Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies

IOC Consultative Group on Ocean Mapping

Sixth Session

R/V Sibiryakov, Monaco Harbour
21-22 April 1997

UNESCO

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IOC/CGOM-VI/3

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1. OPENING OF THE SESSION

The Sixth Session of the IOC Consultative Group on Ocean Mapping was opened by the Chairman, Mr. Desmond P. D. Scott, on Monday, 21 April 1997, at 09.30 on board *R/V Sibiryakov* in Monaco Harbour.

The Technical Assistant Secretary for Ocean Mapping at the IOC, Mr. Dmitri Travin, welcomed participants on behalf of Admiral Anatoly Komaritsyn and Dr. Gunnar Kullenberg, IOC Executive Secretary.

Apologies were received from the Chief Editor IBCWP, Dr. Hou Wenfeng, for not being able to attend. Mr. Wang Hong deputised.

A full List of Participants is given in Annex II.

2. ADOPTION OF THE AGENDA

The Agenda was adopted.

3. CONDUCT OF THE SESSION, DOCUMENTATION

The Chairman announced the arrangements for the Session and presented the general documentation.

4. GENERAL BATHYMETRIC CHART OF THE OCEANS (GEBCO)

Mr. Brian Harper, Permanent Secretary of the Joint IOC-IHO Guiding Committee for GEBCO, presented this item and was designated Rapporteur of this Session.

4.1 REPORT ON INTERSESSIONAL ACTIVITIES.

Following shortly after the Fifth Session of the CGOM in April 1995, the Guiding Committee for GEBCO met in Monaco, 15-17 May 1995. Their next meeting will be held at the Southampton Oceanography Centre (SOC), 23-25 June 1997. In the interim year, 1996, the GEBCO Officers held their meeting at the East-West Center in Honolulu.

The main focus of attention since 1995 has been the planning and production of the New Edition of the GEBCO Digital Atlas (GDA). This major goal has now been achieved and the Second Release took place in February 1997. Copies of the Atlas will shortly be sent gratis to all registered holders of the First Release. The GDA comprises 3 components:

- the GEBCO-97 CD-ROM containing the Atlas data sets and the GDA Software Interface;

- Supporting Volume to the GEBCO Digital Atlas (as published with the First Release of the GDA in March 1994);

- 1997 Supplement to the Supporting Volume.

Although the revised GEBCO Sheet 5.12, South Atlantic, was published in 1995, a pre-publication copy was digitized for inclusion in the First Release of the GDA in the previous year. This represented the first example of the use of techniques for updating the GEBCO. This approach is now continued with the release of GEBCO-97 which includes revised GEBCO bathymetry for three areas:

- Southern Indian Ocean. 31°S to 72°S; 20°E to 140°E. (The Guiding Committee is indebted to the author, Dr. Robert Fisher of the Scripps Institution of Oceanography, for the compilation and release of this first part of his major revision of the bathymetry of the entire Indian Ocean and the contiguous Southern Oceans between 5°W to 166°E.);

- Weddell Sea. 65°S to 79°S; 66°W to 0°. (Authors: officers of the Alfred-Wegener Institute, Bremerhaven);

- North-east Atlantic off the British Iles. 47°N to 64°N; 37°W to 6°E. (Author: Mr. Peter Hunter, SOC).

Additionally, GEBCO-97 includes several other features:

- five versions of the coastline of Antarctica taken from the SCAR Antarctic Digital Data base (1993) at a range of scales from 1:30 million up to 1: 250,000. Unlike the World Vector Shoreline (south of 60°S) which this data set replaces, the SCAR version includes details of seven types of coastline;

- updated inventory of the track lines of the digital sounding data held at the IHO Data Centre for Digital Bathymetry and lists of positions for isolated soundings;

- IHO-IOC Gazetteer updated to include historical background material on the naming of many individual features and recently approved names (1997); and

- modification and improvements to the Software Interface.

GEBCO gratefully acknowledges the provision of funding by NERC to support this initiative. Also, for the planning design and production carried out by Dr. Meirion Jones, for the work of the GEBCO Bathymetric Editor, Mr. Peter Hunter, and for the unstinting efforts of the GEBCO Digital Atlas Manager, Ms. Pauline Weatherall, in digitizing the bulk of the new contour material and successfully stitching it into the GDA. Thanks also go to other numerous contributors including those who undertook the reviewing procedures for the new data before it was accepted for inclusion into the Atlas.

It is of interest to note that since its publication, 700 copies of the First Release of the GDA have been distributed to numerous academic, government and research institutions in 65 countries world-wide.

The last two years intersessional work in general can be grouped into five main categories:

(i) Encouraging the participation of other civilian and military institutions world-wide in exchanging ideas, techniques, expertise and bathymetric data

The venues of meetings were chosen to embrace as wide as possible involvement by bathymetric scientists working in any of the world's oceans. Additionally, the Chairman of the Sub-Committee on Digital Bathymetry and the Scientific Advisers to the GEBCO engaged in discussions with a loose network of other involved scientists. As a result of these activities interest in the work of GEBCO and attendance at meetings of the SCDB is constantly rising - it has trebled its annual attendance figures in ten years.

(ii) Seeking, gathering and reviewing bathymetric data, in the form of maps and surveys, and their subsequent inclusion in the GDA

The bulk of the seeking and gathering work was undertaken by the Bathymetric Editor, Mr. Hunter. Unfortunately, due to the move of IOS (1995) to the new offices at the Southampton Oceanography Centre, he was unable to undertake his usual quota of overseas visits to ocean scientific institutes or devote as much time to his GEBCO activities as he wished. Meanwhile, some bathymetric mapping, suitable for consideration for inclusion in the GDA, has been identified by other officers.

During the SCDB meetings in 1995 and 1996, a review was made of all the known mapping activities throughout the oceans including the IBC projects. The record of this annual investigation is unique in providing an overview of worldwide bathymetric mapping carried out mainly by government and scientific agencies.

The issue of contour generalisation for GDA bathymetry was debated. Agreement was reached that, in cases where divisions between the 1,000 metre contours were 200, 400, 600, and 800 metres, rather than 100-900 metres or the 500 metre convention used throughout GEBCO, the 500 metre contour would have to be added to the new map, preferably by the compiler, before it could be incorporated into the GDA. The 500 metre contour is essential to preserve continuity.

On the issue of continuity, Mr. Hunter has often pointed out that in several cases the GEBCO Fifth Edition departed from the GEBCO Specifications and care should be exercised when using these maps to determine GEBCO conventions.

(iii) Undertaking liaison work, on a broad front, with a number of national and international bodies where the interests of GEBCO are, or may be, affected

Issues include:

- supporting work for UNCLOS. Sir Antony Laughton is undertaking to supply GEBCO-related technical advice for inclusion in a book on Science and Technology associated with the definition of the continental shelf under the United Nations Convention on the Law of the Sea. The 2,500 metre contour line is of prime interest here;

- monitoring the work of the SCOR Working Group 107 on Improved Global Bathymetry (Sir Anthony Laughton and several of the members of the SCDB also serve on this Working Group). It is thought that the proceedings of this Working Group will have a profound impact on the requirements for ocean mapping information in terms of detail, accuracy, and area covered. GEBCO recognizes that the philosophy behind IOC Resolution XVIII-10, June 1995, runs parallel with the thoughts which prompted the formulation of the SCOR Working Group;

- continuing discussions on the content of the final draft for GEBCO Guidelines Part 4, Digital Bathymetric Data (Multibeam Echo-sounders);

- participating in the debate over the vexing problem of exchange formats for digital bathymetric data. GEBCO expressed interest in a system developed by Lamont-Doherty which permitted most formats to be read. This system will be examined. However, while there seemed to be less concern about the choice of formats, it was in full agreement on the need for the provision of good metadata;

- United Nations Interactive Atlas of the Oceans. Although this project has been under consideration since 1995, its existence has only lately come to the attention of GEBCO. This project has been described by the IOC not so much as an "atlas" but more of a process through which IOC could provide inputs such as oceanographic conditions through IGOSS and other programmes, or sea-level data through GLOSS. This initiative and its relationship to GEBCO will be discussed at the June 1997 meeting of the Guiding Committee.

