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IOC/INF-899
Paris, 16 December 1992
English only

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
(of Unesco)

REPORT OF THE CONSULTATIVE GROUP ON OCEAN MAPPING (CGOM) TO THE SEVENTEENTH SESSION OF THE IOC ASSEMBLY

This report is submitted to the IOC Assembly in accordance with clause 1 of the Terms of Reference of the Consultative Group on Ocean Mapping (CGOM). It covers the period since the last report of the CGOM to the IOC Assembly (doc. IOC/INF-822 dated 23 December 1990).

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The following paper provides a brief summary of the activities of the various component projects making up the Ocean Mapping Programme of the Intergovernmental Oceanographic Commission.

1. GENERAL BATHYMETRIC CHART OF THE OCEANS (GEBCO)

1.1 GENERAL

1.1.1 The GEBCO project is jointly sponsored by the IOC and the International Hydrographic Organization (IHO). The CGOM, as an IOC subsidiary body, wishes to pay tribute to the IHO for the excellent close collaboration which characterizes all dealings and discussions held between the two agencies. 1

1.2 MEETINGS

1.2.1 The Joint IOC-IHO Guiding Committee for the GEBCO has met once during the period covered by this report: 2
GEBCO-XIII Head Department of Navigation and Oceanography Leningrad, USSR, 10-12 June 1991 (ref: doc.IOC-IHO/GEBCO-XIII/3).

1.2.2 During the intersessional period the GEBCO Officers have also met once: 3
GEBCO Officers-VIII British Oceanographic Data Centre, Birkenhead, 13-15 April 1992 (ref: doc. IOC-IHO/GEBCO Officers-VIII/3).

1.2.3 The Sub-Committee on Geographical Names and Nomenclature of Ocean Bottom Features has met once: 4
GEBCO SCGN-IX Head Department of Navigation and Oceanography, Leningrad, USSR, 5-7 June 1991 (ref: doc. IOC-IHO/GEBCO SCGN-IX/3).

and the Sub-Committee on Digital Bathymetry has met twice: 5
GEBCO SCDB-VIII Head Department of Navigation and Oceanography, Leningrad, USSR, 5-7 June 1991.

GEBCO SCDB-IX British Oceanographic Data Centre, Birkenhead, 8-10 April 1992 (ref: doc. IOC-IHO/GEBCO SCDB-IX/3).

1.2.4 The composition of the GEBCO Guiding Committee and its Sub-Committees, together with a list of Scientific Advisers to the GEBCO, will be found in Annex I. 6

1.3 TERMS OF REFERENCE

7 1.3.1 The Terms of Reference of the Guiding Committee, under which the Committee has been operating, were originally approved by IHC-XII and IOC-XII in 1982. They are now considered to be obsolescent and in need of revision due to many changes and developments that have taken place over the last ten years.

8 1.3.2 Draft revised Terms of Reference drawn up by the GEBCO Officers (and subsequently slightly modified by the International Hydrographic Organization) will be submitted to IOC-XVII for the consideration of Member States, with a view to approval.

1.4 SUB-COMMITTEE ON DIGITAL BATHYMETRY

9 1.4.1 Digitization of the contours of the GEBCO (5th Edition) has taken far longer than originally envisaged, but the task was completed by the end of 1991 apart from the South Atlantic (0°-46°40'S.), which has had to await compilation of a revised sheet of that area (see section 1.6 below).

10 1.4.2 By the time of IOC-XVII the 'GEBCO Digital Atlas (GDA)', comprising the whole global data set will be available for general release on magnetic tape in GF3 international format. It will be supplemented by the digitized Gazetteer of Geographical Names of Undersea Features (see Annex IV), the database for which is maintained by the International Hydrographic Bureau.

11 1.4.3 During 1993 the complete dataset will be issued on Compact Disc (CD-ROM), and in this product digitized track control will also be included to provide quality control.

12 1.4.4 The digitized version of the International Bathymetric Chart of the Mediterranean (IBCM), taken from the 1:1 million scale printed chart series, has been incorporated into the GDA instead of digitization from the smaller scale GEBCO sheets. It is planned that the digitized versions of IOC's other regional Ocean Mapping projects will also be incorporated into the GDA as and when they become available.

13 1.4.5 A revised coastline, the World Vector Shoreline (WVS), has recently been released by the United States Defense Mapping Agency, and permission has been granted for this to be used for the GDA. The GDA will be transferred to the WVS when it is technically feasible so to do.

1.4.6 The Guiding Committee is of the opinion that the deliberations and decisions of the Sub-Committee on Digital Bathymetry form the basis for the future of the GEBCO, and ensure that the project is in the forefront of modern technological developments without losing its reputation for excellence which is so essential for the future. For this reason it considers it important that the Sub-Committee should continue to meet annually, at least for the foreseeable future. *14*

1.5 NETWORK OF REVIEWERS

1.5.1 Another very important part of the GEBCO structure is the 'Network of Reviewers'. As each ocean region has been digitized, a 'Reviewer' has been nominated who is responsible for identifying and maintaining close links with all potential new data sources within his or her area of responsibility, and for informing the Guiding Committee when sufficient new data exist to justify a block revision to any significant part of the digital database. A copy of the full Job Description for the GEBCO Reviewers and a list of the present appointments appear in Annex II. *15*

1.5.2 At its twelfth session in June 1991, the Guiding Committee emphasised that the GEBCO Bathymetric Editor (GBE) must communicate with the GEBCO Reviewers and act as a link between them, the Guiding Committee and the GDA. The opportunities for data exchange should be reiterated whenever possible, and the bathymetric community should be made aware of the existence of the IHO Data Centre for Digital Bathymetry (DCDB), both as a source of useful data and as an archive for their own data; they should be encouraged to deposit their data therein. *16*

1.5.3 The Guiding Committee considered that the job of the GBE will evolve as the Network of Reviewers system activates, and decisions are made on the updating of the GDA. At present however he should be an initiator and prober so as to maintain the system during the intersessional periods. *17*

1.5.4 Also within the GDA structure are the 'Compilers of Revised Blocks of Contours' who will be responsible for compiling blocks of contours in areas where sufficient new data have been identified to justify this. Compilers will be persons already interested and working actively in the areas for which they will take responsibility; they may be the same persons as the Reviewers but not necessarily so. *18*

1.6 REVISION OF SHEET 5.12 (SOUTH ATLANTIC)

19 1.6.1 At its eleventh session in April 1987 the GEBCO Guiding Committee decided to compile a revised edition of Sheet 5.12 (South Atlantic 7°N.-46°40'S.), based largely on a new chart then being compiled by Mr Norman Cherkis of the US Naval Research Laboratory (NRL). This compilation, however, is in uncorrected metres at 1,500 m/s, with contours at 200 metre intervals and, in addition, the published sheet is on a different scale to the GEBCO and only covers the South Atlantic from 3°-40°S.

20 1.6.2 Consequently, a large amount of recontouring work has had to be carried out to convert the material to GEBCO limits and standards, and in addition some new contouring has been needed to extend Mr Cherkis' material to Sheet 5.12 limits.

21 1.6.3 Compilation work on this revised sheet is now complete and the digitized version has been incorporated into the GDA. The Canadian Hydrographic Service has agreed to finalize the reproduction material and print this final sheet of the 5th Edition during 1993.

1.7 SUB-COMMITTEE ON GEOGRAPHICAL NAMES AND NOMENCLATURE OF OCEAN BOTTOM FEATURES

22 1.7.1 This Sub-Committee meets biennially to study and approve new names for undersea features proposed for use on both the GEBCO and the IOC's regional Ocean Mapping products. In addition a great deal of work is carried out intersessionally by correspondence. The Sub-Committee works closely with the United Nations Group of Experts on Geographical Names.

23 1.7.2 On the advice of the Sub-Committee, the Guiding Committee placed on record that it considered it was highly desirable that the procedures for naming underwater features, together with the availability of Proposal Forms (now available in Arabic, English, French, Greek, Italian, Japanese, Portuguese, Russian and Spanish), be widely publicised. It was suggested, in particular, that such material, including copies of its publication 'Standardization of Undersea Feature Names' should be supplied to all oceanographic research and hydrographic survey ships, as well as to scientists in all marine science disciplines, and not only to geoscientists.

1.8 GUIDELINES FOR THE GEBCO (BP-0007)

1.8.1 The IHO/IOC publication "Guidelines for the General Bathymetric Chart of the Oceans" (BP-0007) supersedes the IHO publication "Regulations for the GEBCO - Standards for Processing of Data" published in 1970, much of its contents being obsolete. The "Guidelines" are being published in loose leaf form. *24*

1.8.2 The Guiding Committee has recognized that the findings of the IHO Working Group on Oceanic Plotting Sheets, which were approved by IHC-XIV in May 1992, are relevant to its future activities, and in particular to the content of Part 4 of the GEBCO Guidelines (see Annex IV). For this reason the Guiding Committee has worked closely with the Chairman of the IHO Working Group on Oceanic Plotting Sheets, Mr Brian Harper, and provided advice and input, within its competence, to the group, and in particular in regard to its recommendations. *25*

1.9 CATALOGUE OF BATHYMETRIC PLOTTING SHEETS (BP-0002) AND ITS ANNEX (BP-0003)

1.9.1 This new edition of the Catalogue (BP-0002) shows that Russia (Head Department of Navigation and Oceanography, St Petersburg) has accepted responsibility for plotting sheets covering the northern waters of the Russian Federation and also part of the north-west Pacific. Also a number of indexes have been added showing the 1:250,000 plotting sheet coverage of IOC's regional ocean mapping projects. *26*

1.9.2 It may be noted that the IHO Working Group on Oceanic Plotting Sheets (WG/OPS) (see paragraph 1.8.2 above) has recommended that inter alia 'all remaining OPS (Bathymetric Plotting Sheets) should be phased out in five years from now, i.e. by 1996'. *27*

1.10 ACHIEVEMENTS AND FUTURE PLANS

1.10.1 The major achievement of GEBCO over the last few years has been the digitization of the contours of the 5th Edition and the preparation of the GEBCO Digital Atlas (GDA). This provides the results of the interpretative contouring in a computer compatible form so that they can be widely used and flexibly manipulated. *28*

29 1.10.2 The GDA also provides for the easy updating of contour blocks, when considered appropriate by the 'GEBCO Reviewers', so that the concept of a new Edition becomes applicable only in terms of a printed chart series.

