Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies

IOC-UN (OETB) Guiding Group of Experts on the Programme of Ocean Science in relation to Non-Living Resources (OSNLR)

Second Session

Paris, 26-30 January 1987

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In this Series

Reports of Meetings of Experts and Equivalent Bodies, which was initiated in 1984, the reports of the following meetings have already been issued:

- Third Meeting of the Central Editorial Board for the Geological/ Geophysical Atlases of the Atlantic and Pacific Oceans
- Fourth Meeting of the Central Editorial Board for the Geological/ Geophysical Atlases of the Atlantic and Pacific Oceans
- Fourth Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of «El Niño»
- First Session of the IOC-FAO Guiding Group of Experts on the Programme of Ocean Science in relation to Living Resources
- First Session of the IOC-UN(OETB) Guiding Group of Experts on the Programme of Ocean Science in relation to Non-Living Resources
- First Session of the Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
- First Session of the Joint CCOP (SOPAC)-IOC Working Group on South Pacific Tectonics and Resources
- First Session of the IODE Group of Experts on Marine Information Management
- Tenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies in East Asian Testonics and Resources
- Sixth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
- First Session of the IOC Consultative Group on Ocean Mapping
- Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ships-of-Opportunity Programmes
- Second Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
- Third Session of the Group of Experts on Format Development of the Working Committee on International Oceanographic Data Exchange
- Eleventh Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of South-East Asian Tectonics and Resources
- Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
- Seventh Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
- Second Session of the IOC Group of Experts on Effects of Pollutants
- Primera Reunión del Comité Editorial de la COI para la Carta Batimétrica Internacional del Mar Caribe y Parte del Océano Pacífico frente a Centroamérica
- Third Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
- Twelfth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of South-East Asian Tectonics and Resources
- Second Session of the IODE Group of Experts on Marine Information Management
- First Session of the IOC Group of Experts on Marine Geology and Geophysics in the Western Pacific

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1. OPENING

1 The Chairman of the IOC-UN(OETB)+ Guiding Group of Experts on the Programme of Ocean Science in Relation to Non-Living Resources (OSNLR), Professor Michel Vigneaux, called the Second Session of the Guiding Group of Experts to order at 09.00 on Monday, 26 January 1986, in Unesco Headquarters, Paris, France.

2 On behalf of the two sponsoring organizations, the Secretary of IOC, Dr. Mario Ruivo, welcomed the participants. The Secretary indicated his satisfaction with the progress made by OSNLR during the intersessional period, which was to a great extent due to the work of the Chairman and the Vice-Chairman, Dr. Peter Cook, and to the assistance provided by Dr. Claude Latouche. He recalled that the post of marine geologist in the IOC Secretariat had been placed "in reserve", and this had been a handicap in the development of the OSNLR Programme. Negociations are underway with a view to a secondment of a specialist by a Member State in the near future with a view of alleviating the present situation.

3 The Chairman OSNLR regretted to announce that Dr. H.N. Siddique, one of the most active members of the Guiding Group, had passed away.

2. ADMINISTRATIVE ARRANGEMENTS

2.1 ADOPTION OF THE AGENDA

4 The Guiding Group adopted the Provisional Agenda with minor amendments. The Agenda as approved is attached as Annex I.

2.2 DESIGNATION OF A RAPPORTEUR FOR THE SESSION

5 The Guiding Group designated Dr. Michael Collins as Rapporteur for the Session.

2.3 CONDUCT OF THE SESSION

6 The IOC Assistant Secretary in charge of the Session, Dr. Kazuhiro Kitazawa, informed the participants of the arrangements for the Session and introduced the Working and Information Documents. He also mentioned that Dr. D.E. Hays, Professor I.S. Gramberg, and Professor L. Martins were unable to attend the Session due to unavoidable commitments. The List of Participants is given in Annex III.

+ A List of Acronyms and Abbreviations is provided in Annex IV

3. MAJOR INTERSESSIONAL ACTIVITIES

7 The Chairman introduced this Item based on a distributed document entitled "Interim Progress Report of the Joint IOC-UN(OETB) Programme on Ocean Science in Relation to Non-Living Resources (OSNLR)" (Document: IOC/INF-689). He recalled that intersessional activities were developed on the basis of priorities given at the First Session of the Guiding Group of Experts, as well as recommendations of the IOC Assembly at its Thirteenth Session (Paris, 12-23 March 1985).