(iv) Monitoring, encouraging and reviewing the correct use of Undersea Feature Names for inclusion in the IHO-IOC Gazetteer and subsequently into the GDA

One hundred and thirty names were approved at the Eleventh Meeting of SCUFN, Monaco, 1995. Since then the examination of new names has continued throughout the intersessional period. Very few of these have so far been accepted. However, agreement was reached between SCUFN and ACUF on the proposal to name a seamount group at the north of Guinea Rise as the Grimaldi Seamounts after the Monegasque ruling family.

The New Edition of the Gazetteer was completed in 1996 and incorporated into the GDA. This included the addition of historic information for some records.

Dr. Fisher (Chairman, SCUFN) aided by Mr. Michel Huet (IHB) completed a review of generic names used by GEBCO. Some small but useful changes were made. These will

be included by the Working Group in the Hydrographic Dictionary. One key feature was the agreed classification of "seamount" or "guyot" as requiring an elevation of at least 1,000 metres.

(v) Planning and utilising technical developments for future inclusion in the GDA and associated products

The quest continues to find a solution to the question of cartographic name placement for the GDA. Unfortunately, Dr. Gary Robinson's new duties left him little opportunity to pursue this work.

The major problem facing GEBCO at present is finding a successful resolution to the problem of gridding the contours of the GDA. Various experiments have been conducted on the digital contours of the new GEBCO Sheet 5.12. Although each version had its merits, none fulfilled all the requirements to meet different viewpoints. The problem with gridding is that there are a range of techniques and parameters available for computing grids and that each such grid can have different properties.

Dr. Michael Loughridge observed that five years ago (1992) in Monaco, the prototype GDA was demonstrated. Since then two releases of the Atlas have been made.

Dr . John Hall remarked that he had experienced difficulties using WVS at large scales in the Eastern Mediterranean - it was evident that there are coastline errors in this region. He added that if it were possible to obtain the co-ordinates of significant features, he could refit the coastline using WGS 84 as control.

The issue of the 500 metre contour for the GDA was discussed. A request was made by Mr. Hunter, GEBCO Bathymetric Editor, that within the IBC mapping projects, wherever the 500 metre contour was not included, a separate overlay should be made at the time of the compilation to be used for inclusion in the GDA. This request was supported by the Session.

Dr. Loughridge said it was expected that the final draft for GEBCO Guidelines No. 4 Multibeam Data would be agreed at the next meeting of the Guiding Committee. He added that the design and use of formats for use with this type of data were no longer difficult issues but that full documentation of data was of primary importance.

The proposed UN Interactive Atlas of the Oceans was discussed and it was generally thought that the time-scales required to produce any meaningful product by 1998 was likely to prove most difficult. GEBCO had not been asked to make any input into this project.

A model and map display of the Grimaldi Seamounts was viewed by Prince Rainier at the opening of the Fifteenth International Hydrographic Conference, held in Monaco, 14-24 April 1997.

4.1.1 GEBCO Centenary (2003-2005)

The Chairman introduced this item. He drew the attention of the Group to the fact that the Centenary of the GEBCO would be coming up early in the next century and the GEBCO Guiding Committee had decided to celebrate this with two publications:

(a) an edited volume in four parts: (i) the early history (First and Second Editions), (ii) the IHB period (Third and Fourth Editions), (iii) SCOR Working Group 41 "Morphological Mapping of the Sea Floor", and the formation of the Joint IOC-IHO Guiding Committee for the GEBCO, leading to the publication of the Fifth Edition, and (iv) the latest developments to be written just before publication;

(b) a well written book directed towards the general public.

The history of the regional International Bathymetric Chart series would be included in the edited volume, possibly as an annex.

Other publicity projects being considered were television programmes and postage stamp issues in Monaco, the United Nations and member countries of IOC and IHO.

The Chairman reported that he had held a number of discussions with appropriate persons concerning the various parts of the edited publication, and had received very positive responses from all those he had approached. He had a number of names in mind for suitable authors for the "well written book".

4.2 PLANNED FUTURE DEVELOPMENTS

It seems likely that a family of compatible global grids will be constructed, each with a different set of properties and uses.

The Third Release of the GDA is planned to be published in 1998. This will include revised bathymetry of the northern Indian Ocean, NE Atlantic south of the British Iles and whatever other charts or maps will become available.

There are no plans to publish a printed revision of the Sixth Edition of the GEBCO before the year 2000. GEBCO intends to await the outcome of current research on techniques to reduce line detail and automatic simplification routines. Later, "Print on Demand" technology may provide a print option, via a large format plotter, rather than go to the expense of printing thousands of hard copy sheets.

5. REGIONAL OCEAN MAPPING PROJECTS

5.1 PROGRESS AND PLANNED FUTURE DEVELOPMENTS FOR THE INTERNATIONAL BATHYMETRIC CHART OF THE MEDITERRANEAN AND ITS GEOLOGICAL/GEOPHYSICAL SERIES (IBCM)

Prof. Carlo Morelli, Chairman, said that the story of the IBCM has been a long one - more than 30 years in the making. The First Edition was printed in 1983; it included data up to the 1970's. The successful collaborative effort has always been considered the prototype of what can be achieved. It owed much to the Hydrographic Offices who shouldered the responsibility for the original data collection.

However, since the 1970's, huge amounts of significant data had been collected, much of it by multibeam surveys, and this now required incorporation into compilations for a Second Edition of the IBCM. He added that the only practical method to progress with this work was by the adoption of digital techniques by all Hydrographic Offices as contributors to the Second Edition. He recognized the difficulties being experienced by some of the smaller Hydrographic Offices in adopting digital methodology. He expressed hope that large amounts of classified swath data being collected by the Institut français de recherche pour l'exploitation de la mer (IFREMER) and commercial companies such as International Sea Mapping (ISM) be released into the public domain, and thus the Second Edition, by the year 2000.

Dr. Hall (Geological Survey of Israel) continues his work on the development of a 0.1' Digital Terrain Model (sea and land) for the areas of Sheets 1.05, 1.08, 1.09 and 1.10. As an indication of the data explosion since 1970, he made the observation that the 30,000 sounding points considered for the First Edition of Sheet 1.10 had risen to over 6,000,000 for the next edition.

Dr. Hall added that a data compilation was underway for the Red Sea, Gulf of Tadjura, and Yemeni-Omani coasts to the Straits of Hormuz. It is intended to prepare a continuation of the IBCM Second Edition, with 0.1′DTM for land and sea, to surround the Arabian Plate. This compilation would be available to IBCWIO, if a northern continuation of this series is desired.

5.2 PROGRESS AND PLANNED FUTURE DEVELOPMENTS FOR THE INTERNATIONAL BATHYMETRIC CHART OF THE CARIBBEAN SEA AND GULF OF MEXICO (IBCCA)

The Chairman CGOM announced that Mr. José Luis Frias Salazar, Mexico, had been elected as Vice-Chairman of the Editorial Board.

Mr. Frias Salazar reported that the IBCCA Editorial Board had experienced a significant change of members. There had also been difficulties for some Member States in attending the Board Meeting in Cartagena, Colombia, 18-20 November 1996.

Sheets 1.04 and 1.09 are published, and the digital version was incorporated into the Digital Data Base. From this, the preparation of other products is being considered. Guidelines have been developed for documentation and despatch of digital files. Additionally, a critical path diagram has been constructed showing documentation processes.

Work is progressing on compiling, scanning and vectorising numerous sheets. It is expected that 80 % of the bathymetry will be in digital form by 1998. France has agreed to undertake sheets 1.10 and 1.16.

Mr. Frias Salazar raised the problem of finding a suitable modern press to print the full-sized map sheets. It seemed likely that the Board would have to adopt the solution of printing each map in two parts with a 1° overlap.