30 1.10.3 The updating procedures of the GDA have yet to be proved in practice. It is expected that the first major update will be the central and southern Indian Ocean where Dr Robert L.Fisher, of Scripps Institution of Oceanography, has been recontouring a huge area.

31 1.10.4 The Guiding Committee welcomes the activities of IOC's regional bathymetric projects, and is collaborating closely with them in order to ensure that their products can be readily incorporated into the GDA.

32 1.10.5 The Guiding Committee believes that by about 1995 sufficient new data will have been acquired, and new contours generated in the GDA, to justify the printing of a 6th Edition of GEBCO. This can now be done by generating hardcopy plots of the linework at the appropriate scale from the digitized contour database. The Canadian Hydrographic Service has offered to investigate taking this hardcopy material and arranging the printing of the 6th Edition, under contract, and has supplied approximate printing costs, but the funds to pay for it have yet to be found.

33 1.10.6 GEBCO is the only global bathymetric database of ocean contours in which the control is precisely shown and in which confidence in given contours can be readily assessed. The late Professor Roger Revelle described it as of "outstanding quality and lasting importance".

34 1.10.7 A full listing of available GEBCO products is given in Annex IV.

2. INTERNATIONAL GEOLOGICAL-GEOPHYSICAL ATLASES OF THE ATLANTIC AND PACIFIC OCEANS (GAPA)

2.1. MEETINGS

35 2.1.1 The Central Editorial Board for GAPA has met twice during the period covered by this report:
GAPA-XI Ocean Research Institute, Tokyo
9-11 September 1991;

and GAPA-XII Japan Hydrographic Department, Tokyo
22-24 August 1992.

2.1.2 The present composition of the Central Editorial Board for GAPA (CEB/GAPA) will be found in Annex I. *36*

2.2 ATLANTIC OCEAN ATLAS

2.2.1 The Atlantic Ocean atlas, published in 1991, has now been fully distributed to contributors and to IOC Depository Libraries, and placed on sale. Publication and printing of this atlas was subsidized by the government of the USSR in order to make the atlases available to as wide as possible an audience of marine scientists and all those interested in the world's oceans and their resources (see International Marine Science Newsletter, No.63, 1992). *37*

2.2.2 This atlas gives information on the development of cartography of the Atlantic Ocean, with illustrations of relevant scientific research ships, and of modern research methods and techniques. The main atlas sections, consisting of maps on both 1:30M and 1:10M scales cover bottom topography, magnetic total intensity anomalies, free-air gravity anomalies, sea surface heights, geothermal data, earthquake epicentres and thickness of sedimentary cover. *38*

2.2.3 Larger scale maps are provided for regions of detailed study (usually bottom topography, magnetic and gravity anomalies, and thickness of sediments). For many regions profiles of seismic study are also shown. The main areas selected for detailed presentation are the Mid-Atlantic Ridge, Bay of Biscay, North-west African Continental Margin and adjacent ocean floor off Morocco, East Walvis Ridge, Caribbean Sea, Gorringe Bank, São Paulo (Santos) Plateau and the Sierra Leone Ridge. *39*

2.2.4 Seabeam Instruments Inc. of Westwood, Massachusetts, USA, have been appointed as Sales Agents for the atlas in North and South America. *40*

2.3 PACIFIC OCEAN ATLAS

2.3.1 Compilation of a companion atlas for the Pacific Ocean is well advanced, with publication expected in 1994-5. *41*

2.3.2 The introductory and main atlas sections will be similar to those provided in the Atlantic Ocean atlas (see paragraph 2.2.2 above). The Pacific Ocean regions selected for detailed study, for which larger scale maps will be provided, are the Melanesian Area, Nankai Trough, Obruchev Rise, Okinawa Trough, Gulf of Alaska, Hess Rise, Shatsky Rise, *42*

Juan de Fuca Ridge, the East Pacific Rise (hydrothermal activity), South China Sea, Japan Sea, Izu-Ogasawara Trench, Japan Trench, Sea of Okhotsk, Bering Sea and the New Zealand region.

43 2.3.3 The CGOM wishes to express its grateful thanks to the University of Tokyo (Ocean Research Institute) and the Ship and Ocean Foundation, Japan (by helping finance a meeting hosted by the Japan Hydrographic Department) for their support to this project.

3. INTERNATIONAL BATHYMETRIC CHART OF THE MEDITERRANEAN AND ITS GEOLOGICAL-GEOPHYSICAL SERIES (IBCM)

3.1 MEETINGS

44 3.1.1 The Editorial Board for the IBCM has met once during the period covered by this report:
EB-IBCM-V International Centre for Theoretical Physics, Trieste, 26-28 June 1991 (doc. IOC/EB-IBCM-V/3).

45 3.1.2 During the intersessional period informal consultations between the members of the Editorial Board were held in the Congress Centre, Trieste, during the XXXIIIrd Congress of ICSEM, 12-13 October 1992 (doc. IOC/INF-911).

46 3.1.3 The present composition of the Editorial Board for the IBCM (EB-IBCM) will be found in Annex I.

3.2 IBCM BATHYMETRY

47 3.2.1 A second edition of the IBCM is planned for publication after the five Geological-Geophysical Series have been completed. This is now tentatively scheduled for 1995-6. The explanatory brochure (at present issued as a pre-print of Chapter 1 of the Supporting Volume) is under revision and a new edition will be published in 1993.

48 3.2.2 At present a full cover of 1:250,000 Plotting Sheets for the region is being maintained by a network of Hydrographic Offices. In view of technological developments (and the policy of the IHO expressed in the report of the IHO Working Group on Oceanic Plotting Sheets, adopted by IHC-XIV in May 1992), it is expected that these plotting sheets will be phased out (by 1996 at the latest) and replaced by digital datasets.

3.3 PROGRESS WITH THE GEOLOGICAL-GEOPHYSICAL SERIES

3.3.1 Bouguer Gravity Anomalies (IBCM-G)

The explanatory brochure (Chapter 2 of the IBCM Supporting Volume) for this series which was published in 1989 is now in press. Arrangements are being made to digitize the series. *49*

3.3.2 Seismicity (IBCM-S)

The full Seismicity Series was published in 1991 on the same scales (1:1M and 1:5M) and sheet limits as the Bathymetry and Gravity series. It is to be regretted that preparation of the explanatory brochure (Chapter 3 of the IBCM Supporting Volume) and an accompanying Catalogue have been delayed but every effort will be made to resume work on these two publications during 1993. *50*

3.3.3 Plio-Quaternary/Messinian Sediments (IBCM-PQ)

Compilation of this series is now complete and the sheets are in proof stage; the series is scheduled for publication in late-1993 or early 1994. *51*

3.3.4 Unconsolidated Sea-bed Surface Sediments (IBCM-Sed)

Progress with compilation of this series is well advanced. Concern has been expressed that it has only been possible to use published western data although it is known that a great deal of unpublished data do in fact exist. Every effort is being made to obtain copies of these data and also nearshore data from Algeria, France, Libya, Morocco, and the northern and eastern Adriatic. A trial digital version of Sheet 10 of the series is being prepared by Dr John K.Hall, Geological Survey of Israel. This series is at present scheduled for publication in 1994. *52*

3.3.5 Magnetic Anomalies (IBCM-M)

Compilation of this series is nearing completion and should be ready for transfer to the Chief Editor during IOC-XVII. The explanatory brochure will be finalised during 1993 and proof copies of the series can be expected before the end of 1993. To ensure complete coverage of the region data are still needed for Albania. Bulgaria, Lebanon and the region formerly known as Yugoslavia. This series is tentatively scheduled for publication in 1995. *53*

3.4 FUTURE PLANS

3.4.1 Integrated Interpretation Proposal

54 Now that the original objectives of the IBCM are nearing fulfilment, a workplan and budget are being drawn up, and Professor Jannis Makris (Vice-Chairman IBCM), University of Hamburg, is preparing a draft proposal for submission to the European Community, with a view to obtaining financial and collegial support for a thorough interpretation of all the multi-disciplinary material that has been compiled by the IBCM project (see EB-IBCM-IV Recommendation for Future Actions, as reproduced in IOC/INF-822 Annex II).

55 3.4.2 A full listing of available IBCM products is given in Annex IV.

4. INTERNATIONAL BATHYMETRIC CHART OF THE CARIBBEAN SEA AND GULF OF MEXICO (IBCCA)

4.1 MEETINGS

56 4.1.1 The Editorial Board for the IBCCA has met once during the period covered by this report:
EB-IBCCA-IV Instituto Cubano de Hidrografía
Havana, Cuba, 24-26 March 1992
(doc. IOC/EB-IBCCA-IV/3).

57 4.1.2 During the intersessional period between EB-IBCCA-III and EB-IBCCA-IV, the Chief Editor paid a number of visits to institutes participating in the project:

Instituto Cubano de Hidrografía
Havana, Cuba, 1-2 July 1991
(with the Mexican and Venezuelan members of the EB-IBCCA);

U.S. National Geophysical Data Center, Boulder, Colorado, 8-9 July 1991;

Laboratorio de Oceanografía, Universidad Nacional Heredia, Costa Rica 25-26 November 1991;

Centro de Investigaciones Oceanográficas e Hidrográficas, Cartagena, Colombia 28-29 November 1991
(this visit was made by the Mexican member of the EB-IBCCA, representing the Chief Editor).