8 The Guiding Group, at its First Session, recommended that scientific efforts should concentrate on developing a global programme for non-living resources in the coastal zone. Priority was given to a limited number of resources, notably: (i) placers, sands and gravels, (ii) carbonates, (iii) phosphorites, and (iv) coastal zone as a resource itself. In order to understand better the origin and distribution of these resources, they were considered in the framework of a broadscale scientific sub-programme on Sea-level changes, Environments and Tectonics during the past Million Years (SETMY) where sea-level changes, environments of deposition and tectonics were considered as major processes controlling genesis, distribution and behaviour of non-living resources. To elaborate further the coastal zone component of the Programme, the OSNLR Officers, at an intersessional meeting held in Paris, 20-25 May 1986, prepared a proposal which was circulated to Members of the Guiding Group of Experts as a basis for discussion for this Session (Document: IOC/INF-689).

9 The IOC Assembly, at its Thirteenth Session, instructed the Secretary IOC to ensure effective links between the Guiding Group of Experts on OSNLR and relevant Task Teams and Groups of Experts of IOC regional subsidiary bodies so as to facilitate implementation of regional components of OSNLR. To meet this recommendation, several meetings of experts were held at the regional level (see Item 5). To provide orientation to these regional meetings on the Programme, a document entitled "Proposals concerning informations to be assembled and discussed during meetings of the OSNLR Regional Groups" (Document IOC/INF-666) was prepared by the IOC Secretariat.

10 During the intersessional period, IOC provided study grants to scientists from developing countries through TEMA for OSNLR related activities: one scientist received a study grant to participate in the Ninth International Field Workshop and Symposium of IGCP Project 156 Phosphorites (Caracas, Venezuela, 16-25 March 1986); five participants received support to attend the Ninth International Sedimentological Congress (Canberra, Australia, 20-30 August 1986); and two co-ordinators and one international advisor received support to participate in the SEATAR Transect Co-ordinators Meeting (Singapore, 22-23 August 1986). In the same context, UN(OETB) produced a report entitled "Unconsolidated Mineral Deposits in the Exclusive Economic Zone (West Africa)" (UN Document ST/ESA/130) as a contribution to the Programme.

11 The Vice-Chairman of OSNLR drew attention to the fact that a large number of international, governmental, and non-governmental organizations now develop research programmes related to objectives which are relevant to the aims of the OSNLR Programme. He summarized the possible organizational and communication links between the scientific programmes and organizations concerned. He emphasized that at present, these links are not well established. The OSNLR Programme could, therefore, play a useful co-ordination role in this context. The IOC Secretary explained that IOC plans to organize a consultative meeting of representatives of the different organisms and programmes involved in research relevant to the non-living resources of the oceans.

4. FORMULATION OF THE SCIENTIFIC RESEARCH PROJECTS UNDER THE PROGRAMME

12 At its First Session, the Guiding Group of Experts recognized that any project under OSNLR must have two components: high quality ocean science, and a clear relevance to non-living resources. It also identified a number of resources for consideration by OSNLR which can be conveniently grouped under the heading "shallow water" and "deep ocean". A separate category "hydrocarbons" was also established. It was recommended by the Guiding Group that priority should be given to the shallow water zone, and this was endorsed by the IOC Assembly at its Thirteenth Session. With this in mind, the Guiding Group reconsidered the resources under these three headings, and the ocean science that should be pursued under OSNLR.

4.1 SHALLOW WATER SUB-PROGRAMME

4.1.1 Resources

13 In order to develop better the scientific framework, the Guiding Group first reviewed the range of important shallow water non-living resources and the controls on their formation and distribution. Sand and gravel is an important resource of the shallow water zone. Some sand deposits have formed (and continue to form) in response to the dynamic conditions that currently prevail on the shelf. Deposits of sand and most offshore gravel deposits are a reflection of the conditions that prevailed during a different dynamic environment, usually during a low-stand of sea-level. Carbonate resources are formed in response not only to present and past dynamic conditions, but also to the prevailing biological environment, for almost all carbonate deposits are biochemical deposits, whether reefs or shallow coastal accumulations. Placers, rich in such minerals as ilmenite, rutile, zircon, gold or diamonds, are found in a number of present day beaches and fluvial channels. Many such deposits have now been mined out and increasingly attention is being directed at deposits associated with old sea-level stands or in buried fluvial channels. The