The next meeting of the Board is scheduled to take place in Caracas in 1998 or may also be held in Mexico instead.

5.3 PROGRESS AND PLANNED FUTURE DEVELOPMENTS FOR THE INTERNATIONAL BATHYMETRIC CHART OF THE CENTRAL EASTERN ATLANTIC (IBCEA)

Reporting on the Editorial Meeting of October 1996, Ing. Gen. André Roubertou, Chairman IBCEA, expressed his concern about the lack of meetings. The only previous meeting of the Board was its Inaugural Session in Lagos, Nigeria, February 1990. Difficulties were experienced in keeping contributors' interest alight. Additionally, some members of the Board were experiencing conflicts of interest between their jobs and editorial responsibilities.

The need for additional bathymetric data was highlighted. The main potential sources were identified as IFREMER, ORSTOM (France) and CERESCOR (Guinea).

Other recommendations included calls for increased liaison with the GEBCO Guiding Committee and the Editorial Boards of the other regions. Additionally, the three national editors were tasked to seek agreements to ensure homogeneous presentations and correct edge matching between sheets. The Editorial Board agreed that published IBCEA sheets should be available at each producer point and should cost only the recovery price of the printing.

The responsibility for producing sheets 1.04 and 1.05 had been formally accepted by Spain (Instituto Hidrografico de la Marina, Cadiz) in 1991. During this Session of CGOM, the Head of the Institute, present at the XVth Hydrographic Conference, officially announced that his country had decided to withdraw from the IBCEA project. Mr. Hunter (SOC) offered to replace Spain for the compilation of these sheets provided by SHOM (France) and to undertake the printing and distribution arrangements.

Later, the Session was joined by Lt. José Manual Fialho, Instituto Hidrografico, Portugal, who responded to questions about the progress of sheets 1.01, 1.02, 1.03 and 1.07. He said that a proof of sheet 1.01, for which Prof. Vanney completed the contouring in 1993, is expected to be available in the Autumn of 1997. Work to complete sheet 1.03 will follow shortly afterwards. Sheets 1.02 and 1.07 will be taken up in due course.

Some post-editing work is being carried out on sheets 1.08 and 1.09, one of which is expected to be published in 1998.

Morocco and Ivory Coast have indicated the wish to participate in IBCEA.

5.4 PROGRESS AND PLANNED FUTURE DEVELOPMENTS FOR THE INTERNATIONAL BATHYMETRIC CHART OF THE WESTERN INDIAN OCEAN (IBCWIO)

Prof. Werner Bettac, Chairman IBCWIO, reported that the Russian Federation had joined the Editorial Board. South Africa and Mozambique have announced their intention to join also. It had not been possible to contact any representative for Madagascar.

Although there has been no meeting of the Board since October 1994, much intersessional work has been undertaken with the financial support of SAREC. All source data has now been
plotted on 1: 250,000 or 1:1,000,000 sheets, dependent on density of soundings, and distributed to each area on CD-ROM. The next session of the Board is planned for later 1997.

With the help of German funds, a Training Course on Bathymetric Charting in the Western Indian Ocean was held in December 1996 on board the *R/V Meteor* off the South African coast.

Prof. Bettac drew attention to the problem of continuing funding provision from the German Government and said that it is vital for the future of the project that this source of funding is not jeopardised.

Some reallocation of the Sheet responsibilities is still taking place.

It is hoped that at least the first two sheets could be printed in 1998.

5.5 PROGRESS AND PLANNED FUTURE DEVELOPMENTS FOR THE INTERNATIONAL BATHYMETRIC CHART OF THE WESTERN PACIFIC (IBCWP)

Dr. Wang Hong, on behalf of the Chief Editor IBCWP, reported that the Second Session of the IOC Editorial Board for the IBCWP took place at the IOC Regional Office, Bangkok, Thailand, 7-12 December 1996 (Doc. IOC/EB-IBCWP-II/3).

Mr. Peter Hill, Australia, was elected Vice-Chairman of the Board.

A period of 26 months had elapsed since the First Session of the Editorial Board in October 1996. Recognizing the problems raised by the large geographic coverage and bathymetric complexity of the region, the Board voiced a need for increased funding and IOC stimulation to support more frequent meetings and to generate more interest by New Zealand, France and Indonesia.

Work in Sub-Regions 1-4 was progressing with a range of data collection and sheet compilations. It is expected that 13 completed charts in these regions will be submitted for approval at the next Session of the Editorial Board in 1998.

Since the Second Session of EB-IBCWP, SOPAC (Suva, Fiji) has expressed the wish to join the scheme, taking responsibility for Sub-Region 6. Meanwhile, news is awaited from New Zealand on their acceptance of responsibility for Sub-Region 5.

A proposal was made to construct an IBCWP data base from which contour evaluation could be made. However, although well supported, some reservations were voiced as to whether such a data base was likely to be supported by national policies on data release.

Standard draft formats for a data catalogue have been prepared and will be sent to all members. The Editorial Board agreed to follow the IBCM as a model for the creation of a standard publication format whilst retaining the specifications of the IBCWP, as adopted at the First Session of the Board.

The US National Geophysical Data Center (NGDC) in Boulder, Colorado, USA, offered to host a workshop on Data Sources and Map Compilation for officers engaged in the IBCWP project. It was tentatively agreed that the next Session of the Editorial Board might take place immediately before or after this event. The Chief Editor said that he hoped that the quality control software package, developed by China, could be demonstrated at Boulder.

Prof. Gleb Udinsev expressed considerable concern at the increasing use of automated contouring packages and stressed the need for Editorial Boards to engage the advice of marine geo-morphologists to examine bathymetric data before accepting it for inclusion in maps. This view was supported by Prof. Morelli who said it is not enough just to look at the surface of the bottom but to consider using data from other physical parameters (magnetics, gravity, seismic reflection and refraction) also. A wide-ranging discussion ensued which embraced a number of key issues pertinent to IOC mapping activities. These ranged from the analysis and interpretation of bathymetric data to the need to urge Member States to give their utmost support to the IBC Series. It was agreed that CGOM should submit a draft Resolution to IOC-XIX covering the main points of the debate.

6. DIGITIZATION OF THE REGIONAL OCEAN MAPPING PROJECTS

Mr. Hunter, GEBCO Bathymetric Editor, reported to the Session that the British Oceanographic Data Centre (BODC), NERC, in Bidston, UK, who maintains the GEBCO Digital Atlas on behalf of IHO and IOC, has stated that they have found by experience that it is better for themselves to carry out digitization of contours which have been identified as being suitable for updating the GDA and which are in their final published form. They offer to do this on behalf of any of the IBC projects.

BODC operates a highly accurate automatic digitizing system that converts scanned images of the maps into vector contours. Problems associated with hand-following digitizing techniques and registration errors are virtually eliminated.

In the past, digital data sets have been submitted to them which contained a large number of errors; it has been quicker to redigitize completely rather than to correct the files.

The IBCCA is already well advanced in this work. It was recommended that Mr. Frias Salazar contact Ms. Weatherall, the GDA Manager, at BODC for guidance.

A digital version of the first edition of the IBCM already exists and is represented in the GEBCO Digital Atlas CD-ROM.

7. PROGRESS AND PLANNED FUTURE DEVELOPMENTS WITH THE GEOLOGICAL/GEOPHYSICAL SERIES

7.1 INTERNATIONAL BATHYMETRIC CHART OF THE MEDITERRANEAN AND ITS GEOLOGICAL/GEOPHYSICAL SERIES (IBCM)

Prof. Morelli, Chairman IBCM, reported that the five overlay geological/geophysical series of the IBCM are now complete. The final series "Magnetic Anomalies" will be published next year. The "Recent Sediments" series is in proof form and will be presented at the IOC Assembly later this year.

Dr. Hall informed the Session that the "Gravity Anomaly" series is also available in digital form from the International Gravity Bureau, Toulouse.