4.1.3 An approach has been made to the Dienst der Hydrografie, Koninklijke Marine, Netherlands, inviting them to join the Editorial Board and take responsibility for the compilation of two sheets of the series (Nos.10 and 16). This invitation has been accepted and the extent of their participation is under negotiation. *58*

4.1.4 The present composition of the Editorial Board for the IBCCA (EB-IBCCA) will be found in Annex I. *59*

4.2 PROGRESS WITH COMPILATION OF THE IBCCA

4.2.1 With any new project it always seems a long time from the original approval by one of IOC's governing bodies, through establishment of an Editorial Board, gathering together of all available data for the region, compilation of the contoured sheets, approval of the sheet proofs, to publication of the first sheet of the series. This lengthy but necessary process, if the chart series is to be of high quality, has now been gone through in the case of the IBCCA and Sheet No.9 (Hispaniola to Dominica 15°-24°N., 61°-69°W.) was published in November 1993. It is planned that a copy of this sheet will be on display during IOC-XVII. *60*

4.2.2 Concurrently, considerable progress has been made with many of the other sheets of the series. The compilation of four further sheets is virtually complete and they are scheduled for publication during 1993: *61*

Sheet 4	Bahamas to Bermuda	24°-33°N., 69°-77°W.
Sheet 6	South-east Gulf of Mexico	15°-24°N., 85°-93°W.
Sheet 7	Honduras to Cuba	15°-24°N., 77°-85°W.
Sheet 8	Cuba to Hispaniola	15°-24°N., 69°-77°W.

4.2.3 It has been brought to the notice of the Editorial Board that the density of data available for different sheets varies considerably in different parts of the region. It has therefore been decided that where data are sparse work will be compiled on plotting sheets on a scale of 1:500,000 in order to simplify contouring. Compilation work is in hand on sheets 1, 2, 3, 5, 12, 13, 14 and 15 (see Annex III, page 4) and plotting sheets are being maintained for the remainder of the region. *62*

4.3 FUTURE WORK PLANS

4.3.1 **Preparation of a digital version of the IBCCA.**
The Editorial Board is aware of the need to develop techniques which will lead to compatible digitization of the *63*

IBCCA bathymetric chart series. It is planned that a digitized version of the IBCCA be produced and that this will be incorporated into the 'GEBCO Digital Atlas' (see paragraph 1.4.4 above). The Instituto Cubano de Hidrografia has agreed to prepare a 'Project for the Creation of an IBCCA Digital Database' for consideration by the Editorial Board.

4.3.2 **Preparation of an IBCCA Geological-Geophysical Series.**

64 The IBCCA bathymetric series has now progressed far enough for the Editorial Board to consider the feasibility and desirability of producing a number of Geological-Geophysical Chart Series on the same scales and projection as the bathymetry, and using the bathymetric series as the base chart.

65 4.3.3 Most of the institutes represented on the Editorial Board do not have the necessary expertise to compile such sheets (though they do have the necessary cartographic skills to produce them). Members of the Editorial Board have therefore been invited to contact specialists in their countries to ascertain whether they would be willing to participate in such a project. It was also decided that a seminar should be called to define and reach agreement as to how such a task could be accomplished.

66 4.3.4 A full listing of IBCCA products in preparation is given in Annex IV.

5. INTERNATIONAL BATHYMETRIC CHART OF THE CENTRAL EASTERN ATLANTIC (IBCEA)

5.1 MEETINGS

67 5.1.1 It is regretted that the 2nd Session of IBCEA had to be postponed through shortage of funding in 1992. It is hoped to convene a meeting during 1993.

68 5.1.2 However, a number of members of the EB/IBCEA were able to meet informally during the Third Conference of the Eastern Atlantic Hydrographic Commission (EAtHC) held in Lagos in March 1991 and certain important decisions were reached.

5.2 RESPONSIBILITY FOR COMPILATION AND EDITING OF THE SHEETS

69 5.2.1 The Instituto Hidrográfico de la Marina, Spain has confirmed its willingness to accept responsibility for two sheets of the series.

5.2.2 Following this decision, sheet responsibilities have been agreed between the hydrographic offices of France, Portugal and Spain (see Annex III, page 5), as follows: 70

France Sheets 6, 8, 9, 10, 11 and 12;
Portugal Sheets 1, 2, 3 and 7;
Spain Sheets 4 and 5.

5.3 PROGRESS WITH COMPILATION OF THE IBCEA

5.3.1 The Instituto Hidrográfico of Portugal has begun compilation of Sheet no.1 with slightly revised latitudinal limits. 71

5.3.2 The Service Hydrographique et Océanographique de la Marine, France, has completed compilation of; 72

Sheet 8 5°-12°N., 12°-22°W.
and Sheet 9 1°S.-7°N., 10°-21°W.

on a scale of 1:500,000 and digitization of these compilation sheets, together with terrestrial topographic data, is well advanced. A preliminary review of these sheets will be carried out by Dr Isabelle Niang (Senegal) Vice-Chairman IBCEA.

6. INTERNATIONAL BATHYMETRIC CHART OF THE WESTERN INDIAN OCEAN (IBCWIO)

6.1 MEETINGS

6.1.1 It is regretted that the 3rd Session of IBCWIO had to be postponed through shortage of funding in 1992. The Chief Editor has stated that it is mandatory that this session be held during 1993, as otherwise it could happen that all work and financial expenses invested up to now in the project will be lost and preparatory work will have to be started afresh. The CGOM strongly supports this viewpoint. 73

6.1.2 Following support given by the CGOM (doc. IOC/INF-822, paragraph 75), the Chief Editor held one week training courses in Mauritius, Kenya and Tanzania between 31 August and 25 September 1991. Unfortunately the training course in Madagascar had to be cancelled owing to the political situation in that country. These courses were financed equally by the German Ministry of Research and Technology and by the IOC. 74

6.2 PROGRESS WITH COMPILATION OF THE IBCWIO

75 6.2.1 As at end-1991, the source materials on hand for evaluating the IBCWIO consisted of 202 plotting sheets (on a scale of 1:250,000), contour plans, working charts, etc. It was intended to start evaluating this material in 1992 and to distribute it to IBCWIO members from Mauritius, Kenya, Tanzania and Madagascar for this purpose. Initially this will mean constructing depth contours at a scale of 1:250,000 and evaluating one chart at a scale of 1:1 million (which consists of 20 working charts/plotting sheets).

76 6.2.2 Although the above-mentioned four countries have functioning land survey offices, they are breaking new ground with the production of bathymetric charts. It was for this reason that it was decided to hold the short training courses.

77 6.2.3 By way of training material, the rapporteur had drawn up a background document, as well as visual aids and exercise material, for retention by the participants, who were well aware of their need for the course and so were found to be attentive and interested. By these courses, the Chief Editor was able to inform himself about staff levels and equipment available in each country, and also to what extent the basic source material had to be reworked, and in some cases re-plotted, before it could be passed for processing by local personnel. He concluded that this preparatory work will involve more than originally envisaged, will have to last longer and will cost more.

7. INTERNATIONAL BATHYMETRIC CHART OF THE WESTERN PACIFIC (IBCWP)

7.1 PRESENT STATUS

78 7.1.1 It is regretted that the 1st Session of IBCWP, scheduled to be held in Beijing in mid-1992 had to be postponed due to lack of financial resources. It is to be hoped that it will be possible to hold this session during 1993.

7.2 ESTABLISHMENT OF THE EDITORIAL BOARD FOR IBCWP (EB-IBCWP)

79 7.2.1 Following formal establishment of an Editorial Board for the IBCWP, together with approved Terms of Reference (resolution XVI-5), the Secretary IOC invited Member States to

submit candidatures of experts to be considered for membership of the EB-IBCWP. Subsequently membership of the Board was announced (see Annex I), including nomination by China of a Chief Editor for the IBCWP and a national institution to provide the Editor with the full support he will need to carry out his responsibilities for review and quality control of the sheet compilations (Dr Hou Wenfeng, National Marine Data and Information Service, Tianjin).

7.3 PROGRESS WITH COMPILATION OF THE IBCWP

7.3.1 No progress has been made, nor can this be expected until the Editorial Board holds its first session. The Australian Bureau of Mineral Resources has however continued to compile and publish its own national coastal resource map series - it has been agreed that certain of these will form part of the IBCWP in due course. *80*

8. CONCLUSIONS

8.1 SUCCESSFUL DEVELOPMENTS

8.1.1 Over the past biennium the GEBCO Digital Atlas (GDA) has become fully operational, providing a global database of bathymetric contours, and geographical names of undersea features. During 1993 digitized shiptracks (for quality control) will also become available and the whole package will be released on compact disc (CD-ROM). Furthermore a structure is now being put in place which will ensure that the GDA is kept continuously updated with all new data as they become available. *81*

8.1.2 The GAPA International Geological-Geophysical Atlas of the Atlantic Ocean has been published and has received wide acclaim from many quarters. Compilation of the Pacific Ocean atlas is well advanced. *82*

8.1.3 Progress with the Geological-Geophysical Series of the International Bathymetric Chart of the Mediterranean (IBCM) is progressing after some production delays with the IBCM-PQ series. It is understood that these difficulties have been overcome and that the speed of production has now returned to normal. *83*

8.1.4 The first sheet of the International Bathymetric Chart of the Caribbean Sea and Gulf of Mexico (IBCCA) has now been published and compilation of further sheets in this series are up to schedule. *84*

85 8.1.5 The first three sheets of the International Bathymetric Chart of the Central Eastern Atlantic (IBCEA) are in an advanced state of compilation.

86 8.1.6 Worthwhile training courses in support of the International Bathymetric Chart of the Western Indian Ocean (IBCWIO) have been held in Mauritius, Kenya and Tanzania.

8.2 DIFFICULTIES AND FRUSTRATIONS

87 8.2.1 On the other hand a number of difficulties and frustrations have been encountered due mainly to shortage of funding for the Ocean Mapping programme:

88 8.2.2 Four meetings scheduled for 1992 (CGOM-V, EB-IBCEA-II, EB-IBCWIO-III and EB-IBCWP-I) have had to be cancelled or postponed.

89 8.2.3 The posts of Senior Technical Assistant for Ocean Mapping in the IOC Secretariat, and IBCM Secretary have become vacant through withdrawal of the seconded staff filling these two posts - a very suitable candidate has applied for the first of these two posts but so far it has not been possible to find the necessary funding (resolution EC-XXV.1 refers).

90 8.2.4 Two planned new Ocean Mapping projects: the International Bathymetric Chart of the Red Sea and Gulf of Aden (IBCRSGA) and the International Bathymetric Chart of the Northern Atlantic (IBCNA) have been postponed indefinitely.