depth or elevation of these deposits is dependent not only on the eustatic rise and fall of sea-level, but also on the extent to which there has been uplift or subsidence due to tectonism. Phosphorites (phosphatic sediments) are a major resource of many continental margins, extending from the nearshore to the upper slope. Their genesis is complex and by no means fully understood, but like other shallow water resource deposits, they form in response to changes in the environment, and sea-level rise and fall, whether as a result of global (eustatic) changes or relative change due to tectonism. The coastal zone as a resource (CZAR), in its own right, is one of the most important resources. Most of the world's population lives in coastal zones; much of its food is obtained from it. It is a recreational environment; it is also a region of great economic significance because of the harbours that lay within it. The coastal zone is extremely sensitive to change, whether natural or man-induced. A rise of sea level will produce erosion; the damming of rivers may reduce the amount of sediment available for shoreline replenishment and similarly result in erosion. Coastal aquifer systems can be affected by rising sea-level. Conversely, over-exploitation of aquifers can result in coastal subsidence and salinization of aquifer systems. The dredging of harbours, the extraction of beach sands, the draining of swamps, can all affect the physical environment of the coastal zone. The rise of sea-level due to the "greenhouse effect" may be a cause of particular concern in many coastal areas in the future.

4.1.2 Research

14 At its First Session in 1985, the Guiding Group proposed a research programme with the acronym SETMY (Sea-level changes, Environments and Tectonic during the past Million Years). To elaborate on the scientific content of SETMY and to formulate an action plan for its implementation, the Guiding Group decided to examine first of all proposals for inclusion in this proposed project (SETMY) and the breadth of related regional components (see Item 5).

15 To assist in the identification of the general components of SETMY, the Guiding Group considered a report entitled "Survey of Foreign Offshore Development Activities for Minerals other than Oil and Gas" (Canada Oil and Gas Lands Administration, Energy Mines and Resources (Canada), September 1986), which was introduced by Dr. David Pasho.

16 The Guiding Group agreed that the following elements could be taken into account for shallow-water research: (i) measures to meet the need for collection and exchange of fundamental scientific information which would be beneficial, in the long-term, for mapping, sediment sampling, study of coastal processes and palaeo-oceanography; (ii) efforts to focus upon 16 000 to 18 000 BP (before present) sea-level stands to delineate areas of potentially exploitable superficial material of the last cycle on the continental shelves: (iii) consideration to be given to compilation of coral reef information on a world-wide basis (environment of formation, carbonate production rate and effect of sea-level changes), and inclusion of groundwater resources as a component of the coastal zone studied.

17 The Guiding Group reconfirmed that the concept of the upper continental margin includes the littoral (inter-tidal) zone, the shelf, and the upper slope, since the sedimentation in these areas are genetically linked.

18 The sediments of the littoral zone and shelf, as well as the coastal zone itself, including groundwater as one of its components, constitute the major resources of the continental margins. The distribution of the sedimentary resources (i.e. sands, gravels, placers, reefs, phosphorites, and the coastal zone itself), are directly influenced by eustatic (global) sea-level changes, as well as local and regional tectonics, and changes in the depositional environment.

19 The Guiding Group recognized that a wide diversity exists in respect of needs, capabilities, and opportunities for resource development by various Member States. Thus any research programme must be structured so as to establish a broad scientific reference within which the coastal States concerned can assign their marine non-living resource issues the priorities they consider relevant to their national and regional needs.

20 For many areas, an important prerequisite for meaningful assessment of resource potential is the detailed geological surveying of the coastal zones. Such surveys should include accurate bathymetric mapping of the superficial bottom sediments, and some understanding of the shallow structure of the region. Bathymetric data, while forming the basis of sea-floor maps of the region, can be combined with historical data including older maps and charts. If borehole data are available, these should be combined with the sediment information. Aerial photographic and satellite imagery can also assist in the assessment of coastal erosion and the identification of sediment-transport pathways.

21 Besides the preparation of regional sea-floor maps, there is a need to compile regional bibliographies on OSNLR research results; these could include references to geology, coastal morphology, mineral potential, and hydrography of the shelf and nearshore regions.

22 In this respect, the Guiding Group requested that IOC assist in the preparation of such sea-floor maps and bibliographies on OSNLR in a standarized format.