There are no plans to update any of the series. However, there are a number of new data sets available.

Digital airborne gravity measurements exist for many areas and could be easily integrated into a new edition but the coverage is not complete, particularly in the Eastern Mediterranean where seaborne measurements would have to be relied on. Other data exist at a number of institutes.

The "Seismicity" series were the result of a careful and complete compilation by the EMSCS, Strasbourg, France. A digital two hundred page data catalogue is also available. It was not thought to be feasible to redo the series.

The maps of the "Plio-Quaternary" series are important in the research of oil, gas and ground water. They were well produced in spite of the absence of data in some areas. Data were impossible to obtain from some companies.

The possibility of combining all the 1:5 million scale versions of the geological/geophysical series into one volume will be discussed at the next Session of the IBCM Editorial Board. At the same Session, digitization of the series will also be discussed. It was noted that a list of data sources would be required for users of the overlay series to refer to.

7.2 OTHER REGIONAL SERIES

Mr. Frias Salazar, Vice-Chairman IBCCA, reported that INEGI, Mexico, would follow the IBCM system, however, it was possibly unlikely to publish maps at the same scale as the bathymetry owing to a lack of data. Details of track lines for the "Gravity" and "Magnetic Anomaly" series have been circulated to the Editorial Board members. It was hoped that a special Session at the AGU may help to bring in experts to help in the compilation. Discussions are taking place with IOC to hold a Session.

Ing. Gen. Roubertou, Chairman IBCEA, stated that it was too early for the project to consider other series. However, he agreed with a suggestion by the Chairman CGOM that it was feasible to start planning and organizing before the "Bathymetry" maps were completed.

Prof. Gleb Udintsev informed the Session that a consortium of Russian marine geological and geophysical institutes are planning compilations on a global scale that may be of use to the IBCEA and IBCWIO projects for their geological/geophysical series. The Session thanked him for the offer.

8. INTERNATIONAL GEOLOGICAL/GEOPHYSICAL ATLAS OF THE PACIFIC OCEAN (OF GAPA)

8.1 REPORT ON PROGRESS AND LIKELY PUBLICATION DATE

Prof. Udintsev, Chief Editor GAPA, reported on the progress of the Pacific project. He presented early colour proofs of a large number of the maps.

The demise of the Soviet Union had complicated work but it was expected that all the proofs will be printed by the end of 1997. Printing would not start before 1998. Discussions were taking place with printing works in Riga and other locations.

Prof. Udintsev emphasized that the atlas would contain a large number of multibeam maps which have never been published. A large number of maps based on satellite altimetry information will also be included.

Work on the bibliography has only just begun.

The Session was informed that although money had been provided to help with the production of the atlas, no provision had been made for the high costs of shipping the atlases to the USA and elsewhere.

9. REPORT ON IOC OCEAN MAPPING ACTIVITIES FOR SUBMISSION TO THE NINETEENTH SESSION OF THE IOC ASSEMBLY

The draft version of the report was discussed by the Session. It was accepted after various alterations to the main body of the report and a number of corrections to the memberships of the Editorial Boards of the International Bathymetric Chart projects.

Mr. Harper and Mr. Hunter volunteered after the Session to redraft the assembly diagrams of the IBC projects to improve their readability (see Annex III).

10. SALES AND PUBLICITY

The Chairman introduced this item by informing the Session of the present sales arrangements for IOC sponsored maps.

The official source for IOC maps is "Ocean Mapping (IOC)" located at Mr. Scott's home in the United Kingdom. To avoid excessive postal costs, North American requests are referred to the Canadian Hydrographic Service, Ottawa, and Russian requests are referred to HDNO, St. Petersburg, Russian Federation.

The arrangements for the International Bathymetric Chart projects differ in that they will also be available from other centres, such as SHOM in France for the IBCEA, and INEGI in Mexico for the IBCCA.

Sales of the IBCM are three times higher in Italy as compared with elsewhere in the world, this is due to the efforts of its Italian Chairman, Prof. Morelli.

IBCCA sheets 1.04 and 1.09 are available from Ocean Mapping (IOC).

Copies of maps are supplied free-of-charge to interested bodies whose activities are of benefit to the IOC.

The Chairman further stated that it was important to maintain low prices, although recently there had been an increase in the cost of GEBCO sheets from the CHS and at the same time a reduction in its agents' commission.

On the subject of publicity, the Chairman informed the Session that the copies of the new journal *Hydro International* are being handed out gratis at the conference. In it, an article by Admiral Ritchie (Royal Navy Hydrographer, retired) publicises the GEBCO. The journal has commissioned an article on GEBCO to be written by Dr. Jones, Chairman of the GEBCO Sub-Committee on Digital Bathymetry. The same issue will include an advertisement for the GEBCO Digital Atlas obtained at a special reduced rate.

The Session asked if it would be possible to advertise published IBC project maps in the International Hydrographic Bulletin, in the same manner as the GEBCO. Other publications such as the International Hydrographic Yearbook and the British Admiralty Chart Catalogue were also mentioned. Mr. Huet, IHB, said that he would make enquiries.

A discussion of the use of the computer-based World-Wide Web (WWW) followed. The Chairman said that an email from Mr. Hunter to scientists at the Southampton Oceanography Centre had resulted in almost 100 sales of the GEBCO 1:30 Million scale World Sheet.

11. ELECTION OF A NEW CHAIRMAN

The Chairman informed the Session that he had been in his post since 1984 and to his regret wished to resign after the Session.

Prof. Morelli said that he was sorry but he begged to differ with the Chairman's decision. He argued that it was essential for Mr. Scott to continue as the Chairman of the CGOM in order to provide the continuity, knowledge and personal character that the post requires. He emphasised that Mr. Scott was an excellent example of all three. He also said that the Chairman could not claim to be too old as he (Prof. Morelli) was even older. He asked if Mr. Scott would consider a two-year change-over period with the incoming Chairman. Mr. Scott thanked him for his kindness and added that, in effect, there had already been a change-over period with a possible
candidate (Dr. Günter Giermann).

Ing. Gen. Roubertou proposed that Dr. Giermann be elected Chairman of the CGOM. Prof. Bettac seconded the motion.

There were no other nominees. The Session voted and the motion was carried with no votes against it. There was one abstention - Prof. Morelli.

Mr. Scott expressed his appreciation of all that had been said and said that he would be pleased to support the new Chairman in any way that he could.

Dr. Giermann thanked the Session for electing him.

The position of Prof. Morelli as Vice-Chairman remained unchanged.

12. OTHER BUSINESS

Prof. Udintsev asked the Session to consider a Russian proposal to create an atlas of the world, based on the IOC Geological and Geophysical Atlases (GAPA) formula. The Head Department of Navigation and Hydrography (HDNO, Saint-Petersburg) is ready to supply such an atlas. It would be published in five volumes:

- Bathymetry;
- Geology and Geophysics;
- Hydrophysics;
- Biology;
- Ecology.

He stated that the atlas would not need large financing as existing budgets would be sufficient and that although the expertise and human resources are available in Russia, international recognition was required to obtain national funding. He asked whether such an idea was attractive to the IOC.

The Chairman asked why money would be forthcoming for this project when it had not been available to complete the GAPA; he also referred to the delay in translating the text of the Russian Navy Atlases into English. In reply, Prof. Udintsev stated that the funding situation in Russia had changed and that funding for projects such as a multibeam ship for the Academy of Sciences had been recently approved.

Prof. Udintsev further stated that a group under the direction of Mr. Viktor Sedov is preparing maps for an international exhibition and that these would make a good basis for the project. Preliminary talks with Russian scientists had been encouraging.

Mr. Travin informed the Session that two years ago details of the proposal had been circulated to the community, but that there had been only one positive reply.

After further discussion, the Chairman stated that no IOC or IHO support would be likely and thanked Prof. Udintsev for informing the Session of the project.