8.3 SUBMISSION BY THE CGOM

91 8.3.1 The Assembly is invited to give its full support to the IOC's Ocean Mapping programme which we believe has great potential and much of which is developing most satisfactorily. We consider that it is making a worthwhile and responsible contribution to the aims and purposes of the Commission.

ANNEX I

MEMBERSHIP OF ALL GROUPS RESPONSIBLE FOR SUPERVISING OCEAN MAPPING PROJECTS SPONSORED (OR CO-SPONSORED) BY THE COMMISSION

A. JOINT IOC-IHO GUIDING COMMITTEE FOR THE GENERAL BATHYMETRIC CHART OF THE OCEANS (GEBCO)

Sir Anthony Laughton (UK) Chairman	representing SCOR
Mr David Monahan (Canada) Vice-Chairman	IHO appointment
Capitão de Corveta Lucas de Campos Costa (Brazil)	IHO appointment
Capitán de Fragata J.M.Fernandez de la Puente (Spain)	IHO Appointment
Dr Robin K.H.Falconer (New Zealand)	representing CMG
Dr Robert L.Fisher (USA)	representing IAPSO
Dr Ing. Hans-Werner Schenke (Germany)	IOC Appointment
Dr Lysandros Tsoulos (Greece)	IHO appointment
Dr Gleb B.Udintsev (Russia)	IOC appointment
Mr Kunio Yashima (Japan)	IHO appointment

SCIENTIFIC ADVISERS TO THE GEBCO

Dr Carl Brenner, JOIDES/ODP Site Survey Data Bank
Mr Norman Z.Cherkis, U.S.Naval Research Laboratory
Mr Gerald N.Ewing (Canada) Former Chairman GEBCO
Mr Brian Harper, U.K. Hydrographic Office
Dr G.Leonard Johnson, U.S. Office of Naval Research
Dr Meirion T.Jones, Director, British Oceanographic Data Centre
Dr Michael S.Loughridge, Director, WDC'A', Marine Geology and Geophysics
Mr Carl Nelius, U.S. Defense Mapping Agency
Mr Donald E.Pryor, U.S. National Ocean Service

also (ex-officio):
Mr Desmond P.D.Scott, Permanent Secretary GEBCO
Mr Peter Hunter, GEBCO Bathymetric Editor
Ms Pauline Weatherall, GEBCO Digital Atlas Manager
Rear Admiral Christian Andreasen, President of the Directing Committee, IHO
Dr Alexei Suzyumov, Office of IOC and Marine Science Related Issues, Unesco

GEBCO SUB-COMMITTEE ON DIGITAL BATHYMETRY

Dr Meirion T.Jones **Chairman**
Director, British Oceanographic Data Centre
Ing.en Chef Michel Huet, International Hydrographic Bureau
Dr Michael S.Loughridge
Director, WDC'A' Marine Geology & Geophysics
Mr Francis Marchant, U.S. Naval Oceanographic Office
Dr Andrey Popov
Head Department of Navigation & Oceanography, Russia
Dr.Ing.Hans-Werner Schenke, Alfred-Wegener-Institut, Germany
Mr Shin Tani, Japan Oceanographic Data Center
Dr Lysandros Tsoulos, Hellenic Navy Hydrographic Service
Rear Admiral J.Austin Yeager NOAA, Chairman IHO Committee on Exchange of Digital Data (CEDD) (ex-Officio as an Observer)

GEBCO SUB-COMMITTEE ON GEOGRAPHICAL NAMES AND NOMENCLATURE OF OCEAN BOTTOM FEATURES

Dr Robert L.Fisher **Chairman**
Scripps Institution of Oceanography, USA
Ing.en Chef Michel Huet Secretary
International Hydrographic Bureau
Dr Galina V.Agapova, Geological Institute of the Russian Academy of Sciences
Rear Admiral Christian Andreasen, President of the Directing Committee, IHO
Dr Robin K.H.Falconer, GEORESEARCH Associates, New Zealand
Dr Richard R.Randall, U.S. Board on Geographic Names
Mr Kunio Yashima, Japan Hydrographic Department

B. CENTRAL EDITORIAL BOARD FOR THE INTERNATIONAL GEOLOGICAL-GEOPHYSICAL ATLASES OF THE ATLANTIC AND PACIFIC OCEANS (GAPA)

Dr Gleb B.Udintsev, **Chief Editor**
Vernadsky Institute of Geochemistry, Russia
Mr Desmond P.D.Scott (IOC) Deputy Editor
Academician Igor S.Gramberg, Director,
Institute of Ocean Geology, Russia
Dr Brian T.R.Lewis, University of Washington, USA
Dr Manik Talwani, Houston Advanced Research Center, USA
Dr Seiya Uyeda, Tokai University, Japan
Dr Dina Zhiv, Mapping Production Association 'Kartografia', Russia

C. EDITORIAL BOARD FOR THE INTERNATIONAL BATHYMETRIC CHART OF THE MEDITERRANEAN AND ITS GEOLOGICAL/GEOPHYSICAL SERIES (IBCM)

Prof.Carlo Morelli, Istituto di Miniere e Geofisica Applicatà, Italy — **Chairman**
Prof.Jannis Makris, Universität Hamburg — Vice Chairman
Captain Andrey Popov, Head Department of Navigation & Oceanography,Leningrad — Chief Editor
Prof.Pierre F.Burollet, Geological Consultant
Prof.Frank Fabricius, Technische Universität Munchen, Germany
Prof.Maurice Gennesseaux, Université Pierre et Marie Curie, France
Dr John K.Hall, Geological Survey of Israel
Prof.Pavel Kuprin, Moscow State University
Rear Admiral Christian Andreasen (ex-officio) President of the Directing Committee, IHO

D. EDITORIAL BOARD FOR THE INTERNATIONAL BATHYMETRIC CHART OF THE CARIBBEAN SEA AND GULF OF MEXICO (IBCCA)

Dr Nestór Duch Gary, Dirección General de Geografía, México — **Chairman and Chief Editor**
Capitán de Navio Fernando Aranda Griman, Dirección de Hidrografía y Navegación, Venezuela
Dr José Ma Diaz Andrade, Universidad Nacional, Costa Rica
Capitán de Fragata Angel Garcia Alvarez, Instituto Cubano de Hidrografía, Cuba
Dr Troy L.Holcombe, National Geophysical Data Center, USA
Capitán de Fragata Jorge Urbano Rosas, Centro de Investigaciónes Oceanográficas e Hidrográficas, Colombia
Lic. José Luis Frias Salazar, Instituto Nacional de Estadística, Geografía e Informática, México
J.G.Ferwerda, Dienst der Hydrografie, Koninklijke Marine, Netherlands
Rear Admiral Christian Andreasen (ex-officio) President of the Directing Committee, IHO

E. EDITORIAL BOARD FOR THE INTERNATIONAL BATHYMETRIC CHART OF THE CENTRAL EASTERN ATLANTIC (IBCEA)

Ing.Gén. André Roubertou, (Service Hydrographique et Océanographique de la Marine) Chairman
Dr Isabelle Niang, Université C.A.DIOP, Dakar, Senegal Vice-Chairman
Ing. en Chef Jean-François Bonnot, Service Hydrographique et Océanographique de la Marine, France Co-Chief Editor
Capitão-de-Fragata Jose D.Torres Sobral, Instituto Hidrográfico, Lisbon, Portugal Co-Chief Editor
Mr Lawrence E.Awosika, Institute for Oceanography and Marine Research, Lagos, Nigeria
Mr Boubacar Diallo, Centre de Recherches Scientifiques de Conakry-Rogbane, Republic of Guinea
Dr Troy Holcombe, National Geophysical Data Center, Boulder, Colorado, USA
Dr E.John W.Jones, University of London, United Kingdom
Ing.Ocean. Mensah Koffi Nutsudza, Université du Bénin, Lomé, Togo
Rear Admiral Christian Andreasen (ex-officio) President of the Directing Committee, IHO

F. EDITORIAL BOARD FOR THE INTERNATIONAL BATHYMETRIC CHART OF THE WESTERN INDIAN OCEAN (IBCWIO)

Dr Werner Bettac, Germany Chairman and Chief Editor
Darmalingum Ramasawmy, Ministry of Housing, Lands and Environment, Mauritius Vice Chairman
Jean-François Bonnot, Service Hydrographique et Océanographique de la Marine, France
Omar Haji Ahmed Dubad, Ministry of Fisheries & Marine Transport, Somalia
Sesaluxo Emilio das Neves Gaveta, National Institute of Hydrography & Navigation, Mozambique
Troy Holcombe, National Geophysical Data Center, USA
Peter Hunter, Institute of Oceanographic Sciences, UK
Shaibu Yussuf Juma, Director of Surveys and Urban Planning, Zanzibar, Tanzania
John Dominic Obel, Survey of Kenya
Christian Andreasen (ex-officio) President of the Directing Committee, IHO

G. EDITORIAL BOARD FOR THE INTERNATIONAL BATHYMETRIC CHART OF THE WESTERN PACIFIC (IBCWP)

Dr HOU Wenfeng, National Marine Data & Information Service. Tianjin, China — Chief Editor
Captain Mohd. Rasip BIN HASSAN RMM, Hydrographic Directorate, Kuala Lumpur, Malaysia
Mrs Orapin CHANPONGSAENG, Oceanic Fisheries Division, Samuthprakarn, Thailand
HUANG Zumo, Mapping Agency of Navigation Guarantee Department, Tianjin, China
Christopher R.JOHNSTON, Bureau of Mineral Resources, Canberra, Australia
The Tien LE, State Department of Geodesy and Cartography, Hanoi, Vietnam
Sung Kee PAIK, Maritime Safety Division, Seoul, Republic of Korea
George F.SHARMAN, National Geophysical Data Center, Boulder, Colorado, USA
Evgeniy SHCHAULOV, Head Department of Navigation and Oceanography, St Petersburg, Russia
Kunio YASHIMA, Japan Hydrographic Department, Maritime Safety Agency, Tokyo, Japan