23 Bearing in mind all of these factors, the Guiding Group concluded that in order to provide a satisfactory framework for the conduct of science of direct relevance to shallow-water non-living resources, it was necessary to modify the existing SETMY framework and also to establish a second global project on shelf and upper slope.

24 Specifically, the Guiding Group recommended that the title of the current global sub-programme on Sea-level changes, Environments, and Tectonics during the past Million Years (SETMY), be modified to Sedimentary Environments, Eustatic Changes, Tectonics and Resources (SETR), so as to better reflect its content. Components of SETR would include:

(i) Study of natural and human effects on the coastal zone, including global sea-level rise, regional subsidence, extraction of ground water and hydrocarbons, and river-estuarine-coastal dynamics and interactions;

(ii) Mapping of the distribution and composition of superficial shelf sediments; the strand-lines of the last low (18 000 BP) and high (125 000 BP) still-stands should be delineated world-wide.

25 The Guiding Group also recommended a second global sub-programme on Shelf and Upper Slope Dynamics (SUSD). This is a natural extension of studies in the coastal zone. The understanding of near-shore processes, including channel behaviour, sediment transport, slumping of mass-wasting along the slope, is obviously important to such engineering issues as the laying of undersea cables, locating rigs, and the construction of harbours.

26 The mechanical and sedimentary processes active on the shelf and slope can have important implications for engineering and resource development in these areas. The understanding of the dynamics of these processes is therefore of considerable importance.

27 Outlines for project proposals regarding shallow water are listed in Annex IV.

4.2 DEEP OCEAN SUB-PROGRAMME

4.2.1 Resources

28 In recent years, considerable attention has been focussed on the potential for finding mineral resources on the sea floor. Although the original focus was on deep-sea polymetallic nodules, recent discoveries of massive sulphides and cobalt-rich manganese crusts have stimulated interest in other oceanic environments. There are in addition phosphatic crusts on many open ocean plateaux and seamounts. Whilst there is little prospect of these being mined for phosphates in the foreseeable future, they do constitute a significant resource. The deep ocean also has a resource significance because it provides present day analogs for many onshore sulfide deposits, and also for some onshore hydrocarbon occurrences such as those in deep sea form.

4.2.2 Research

29 It was recalled that the deep ocean had not been considered as a prime research topic at the First Session of the Guiding Group of Experts, mainly because investigations of the deep ocean require large vessels and expensive research equipment. Nevertheless, the Guiding Group had considered that this environment should not be ignored and recommended an increase in the number of opportunities for scientists from developing countries to participate and receive training in deep-sea research. Contacts between IOC and JOIDES indicate the possibilities for such participation in the Ocean Drilling Programme (ODP) which offers some of the most advanced technology available at present for exploring the sea floor (see Item 6.2).

30 Obtaining a general understanding of the deep-sea environment as specific topics such as hydrothermal processes and the search for conditions of formation of hydrocarbon source rocks are sufficiently important reasons for incorporating deep-sea research objectives in the framework of the OSNLR Programme. The ODP could offer opportunities to develop such research. Nevertheless, for researchers from developing countries, certain problems arise. Deep ocean research requires facilities both on-board and on-shore that are generally available only in a limited number of countries and institutes.

31 Possibilities of funding deep ocean research through TEMA were discussed. The Technical Secretary explained that IOC's Regular Programme Budget or Funds-in-Trust contributions by Member States can eventually assist in corporating participation in on-board training on various research vessels. On the other hand, they are not sufficient to support laboratory expenses carrying out research. Special co-operation from developed countries would be necessary to offer these facilities and cover such costs. To attain this objective, it is desirable that economically relevant and attractive scientific programmes be proposed.

32 The Guiding Group noted that the modern deep-sea environment is a key to the interpretation of many ancient deposits, which are now found in continental areas, and that interesting project proposals could be developed on topics such as tectonic studies in the deep-sea, deep-sea fans, and morphological analysis of the deep-sea floor.

33 In the light of the foregoing discussion and the interest expressed in deep-sea research by various IOC subsidiary bodies, the Guiding Group proposed a Deep Ocean Sub-Programme that could include components such as: (i) The study of the distribution and composition of cobalt-rich ferromanganiferous crust and hydrothermal sulphides; and (ii) The study of tectonic and magmatic processes of divergent and convergent plate margins, to provide the geological and geophysical framework for resource exploitation. Details of relevant proposals are given in Annex IV.