A proposal by the International Arctic Science Council (IASC) was drawn to the attention of the Session for an International Bathymetric Chart of the Arctic Ocean.

Dr. Giermann informed the Session of the German involvement in their mapping activity. There had already been discussions between Mr. Ron McNab, Canada, and Dr. Geoffrey Holland, Chairman IOC, Sir Anthony Laughton, Chairman GEBCO, and Dr. Gunnar Kullenberg, Executive Secretary IOC, also had talks on the subject. The consensus of opinions was that it might well fit in with the aims of IOC, in particular, those of GEBCO.

Dr. Hall expressed his wish to be a member of the Editorial Board of the project if it came into being.

13. DATE AND PLACE OF THE NEXT SESSION

The next Session, CGOM-VII, should be held in two years time, funds permitting. It was recommended that the Session should take place before the two-yearly IOC Assembly.

Prof. Morelli suggested that a venue in Israel might be worth considering.

Dr. Hall informed the Session that there was a possibility that an invitation might be forthcoming to hold the Session in Jerusalem or Eilat, Israel. He would investigate the matter further.

14. ADOPTION OF THE SUMMARY REPORT

The Committee accepted that the first draft of the Summary Report would be prepared after the Session and distributed to the participants.

15. CLOSURE OF THE SESSION

The Chairman closed the Session at 15.10 on Tuesday, 22 April 1997. He thanked the Captain and crew of the *R/V Sibiryakov* for hosting the Session and for their warm hospitality. Mr. Travin, IOC, was thanked for his arrangements for the Session.

ANNEX I

AGENDA

1. OPENING OF THE SESSION

2. ADOPTION OF THE AGENDA

3. CONDUCT OF THE SESSION, DOCUMENTATION

4. GENERAL BATHYMETRIC CHART OF THE OCEANS (GEBCO)

    4.1 REPORT ON INTERSESSIONAL ACTIVITIES
        4.1.1 GEBCO Centenary (2003-2005)
    4.2 PLANNED FUTURE DEVELOPMENTS

5. REGIONAL OCEAN MAPPING PROJECTS

    5.1 PROGRESS AND PLANNED FUTURE DEVELOPMENTS FOR THE INTERNATIONAL BATHYMETRIC CHART OF THE MEDITERRANEAN AND ITS GEOLOGICAL/GEOPHYSICAL SERIES (IBCM)
    5.2 PROGRESS AND PLANNED FUTURE DEVELOPMENTS FOR THE INTERNATIONAL BATHYMETRIC CHART OF THE CARIBBEAN SEA AND GULF OF MEXICO (IBCCA)

5.3 PROGRESS AND PLANNED FUTURE DEVELOPMENTS FOR THE INTERNATIONAL BATHYMETRIC CHART OF THE CENTRAL EASTERN ATLANTIC (IBCEA)
5.4 PROGRESS AND PLANNED FUTURE DEVELOPMENTS FOR THE INTERNATIONAL BATHYMETRIC CHART OF THE WESTERN INDIAN OCEAN (IBCWIO)
5.5 PROGRESS AND PLANNED FUTURE DEVELOPMENTS FOR THE INTERNATIONAL BATHYMETRIC CHART OF THE WESTERN PACIFIC (IBCWP)

6. DIGITIZATION OF THE REGIONAL OCEAN MAPPING PROJECTS

7. PROGRESS AND PLANNED FUTURE DEVELOPMENTS WITH THE GEOLOGICAL/GEOPHYSICAL SERIES

7.1 INTERNATIONAL BATHYMETRIC CHART OF THE MEDITERRANEAN AND ITS GEOLOGICAL/GEOPHYSICAL SERIES (IBCM)
7.2 OTHER REGIONAL SERIES

8. INTERNATIONAL GEOLOGICAL/GEOPHYSICAL ATLAS OF THE PACIFIC OCEAN (OF GAPA)

8.1 REPORT ON PROGRESS AND LIKELY PUBLICATION DATE

9. REPORT ON IOC OCEAN MAPPING ACTIVITIES FOR SUBMISSION TO THE NINETEENTH SESSION OF THE IOC ASSEMBLY

10. SALES AND PUBLICITY

11. ELECTION OF A NEW CHAIRMAN

12. OTHER BUSINESS

13. DATE AND PLACE OF THE NEXT SESSION

14. ADOPTION OF THE SUMMARY REPORT

15. CLOSURE OF THE SESSION

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ANNEX II

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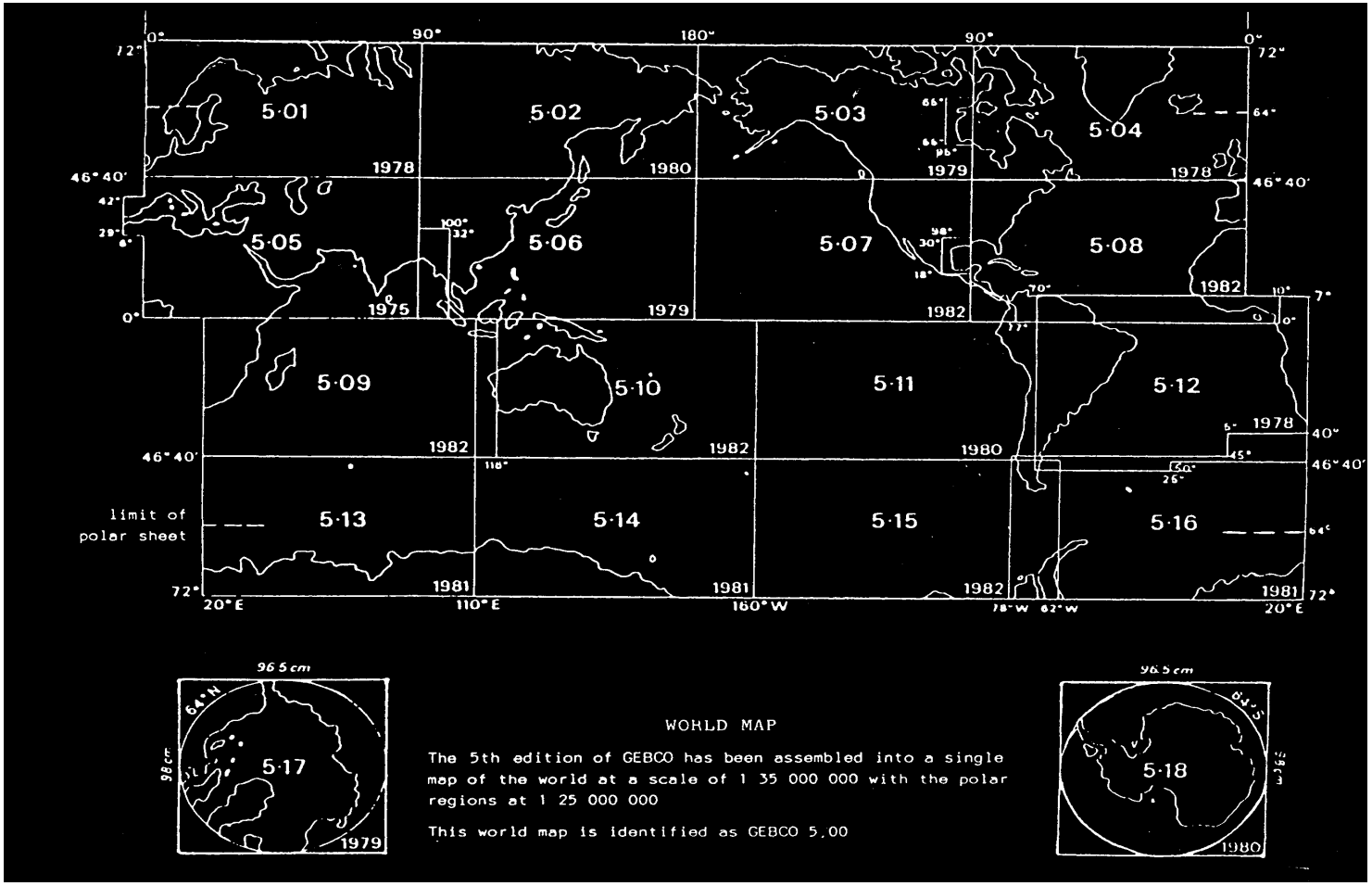
ANNEX III