H. IOC CONSULTATIVE GROUP ON OCEAN MAPPING (CGOM)

Mr Desmond P.D.Scott		**Chairman**
Prof.Carlo Morelli	Chairman IBCM	Vice-Chairman
Dr Werner Bettac	Chairman IBCWIO	
Dr Néstor Duch Gary	Chairman IBCCA	
Sir Anthony Laughton	Chairman GEBCO	
Ing.Gén. André Roubertou	Chairman IBCEA	
Dr Hou Wenfeng	Chief Editor IBCWP	
Dr Gleb B.Udintsev	Chief Editor GAPA	

Rear Admiral Christian Andreasen (ex-officio) representing IHO

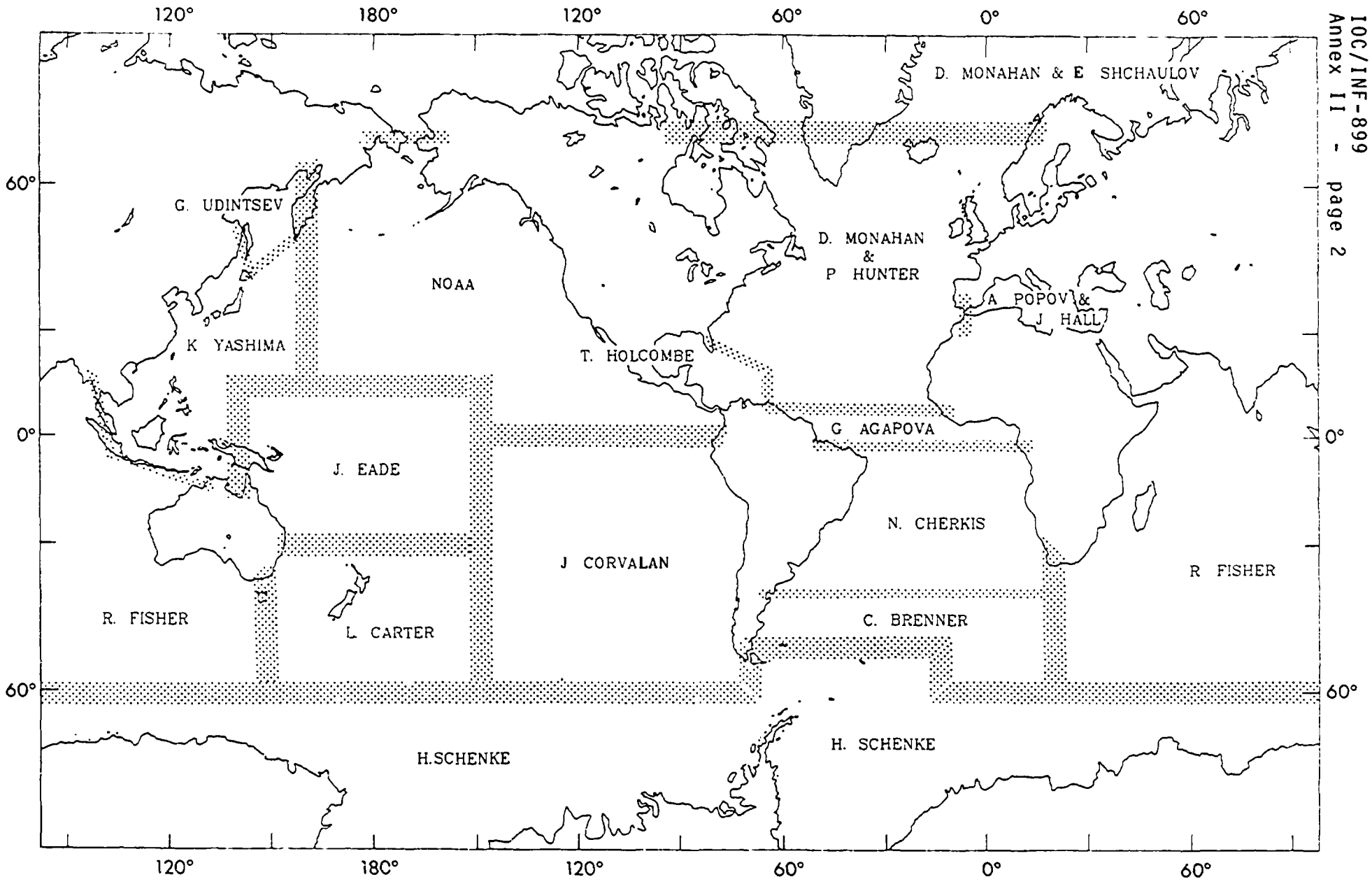
Representative of the IOC Secretariat for Ocean Mapping

Dr Alexei Suzyumov, Office of IOC and Marine Science Related Issues, Unesco.

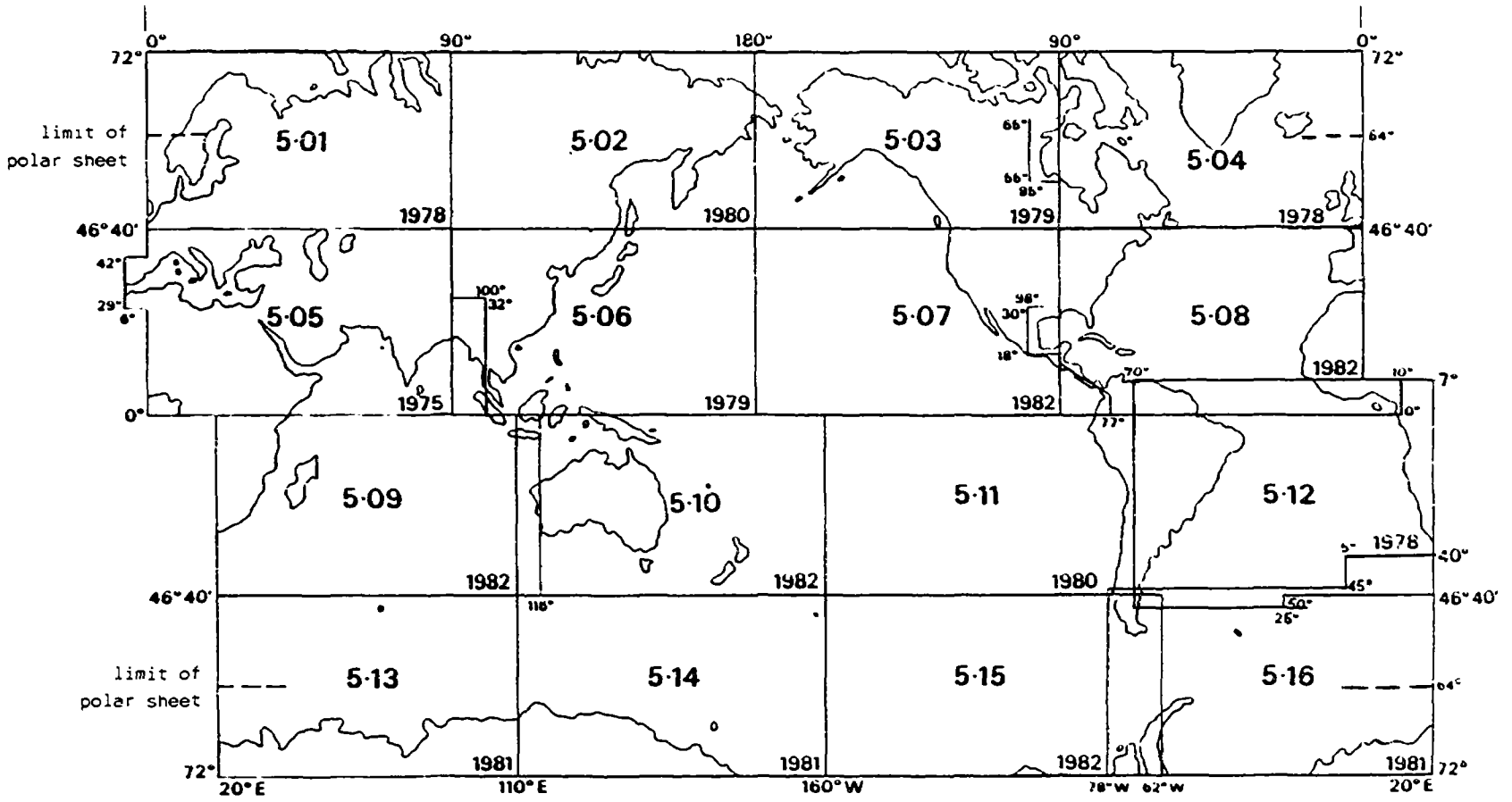
ANNEX II

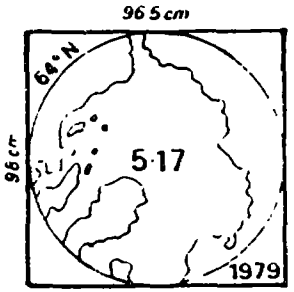
LIST OF REVIEWERS

Antarctic Waters south of 46°40'S.	Hans-Werner Schenke	Accepted
North Atlantic Ocean (excluding Caribbean Sea & Gulf of Mexico)	Peter Hunter David Monahan (link to Galina Agapova for area 0°-7°N.)	Accepted Accepted
Caribbean Sea & Gulf of Mexico	Troy Holcombe	Accepted
Mediterranean & Black Seas	John K.Hall Andrey Popov	Accepted Accepted
Arctic Ocean	David Monahan Evgeniy Shchaulov	Accepted Accepted
South Atlantic Ocean	Norman Z.Cherkis (link to Brazilians, also Carl Brenner and Robert L.Fisher)	Accepted
Indian Ocean	Robert L.Fisher	Accepted
North-west Pacific Ocean	Kunio Yashima (link to Gleb Udintsev for Sea of Okhotsk area)	Accepted
South-west Pacific Ocean	James V.Eade	Accepted
North-east Pacific Ocean	NOAA/NOS (to be nominated)	Accepted
South-east Pacific Ocean	José Corvalan D.	Accepted
New Zealand waters	Lionel Carter	Accepted