34 The Guiding Group noted that collaborative studies of marginal deep-water sedimentary sequences in conjunction with the Ocean Drilling Programme could be highly relevant to these topics.

4.3 HYDROCARBONS

35 At its First Session, the Guiding Group recognized that hydrocarbons are one of the most important non-living resources, onshore and offshore, but it did not discuss in any detail the ways to enhance exploration for hydrocarbons. These issues were deemed to be dealt with better by the exploration industry rather than national, regional or international bodies such as IOC or its technical subsidiary bodies. However, the scientific issues in the development of other continental margin resources, such as those mentioned above, are relevant to petroleum exploration.

36 Hydrocarbons are generally found in sedimentary basins containing suitable thicknesses of sediment that have been subjected to geothermal conditions appropriate to the generation, accumulation and preservation of oil and gas. To determine the suitability of these geological settings for hydrocarbon occurrence, detailed studies of the history and facies development of the basins is required. Such basins are unlikely to occur in the deep ocean, but may be found in waters of intermediate depth at the ocean margins. Exploratory work aimed at delineating the extent of thick sedimentary sequences and their facies in the marginal ocean have already begun, especially in the Western Pacific.

37 The Guiding Group agreed to look in greater detail at the potential role that OSNLR might play in research related to hydrocarbons.

38 The Guiding Group noted that collaborative studies of marginal deep-water sedimentary sequences in conjunction with the Ocean Drilling Programme could be highly relevant to this topic.

5. REGIONAL COMPONENTS OF THE PROGRAMME

5.1 CARIBBEAN AND ADJACENT REGIONS (IOCARIBE)

39 The IOC Senior Assistant Secretary for IOCARIBE, Dr. Fernando L.E. Robles, introduced this item. He focussed on the project proposals and recommendations arising from an IOCARIBE Mini-symposium on the Regional Development of the OSNLR Programme which was convened in Havana, Cuba, 4-7 December 1986, immediately prior to the Second Session of the IOC Sub-Commission for IOCARIBE (Havana, Cuba, 8-13 December 1986). Details are given in IOC Workshop Report No. 48.

40 The Mini-symposium considered projects on the coastal zone and on deep-sea environments and palaeogeographic studies:

(i) The Coastal Zone

41 The Mini-symposium recommended that processes related to beach dynamics and monitoring be given high priority, in view of the importance of the subject to many Member States of IOCARIBE. The Mini-symposium proposed three regional projects for coastal zone studies:

Project No. 1: Cartography of Surface Deposits including Collection and Analysis of Samples

Project No. 2: Preparation of Geomorphological Charts

Project No. 3: Beach Dynamics and Monitoring.

The Second Session of the Sub-Commission for IOCARIBE approved a recommendation to co-ordinate the proposed Project No. 3 (Beach Dynamics and Monitoring) with relevant activities of the COMAR/ COSALC Project executed by the Division of Marine Sciences of Unesco.

(ii) Deep Environments and Palaeogeographic Studies

42 The Mini-symposium put forward two project proposals of regional scope:

Project No. 1: Quaternary Palaeo-Oceanographic Studies

Project No. 2: Geotectonics, Morphostructural and Geodynamic Studies of Deep Sea Trenches

Details of the above five regional projects are provided in Annex V.

43 To facilitate development of the above-mentioned projects, the Mini-symposium recommended (and the Sub-Commission endorsed) the creation of a regional group of experts. The Regional Group of Experts will provide technical assistance in OSNLR problems, at the request of IOCARIBE Member States.

44 The Guiding Group emphasized the similarity of problems being faced in IOCARIBE (through the project proposals considered) with those observed in other oceanic regions, such as the western Pacific (WESTPAC), particularly regarding the coastal zone.

45 The Guiding Group expressed its satisfaction with the steps undertaken in the IOCARIBE region to co-ordinate efforts between OSNLR components and those of the COMAR/COSALC Regional Project executed by the Division of Marine Sciences of Unesco and hoped that the same type of cooperation could be established in other regions.

5.2 WESTERN PACIFIC (WESTPAC)

46 In this region, the IOC Group of Experts on Marine Geology and Geophysics in the Western Pacific, the Joint CCOP-IOC Working Group on Post-IDOE Studies of East Asia Tectonics and Resources (SEATAR), and the Joint CCOP(SOPAC)-IOC Working Group on South Pacific Tectonics and Resources (STAR), are currently involved in activities relevant to OSNLR.