ASSEMBLY DIAGRAM OF THE GENERAL BATHYMETRIC CHART OF THE OCEANS (GEBCO)

scale: 1:1 million at the Equator

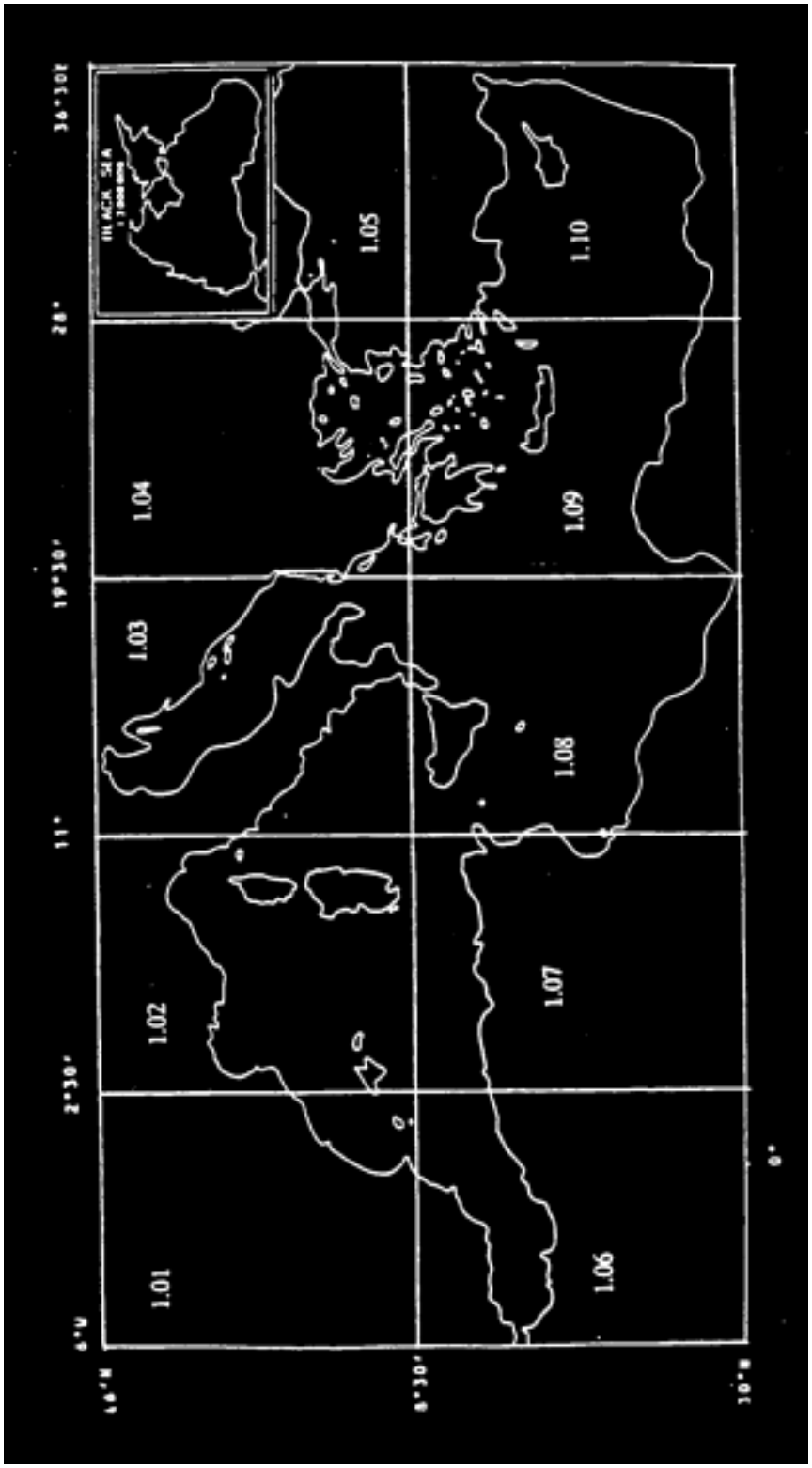


WORLD MAP

The 5th edition of GEBCO has been assembled into a single map of the world at a scale of 1 35 000 000 with the polar regions at 1 25 000 000

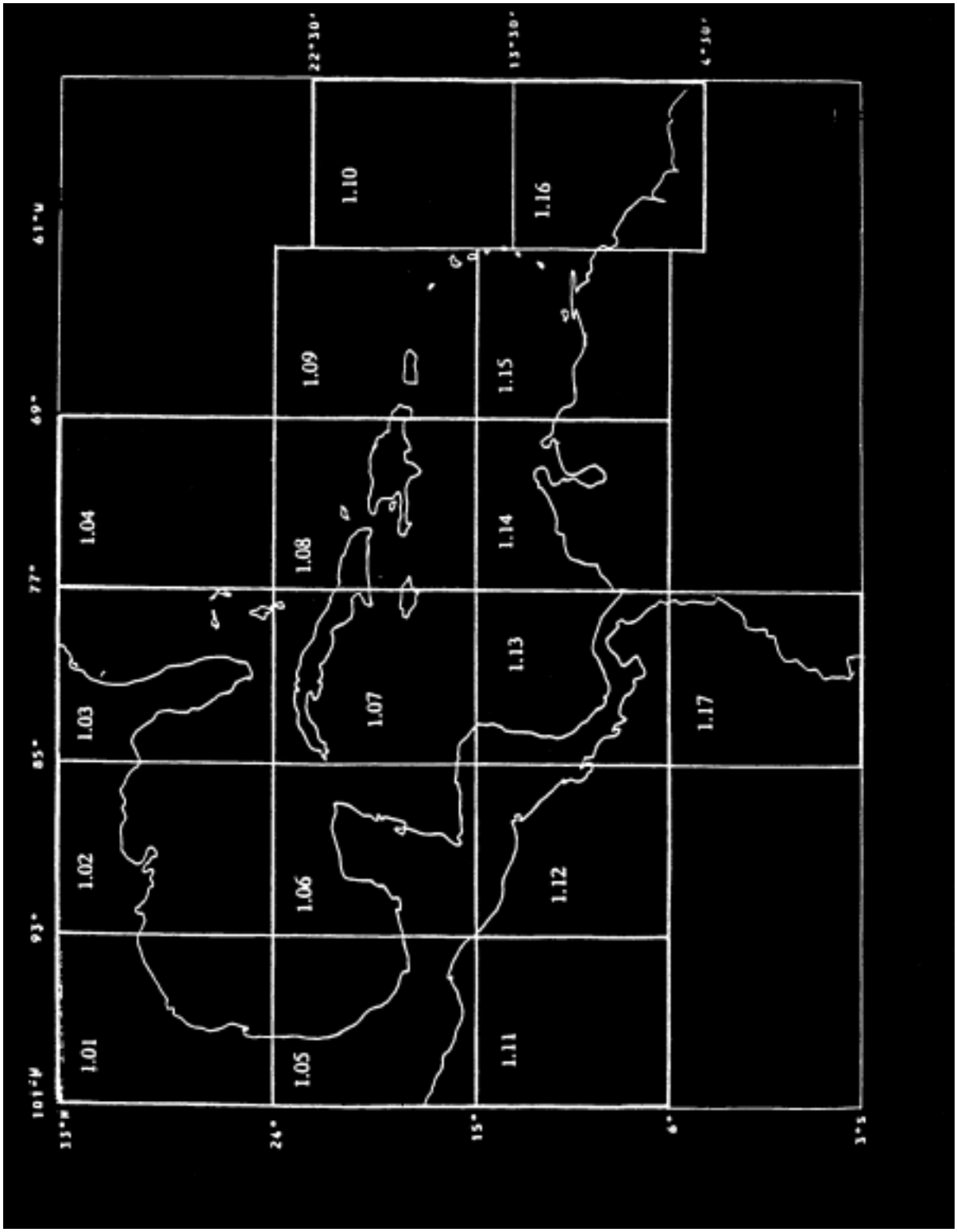
This world map is identified as GEBCO 5.00