120°
180°
120°
60°
0°
60°
D. MONAHAN & E SHCHAULOV
60°
G. UDINTSEV
NOAA
D. MONAHAN
&
P HUNTER
A POPOV &
J HALL
K YASHIMA
T. HOLCOMBE
0°
G AGAPOVA
J. EADE
N. CHERKIS
J CORVALAN
R FISHER
R. FISHER
L. CARTER
C. BRENNER
60°
H.SCHENKE
H. SCHENKE
120°
180°
120°
60°
0°
60°

GENERAL BATHYMETRIC CHART OF THE OCEANS
scale 1:1 million at 0°

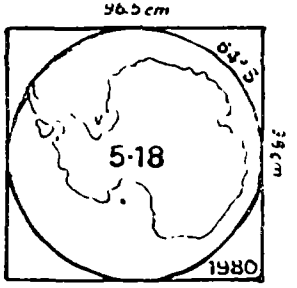




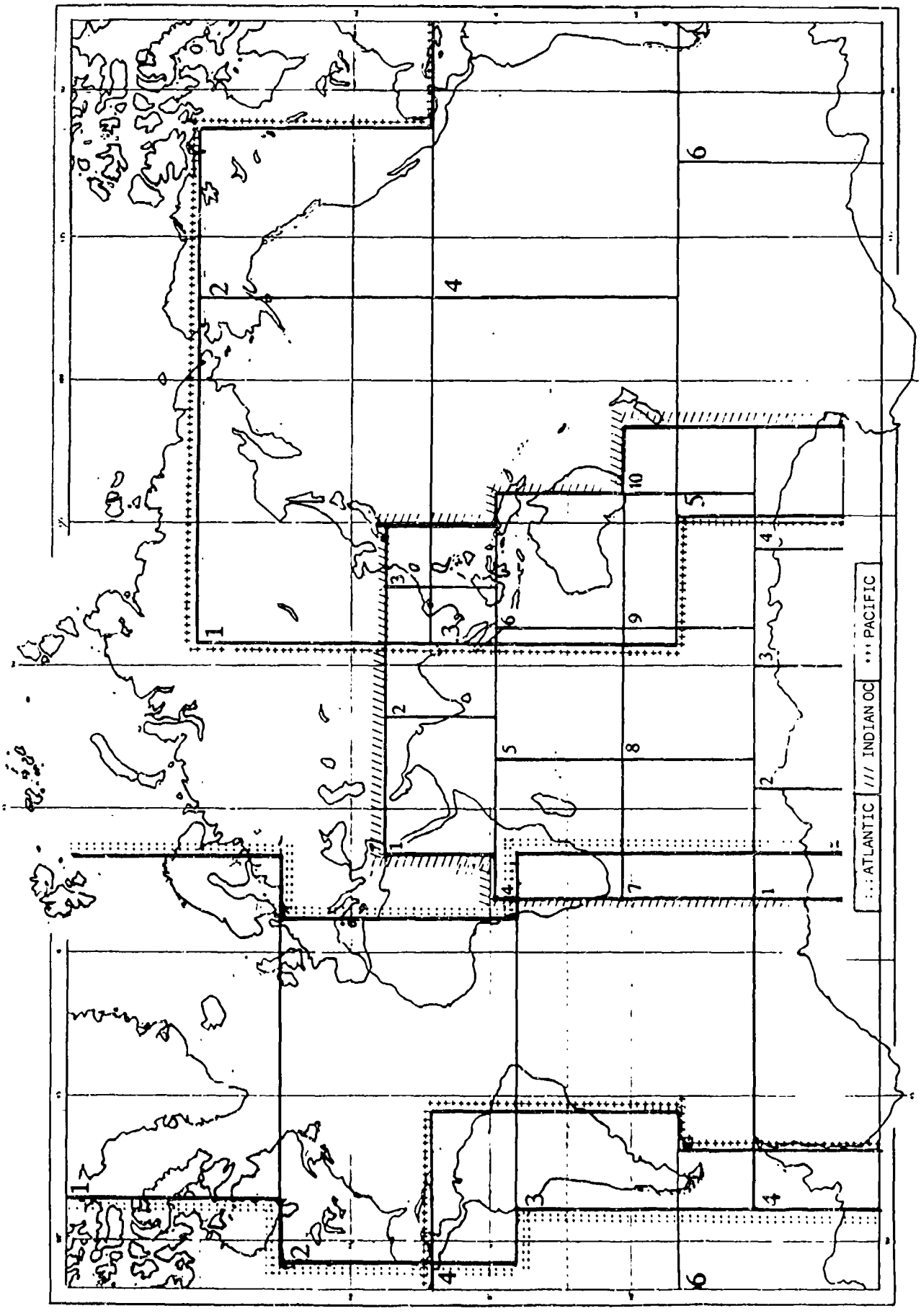
WORLD MAP

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

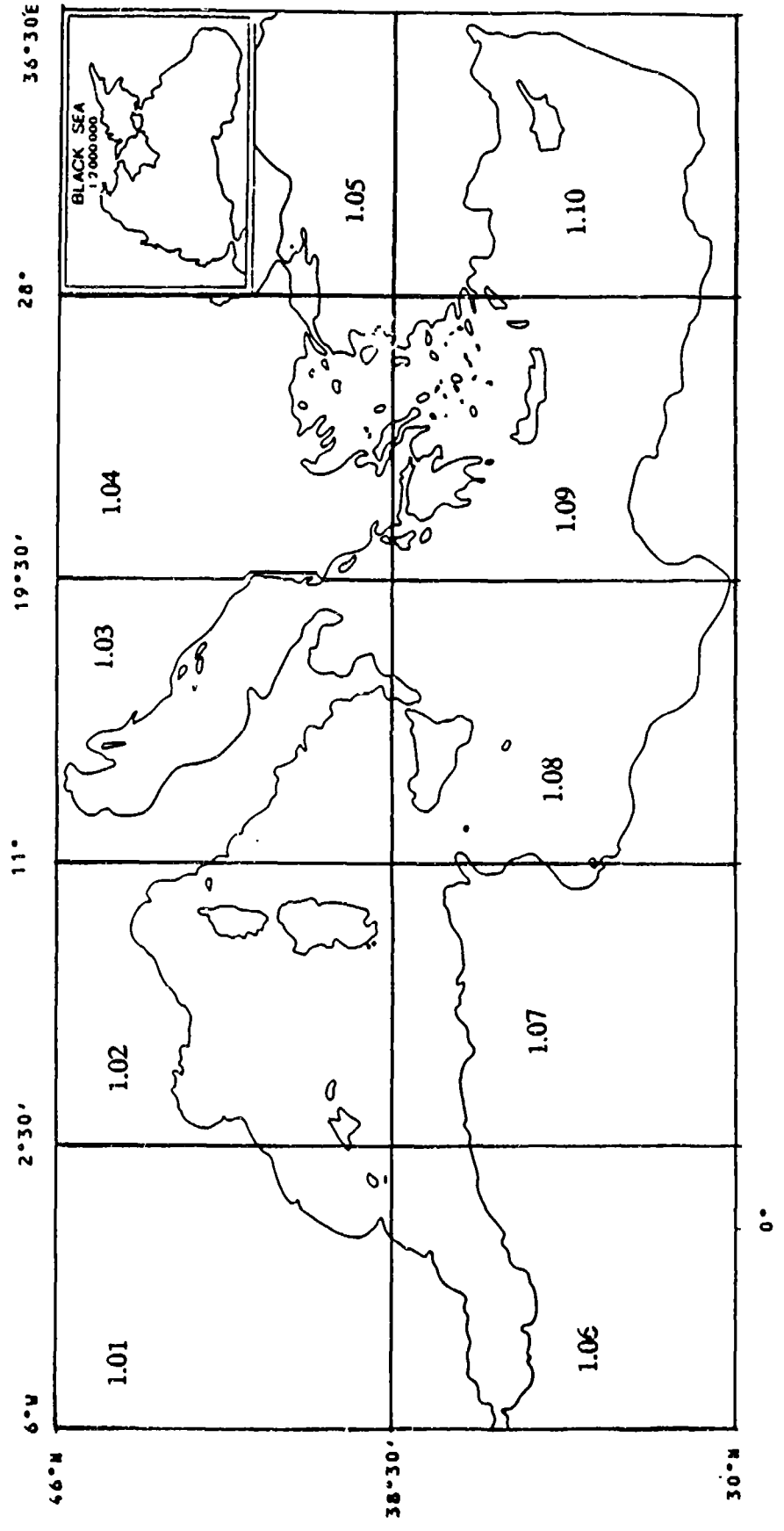
This world map is identified as GEBCO 5.00



