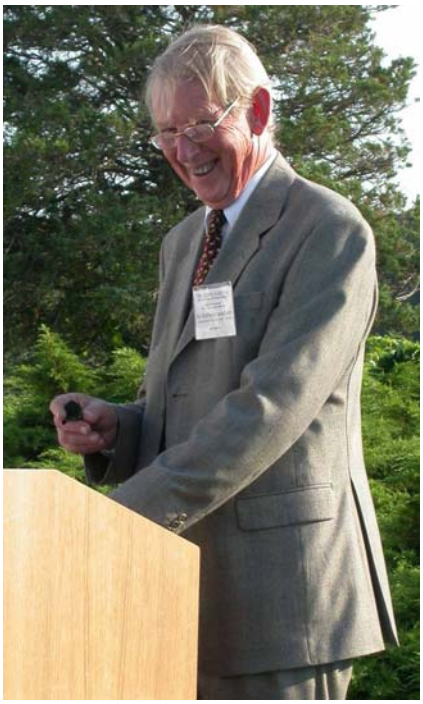
Photographs of the Presentation Ceremony:

Desmond Scott (right) about to present a replica of the 1589 Drake Medal to Bob Fisher.

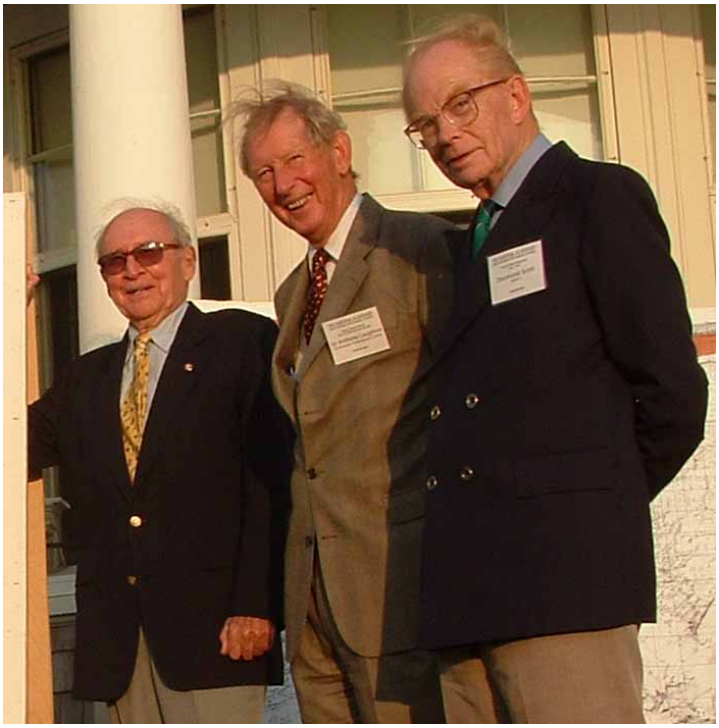
Former chairman of GEBCO, Tony Laughton (left), and former GEBCO Permanent Secretary, Desmond Scott, enjoying the festivities.



Former chairman of GEBCO, Tony Laughton, recounting some of the many highlights of Bob's forty year involvement with GEBCO.

Bob Fisher thanking the more than fifty attendees.

Using plots made from the new GEBCO 1-minute global bathymetric grid, current GEBCO chairman, Dave Monahan, points to the Bob Fisher Ridge south of Madagascar as Bob Fisher (centre) and Tony Laughton look on.



Long-time GEBCO colleagues and close friends, (left to right) Bob Fisher, Tony Laughton, Desmond Scott.

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