ASSEMBLY DIAGRAM OF THE
INTERNATIONAL BATHYMETRIC CHART OF THE MEDITERRANEAN AND ITS GEOLOGICAL/GEOPHYSICAL SERIES (IBCM)
scale 1:1 million at 38°N



ASSEMBLY DIAGRAM OF THE INTERNATIONAL BATHYMETRIC CHART OF THE CARIBBEAN SEA AND THE GULF OF MEXICO (IBCCA)

scale 1:1 million at 15°N

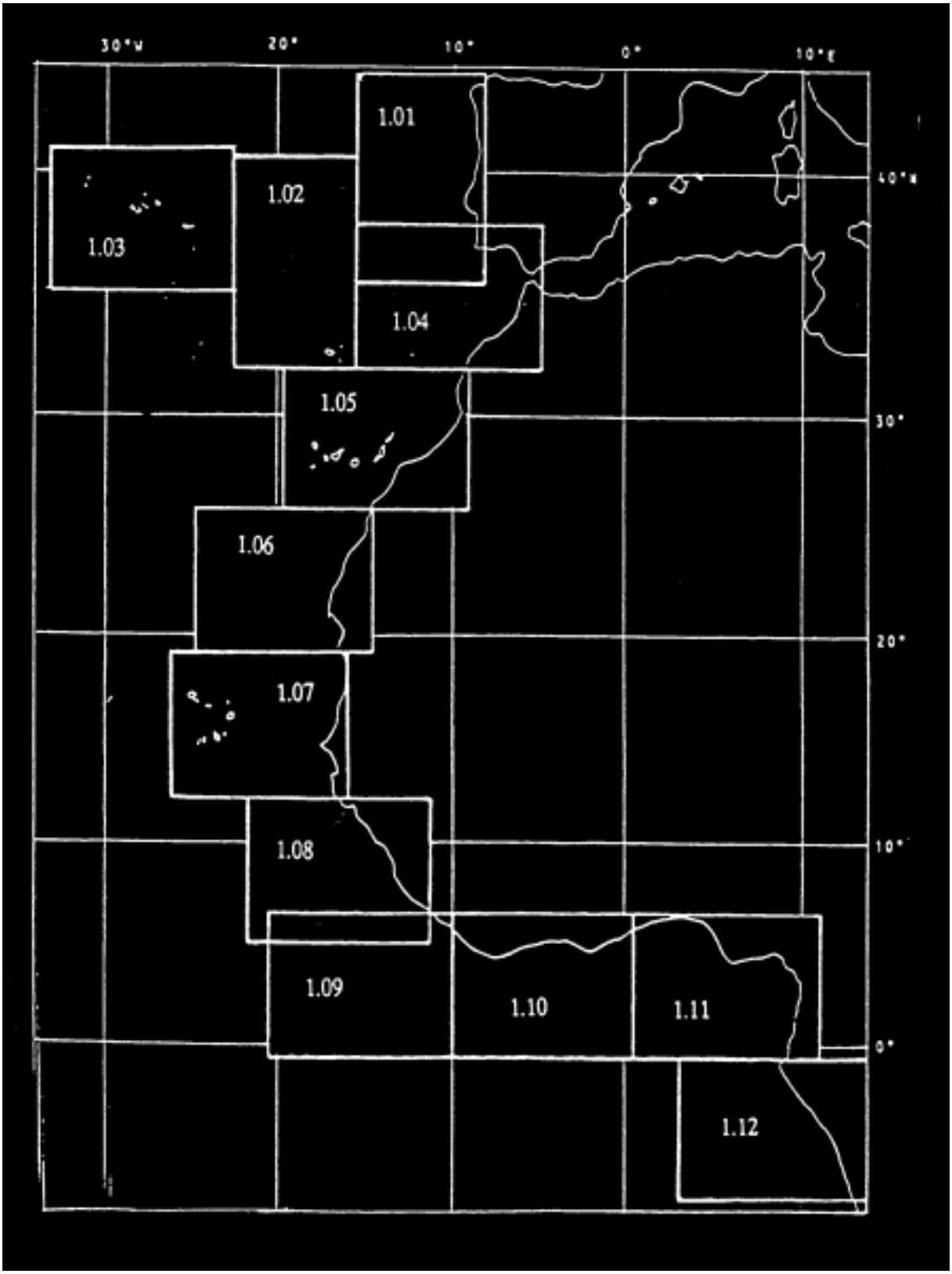


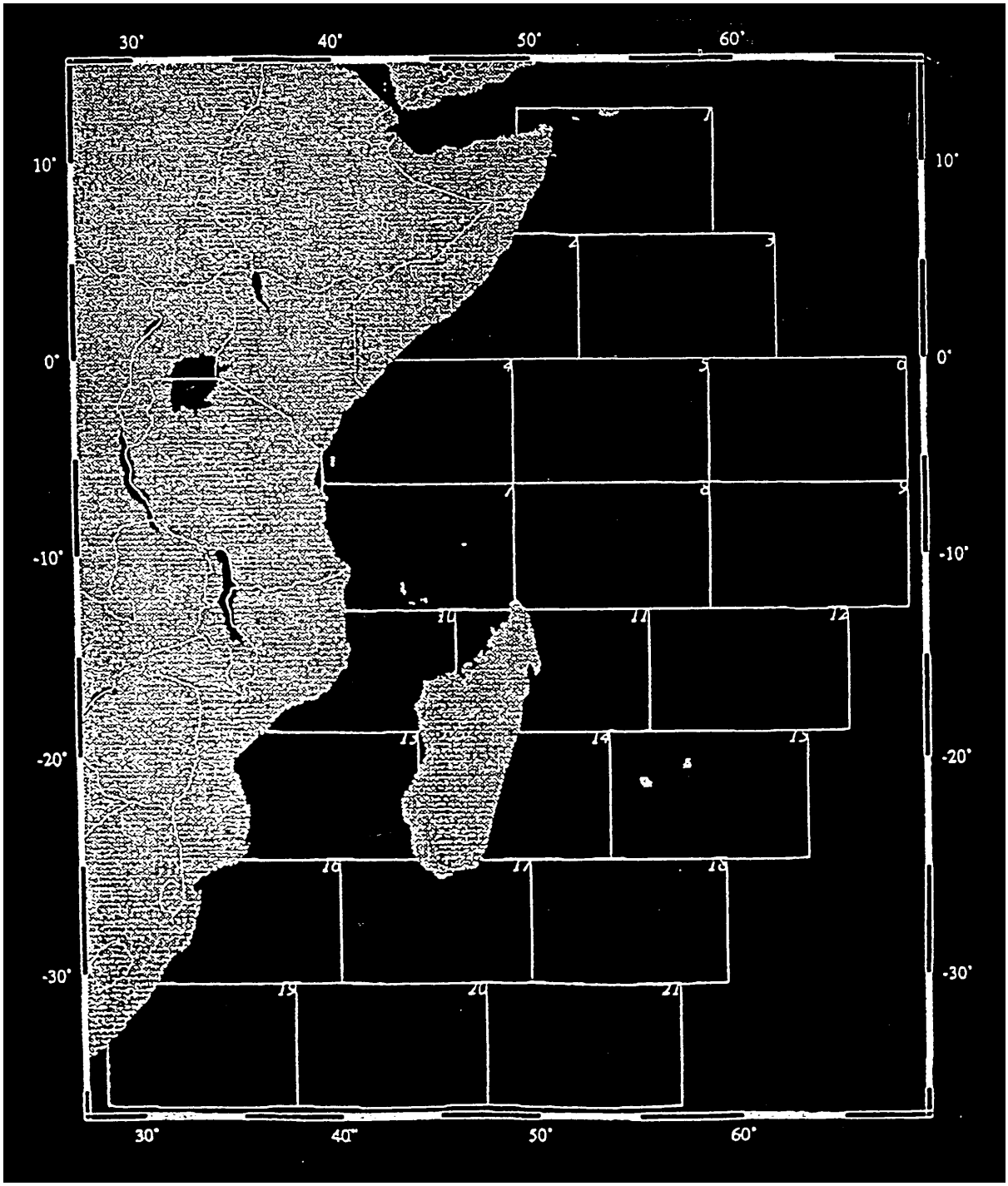
ASSEMBLY DIAGRAM OF THE INTERNATIONAL BATHYMETRIC CHART OF THE CENTRAL EASTERN ATLANTIC (IBCEA)

scale 1:1 million at 20°N

ASSEMBLY DIAGRAM OF THE INTERNATIONAL BATHYMETRIC CHART OF THE WESTERN INDIAN OCEAN (IBCWIO)