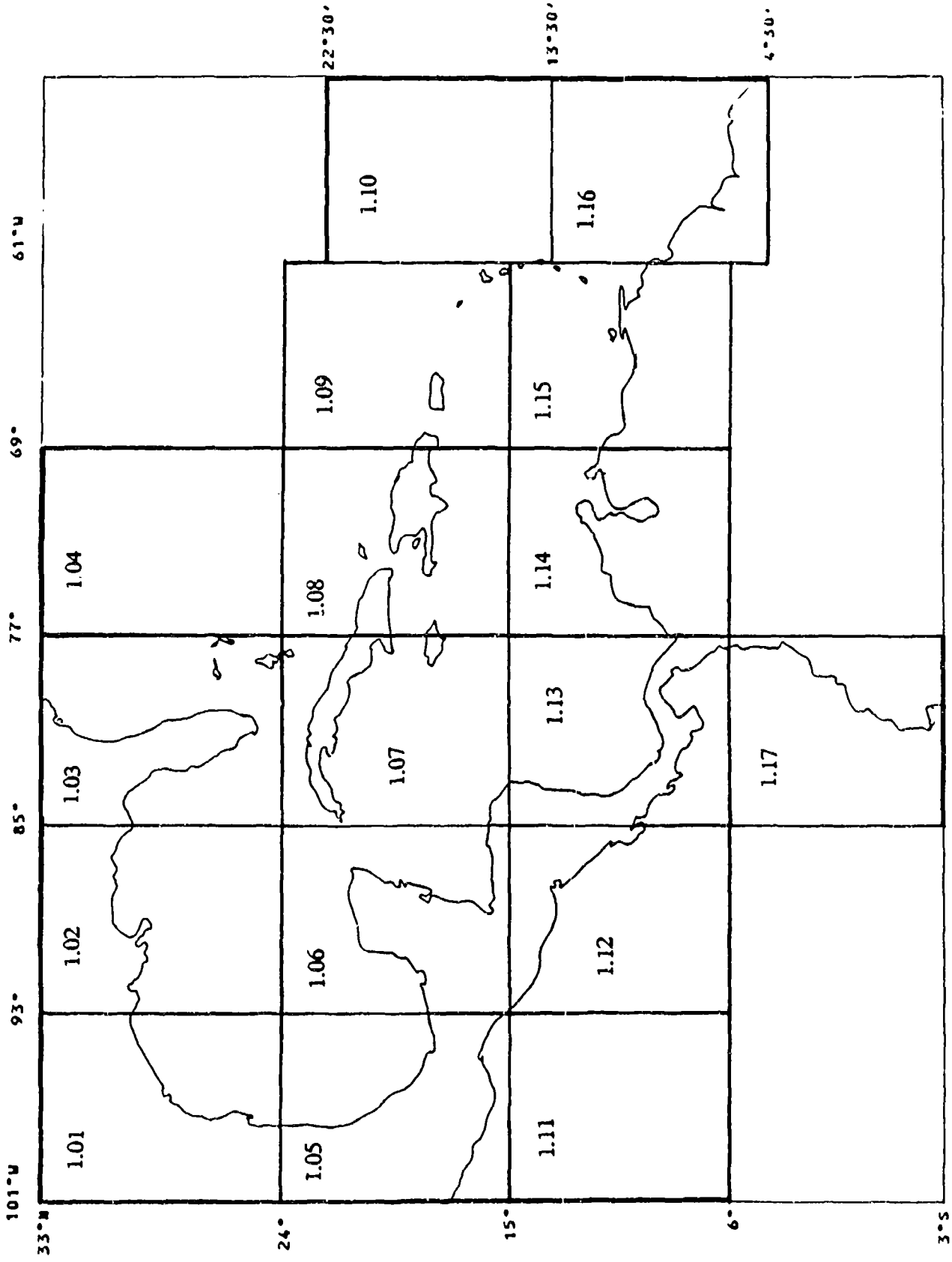
INTERNATIONAL GEOLOGICAL/GEOPHYSICAL ATLASES
scale 1:5 million at 45° for Indian Ocean Atlas and
1:10 million at 45° for Atlantic and Pacific Ocean Atlases



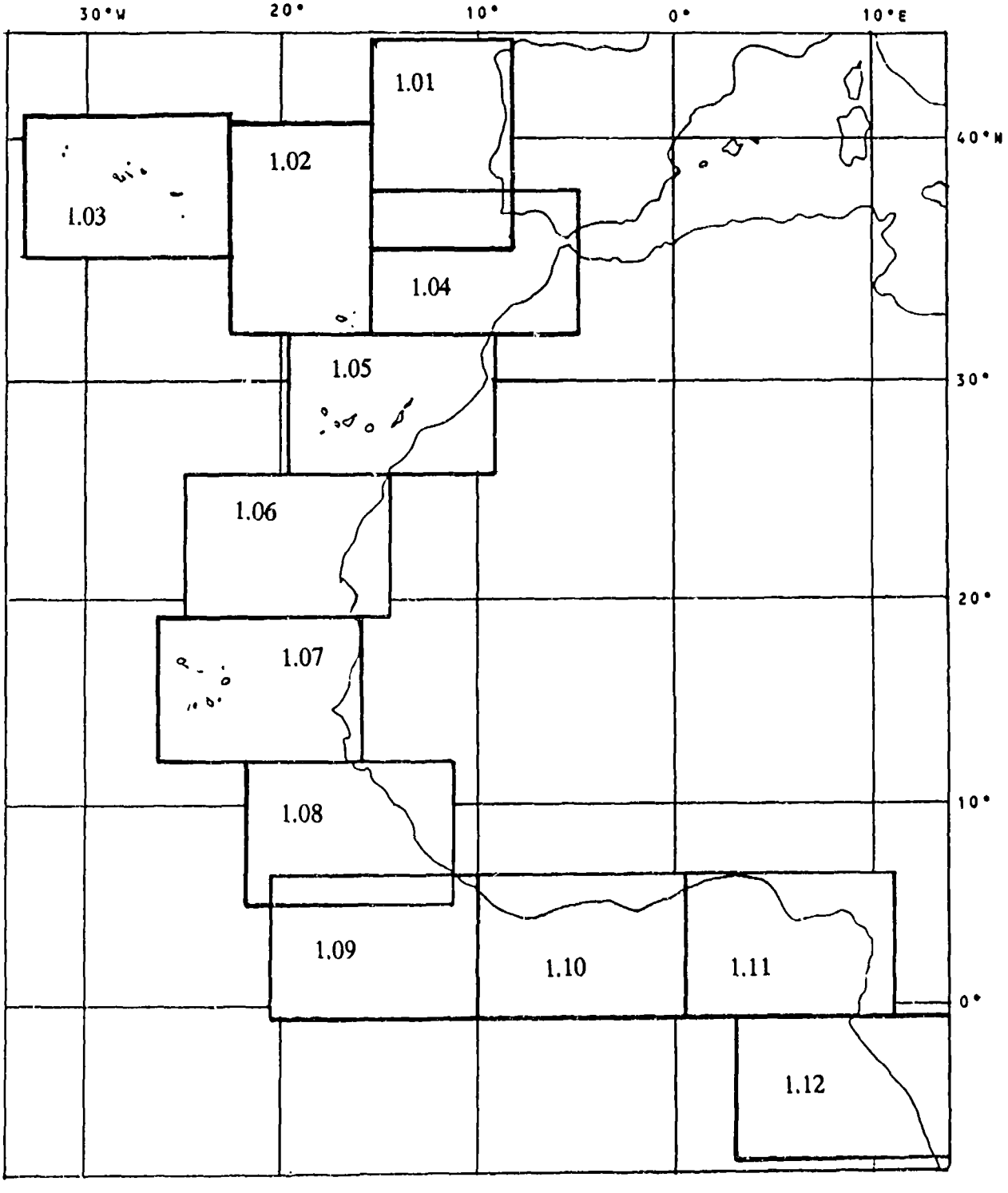
INTERNATIONAL BATHYMETRIC CHART OF THE MEDITERRANEAN
scale 1:1 million at 38°N



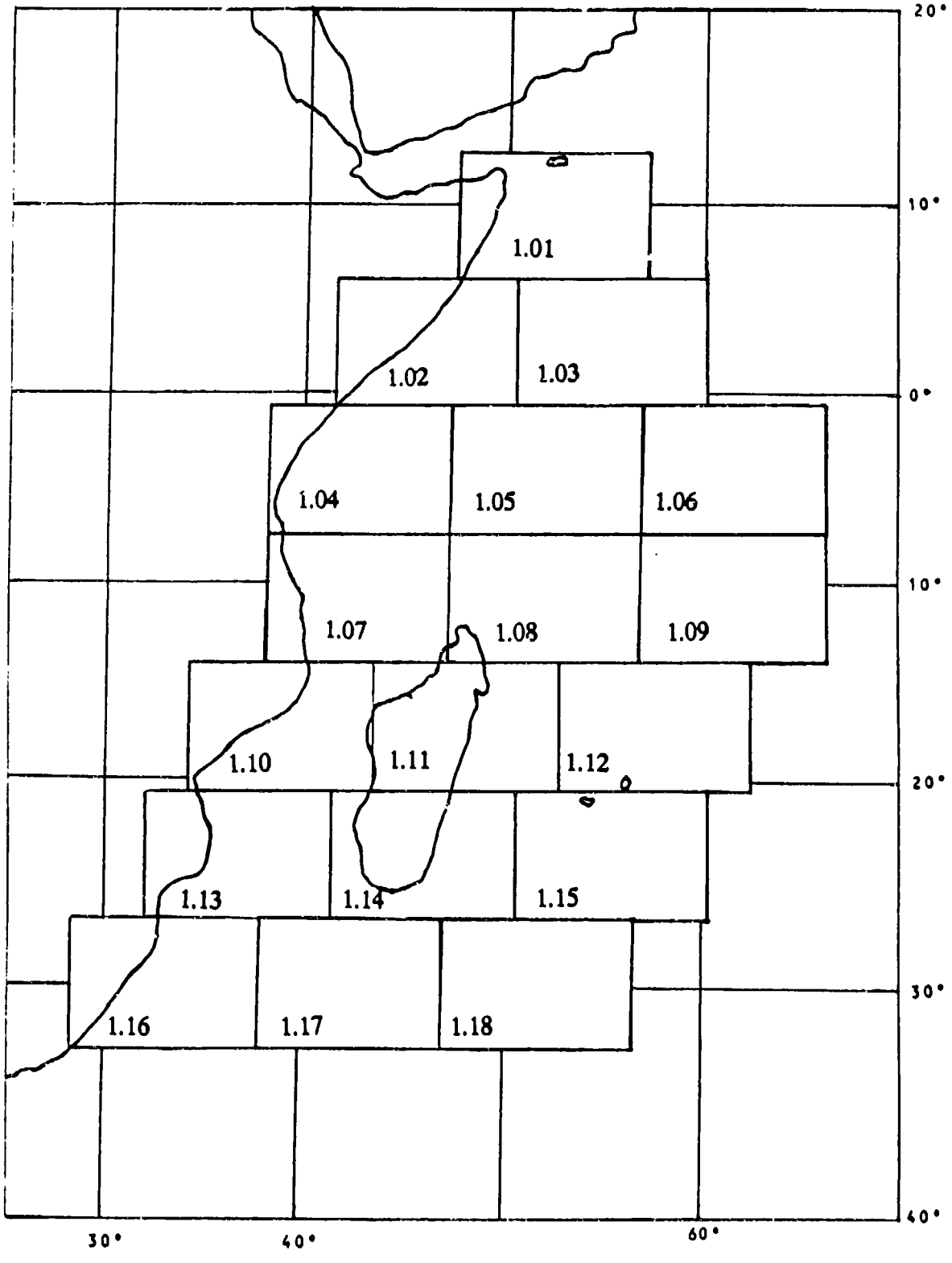
INTERNATIONAL BATHYMETRIC CHART OF THE CARIBBEAN SEA AND THE GULF OF MEXICO
scale 1:1 million at 15° N



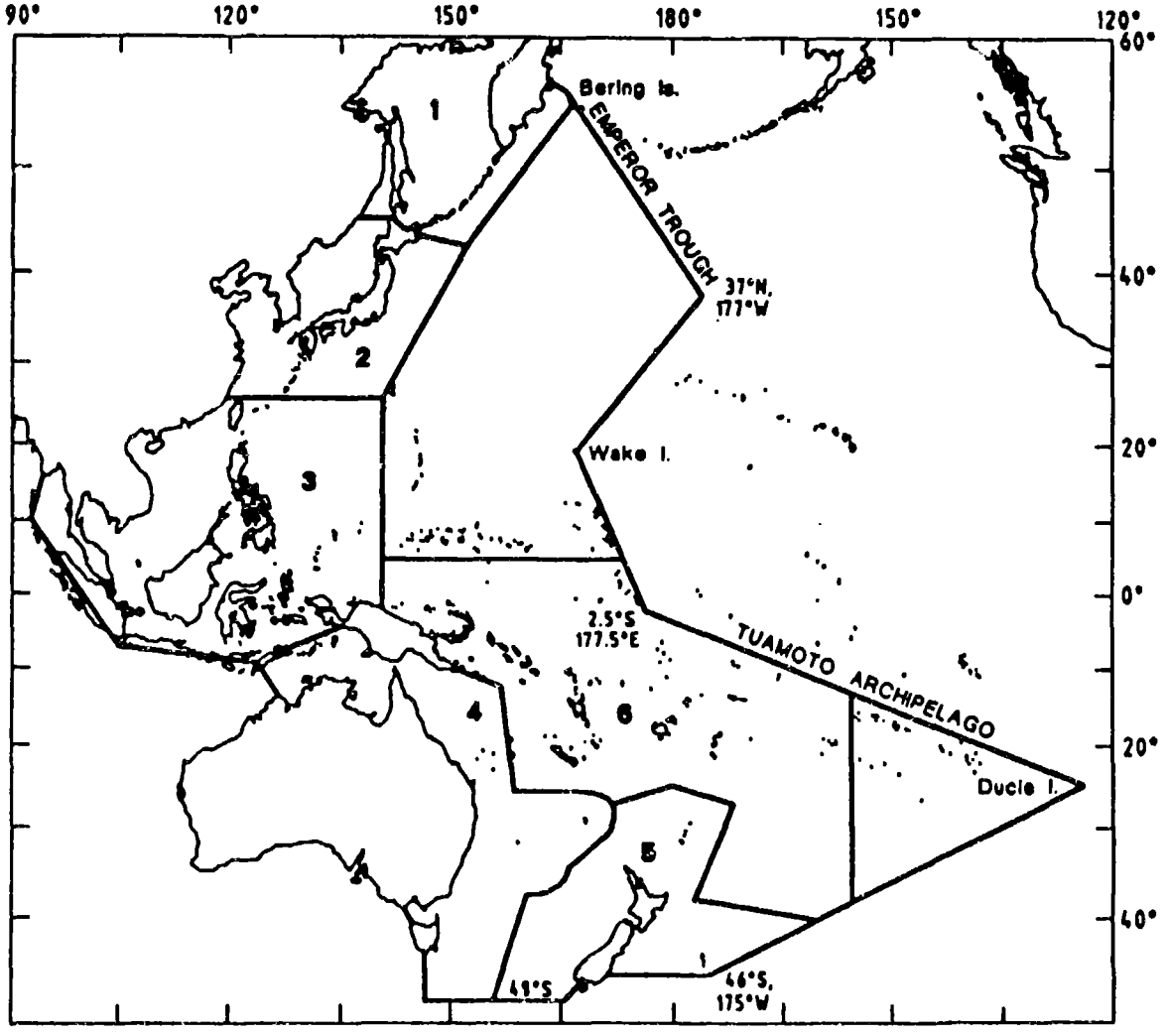
INTERNATIONAL BATHYMETRIC CHART OF THE CENTRAL EASTERN ATLANTIC
scale 1:1 million at 20°N



INTERNATIONAL BATHYMETRIC CHART OF THE WESTERN INDIAN OCEAN
scale 1:1 million at 0°



APPROXIMATE LIMITS OF PROPOSED SUBREGIONS
COVERING THE WESTERN PART OF THE WESTPAC AREA



Subregions

1 - Sea of Okhotsk and S.E.Kamchatka
2 - Japan Sea and waters surrounding Japan
3 - The Central Western Pacific
4 - The Australian northern and eastern margin
5 - Waters surrounding New Zealand
6 - SOPAC area

ANNEX IV

LIST OF IOC OCEAN MAPPING PRODUCTS

1. THE GENERAL BATHYMETRIC CHART OF THE OCEANS (GEBCO)
[Jointly sponsored with the International Hydrographic Organization]
(see Assembly Diagram Annex III, page 1)

Flat sheets:

- 16 sheets 72°N to 72°S, Mercator projection
Scale 1:10M at the equator;
- 2 polar sheets to 65° lat. Polar Stereographic projection
Scale 1:6M at 75° latitude;
- 1 world sheet, 72°N to 72°S, Mercator projection
Scale 1:35M at the equator and 2 polar insets (as above) Scale 1:25M at 75° latitude.
- Revised Sheet 5.12 (South Atlantic) - in press.
- Supporting Volume.

Boxed Set containing all above 19 sheets (folded)
Supporting Volume and legend.

GEBCO Digital Atlas (GDA) Digitized contours on magnetic tape in GF-3 international format, with necessary documentation, and the digitized Gazetteer of Geographical Names (see below):

- Global data set;
- Also available on a sheet-by-sheet or regional basis.

Gazetteer of Geographical Names of Undersea Features shown (or which might be added) on the GEBCO and on the IHO small-scale International Chart series (1:2,250,000 and smaller)
- IHO/IOC publication BP-0008, 1st Edition, 1988

Guidelines for the GEBCO - IHO/IOC publication BP-0007
The present state of production is as follows:
Part 1 GEBCO Organizational Framework Approved and published September 1991 (in English and French).
Part 2A Bathymetric Data Management - Analogue Data
Approved and published September 1991 (in English and French).
Part 2B Bathymetric Data Management - Digital Data
3rd draft is scheduled to be submitted to GEBCO-XIV in May 1993 for approval with a view to publication shortly thereafter.
Part 3 Digital Bathymetric Data (Single-Beam Echo Sounders)
Approved and published March 1992 in English (French text to follow).
Part 4 Digital Bathymetric Data (MultiBeam Echo Sounders) In preparation; a first draft is scheduled for presentation to GEBCO SCDB-X in April 1993.
Part 5 Underway Geophysics Data Approved and published March 1992 in English (French text to follow).

Catalogue of Bathymetric Plotting Sheets and its Annex
- IHO/IOC publications BP-0002 and BP-0003
BP-0002 4th Edition published March 1991;
BP-0003 6th Edition published May 1991.
Note: BP-0002 contains indexes showing the 1:250,000 plotting sheet coverage of IOC's regional ocean mapping projects.

Standardization of Undersea Feature Names *
- IHO/IOC publication BP-0006

Versions:	English/French	[2nd Edition published 1989]
	English/Russian)	[2nd Edition published 1990]
	English/Spanish)	[1st Edition published 1985, 2nd Edition in press]
	English/Japanese	[1st Edition published 1991]
	English/Chinese	[in preparation]
	English/German	[in preparation]
	English/Portuguese	[in preparation]

* These publications are provided free of charge on request.

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2. THE INTERNATIONAL GEOLOGICAL-GEOPHYSICAL ATLASES

(see Assembly Diagram Annex III, page 2)

The Geological-Geophysical Atlas of the Indian Ocean (published 1975)

The International Geological-Geophysical Atlas of the Atlantic Ocean (published 1991)

The International Geological-Geophysical Atlas of the Pacific Ocean (in preparation).

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

(see Assembly Diagram Annex III, page 3)

Flat sheets:

Bathymetric Chart in 10 sheets Mercator projection
Scale 1:1M (at 38°N.) Black Sea 1:2M.
Bathymetric Chart in 1 sheet Mercator projection
Scale 1:5M (at 38°N.) Black Sea 1:10M.

Digitized contours of the bathymetric chart on magnetic tape in GF-3 international format, with necessary documentation.
This dataset is also forms part of the GEBCO Digital Atlas (see above).

Geological/Geophysical series
(same scales and sheet limits as the bathymetric chart):

Bouguer 2.67 Gravity Anomalies of the Mediterranean Region

Seismicity of the Mediterranean Region

Plio-Quaternary/Messinian Sediments of the Mediterranean Region (in press)

Unconsolidated Sea-bed Surface Sediments of the Mediterranean and Black Seas (in preparation)

Magnetic Anomalies of the Mediterranean Region (in preparation)

List of Geographical Names of Undersea Features shown (or which might be added) on the International Bathymetric Chart of the Mediterranean (IBCM) and on the IHO small-scale international chart series for the Mediterranean [IHO/IOC publication BP-0008 Supplement No.1 (IBCM), 1st Edition, 1990]

IBCM Supporting Volume (being issued chapter by chapter as each of the above chart series is published).

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4. THE INTERNATIONAL BATHYMETRIC CHART OF THE CARIBBEAN SEA AND GULF OF MEXICO (IBCCA)

(see Assembly Diagram Annex III, page 4)

Flat sheets:

Bathymetric Chart Mercator projection Scale 1:1M (at 15°N.)

Sheet 3 In preparation (USA);
4 Compilation complete (USA);
5 In preparation (Mexico);
6 Compilation complete (Mexico);
7 Compilation complete (Cuba);
8 Compilation complete (Cuba);
9 Colour proof approved (USA) - will be published in 1993;
12 In preparation (Costa Rica);
13 In preparation (Costa Rica);
14 In preparation (Venezuela);
15 In preparation (Venezuela).