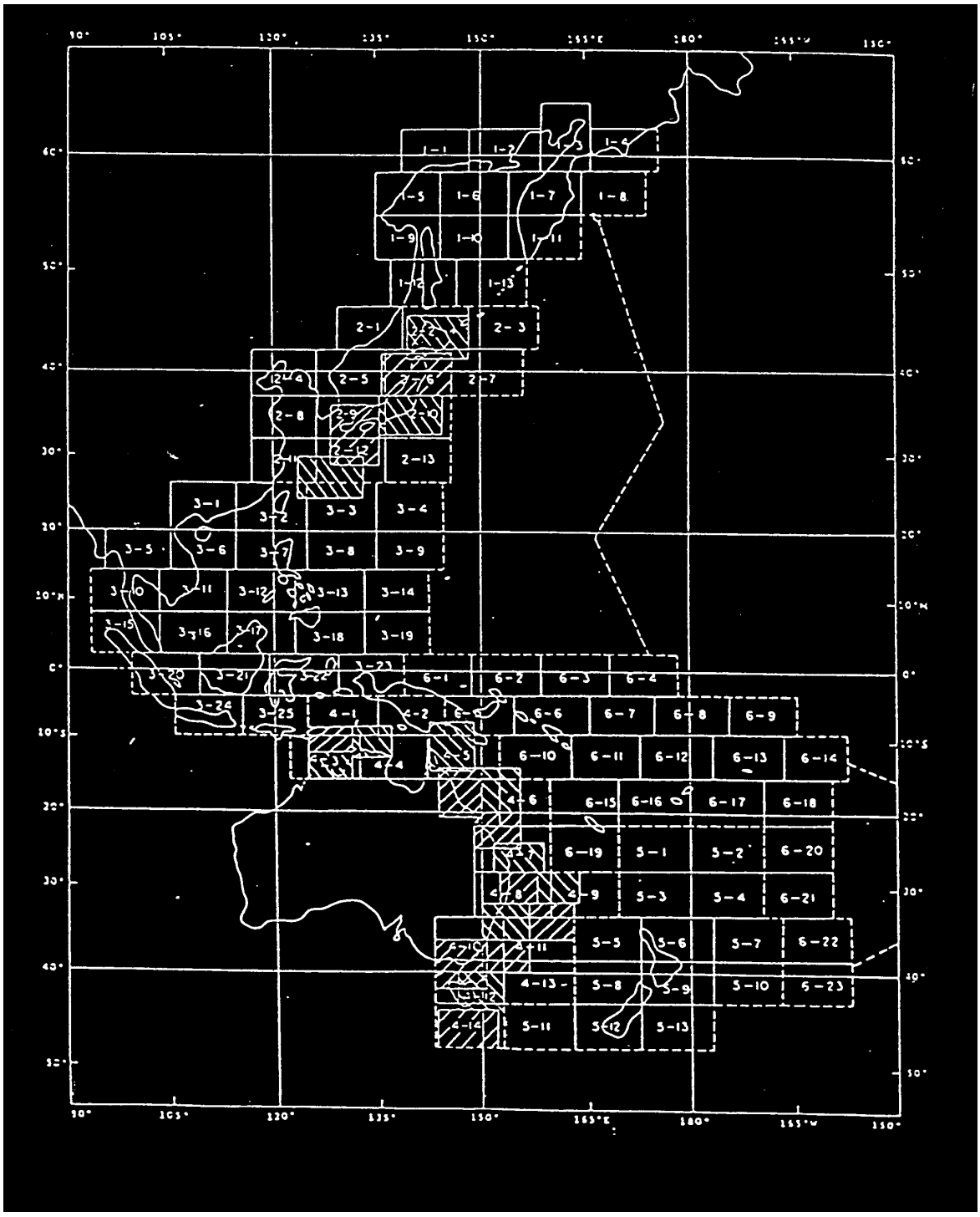
scale 1:1 million at the Equator




30°
40°
50°
60°
10°
0°
-10°
-20°
-30°

ASSEMBLY DIAGRAM OF THE INTERNATIONAL BATHYMETRIC CHART OF THE WESTERN PACIFIC (IBCWP)

scale 1:1 million at 33° latitude



ANNEX IV

LIST OF ACRONYMS

ACUF	Advisory Committee on Undersea Features (SCUFN)
AGU	American Geophysical Union
BODC	British Oceanographic Data Centre
CERESCOR	Centre de Recherche Scientifique de Conakry (Guinée)
CGOM	IOC Consultative Group on Ocean Mapping
CHS	Canadian Hydrographic Service
DTM	Digital Terrain Model
EB	Editorial Board
EMSCS	European Mediterranean Seismological Centre (France)
GAPA	International Geological/Geophysical Atlases of the Atlantic and Pacific Oceans
GDA	GEBCO Digital Atlas (GEBCO Data base)
GEBCO	General Bathymetric Chart of the Oceans (IOC-IHO)
GLOSS	Global Sea Level Observing System (IOC)
HDNO	Head Department of Navigation and Oceanography (Russian Federation)
IASC	International Arctic Science Committee (Norway)
IBCCA	International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico
IBCEA	International Bathymetric Chart of the Central Eastern Atlantic
IBC	International Bathymetric Chart
IBCM	International Bathymetric Chart of the Mediterranean and its Geological/Geophysical Series
IBCWIO	International Bathymetric Chart of the Western Indian Ocean
IBCWP	International Bathymetric Chart of the Western Pacific
IFREMER	Institut Français de Recherche pour l'Exploitation de la Mer
IGOSS	Integrated Global Ocean Services System (IOC-WMO)
IHB	International Hydrographic Bureau (Monaco)
IHO	International Hydrographic Organization (Monaco)

INEGI	Instituto Nacional de Estadistica, Geografia e Informatica (Mexico)
IOC	Intergovernmental Oceanographic Commission (UNESCO)
IOS	Institute of Oceanographic Sciences (UK)
ISM	International Sea Mapping
NERC	Natural Environment Research Council (UK)
NGDC	National Geophysical Data Centre (USA)
ORSTOM	Institut Français de Recherche Scientifique pour le Développement en Coopération
SAREC	Swedish Agency for Research Co-operation with Developing Countries
SCAR	Scientific Committee on Antarctic Research (UK)
SCDB	Sub-Committee on on Digital Bathymetry (GEBCO)
SCOR	Scientific Committee on Oceanic Research (USA)
SCUFN	Sub-Committee on Undersea Feature Names (GEBCO)
SHOM	Service Hydrographique et Océanographique de la Marine (France)
SOC	Southampton Oceanographic Centre (UK)
SOPAC	South Pacific Applied Geoscience Commission (Fiji)
UNCLOS	United Nations Conference on the Law of the Sea
UNESCO	United Nations Educational, Scientific and Cultural Organization
WVS	World Vector Shoreline
WWW	World-Wide Web