47 The First Session of the IOC Group of Experts on Marine Geology and Geophysics in the Western Pacific (WESTPAC) was held in Townsville (Australia) from 4 to 6 December 1986 (Document: IOC/GEMGGWP-I/3). The Chairman of the Group of Experts, Dr. Hideo Kagami, informed the Guiding Group that the WESTPAC Group of Experts had felt it necessary to update the concept on margins of active plates (MAP) originally proposed

in 1983. Within the context of plate boundary research, the northern mountain system of Papua-New Guinea is regarded widely as being one of the largest collision zones in the world, occuring between the Australian passive margin and several island arcs. Seismic data show that convergence is continuing. Though possessing many of the aspects of a "thin-skinned" thrust belt, seismic evidence suggests significant basement involvement in the thrusting. In addition, strike-slip motion is also important between the Pacific and Indian Ocean Plate.

48 The WESTPAC Group of Experts proposed the following regional projects (descriptions are given in Annex V):

Project No. 1: Origin and Evolution of Microplates

Project No. 2: Back-arc Tectonics

Project No. 3: Collision Tectonics

49 The WESTPAC Group of Experts considered that the concept on Sea-level, Environments and Tectonics (SET) proposed in 1983 was sufficiently comprehensive to stimulate on-going research, such as sea-level changes in relation to the nature of elastic lithosphere and dendro-chronology of the coral reef. Two projects were considered relevant to SET:

Project No. 1: Sedimentary Evolution on Active Margins

Project No. 2: Cenozoic Reef Evolution in Space and Time

50 Concerning SEATAR, the Vice-Chairman of OSNLR informed the Guiding Group of current progress on SEATAR Transect Studies which are nearing completion. Some research results were displayed at the poster session at the Circum-Pacific Conference held in Singapore in August 1986 (Document CCOP-IOC/SEATAR-XII/3). He also informed the Guiding Group that CCOP and IOC Member States want a continuation of SEATAR activities after completion of the present Transect Studies, but they do not yet have any specific ideas, and look to the Joint Working Group on SEATAR for suggestions and recommendations.

51 The activities of the Joint CCOP(SOPAC)-IOC Working Group on STAR was introduced by its Chairman, Dr. Charles Helsley. The main purpose of the Joint Working Group is to formulate and assist in the implementation of scientific technical research programmes in the South Pacific under the general guidance of IOC, but addressing the needs of the Region. Activities are mostly carried out through study groups (see Document CCOP-IOC/STAR-III/3). The Ocean Drilling Study Group reviewed planned ODP drilling sites in the South Pacific and concluded that a greater focus of the world scientific community on the south-west Pacific is needed. The Age Dating Study Group is nearing the completion of its task with more than 500 age data of islands and sea-mounts in the central Pacific. The Tectonic Study Group summarized the progress of 13 research cruises that have taken place in the last year or so, and noted several research projects recommended at previous STAR sessions had started

implementation. The Information Exchange Study Group maintained updated information on cruises with their preliminary results. The Island Drilling Group received ideas and proposals for 14 drilling sites, with the conclusion that there is sufficient interest in the Island Drilling Project to justify its continual inclusion in future work programmes. A workshop on Coastal Processes and Non-Living Resources is planned in autumn 1987 by the Coastal and Nearshore Processes and Resources Study Group. The Joint Working Group on STAR stressed the importance of organizing this Workshop as a means of providing scientific and technical information and background to SOPAC Member Countries currently facing serious problems dealing with coastal protection. The Remote Sensing Study Group proposed pilot projects in four areas in the region for demonstration. Following the Workshop on the Use of Submersibles and Remotely Operated Vehicles in the South Pacific, Suva (Fiji), 24-29 September 1985 (Document: IOC Workshop Report No. 39), the Study Group on the Use of Submersibles and Remotely Operated Vehicles was formulated, and the Study Group received several proposals as diving sites.

52 The Guiding Group of Experts noted with satisfaction that current activities carried out by the Joint Working Groups on SEATAR and STAR, and welcomed the initiatives taken by the WESTPAC Group of Experts on Marine Geology and Geophysics.

53 The Guiding Group recommended that IOC assist SEATAR in bringing its current programme to a successful conclusion and then consider developing two sub-regional components of OSNLR, one addressing problems related to marginal basins near the Asian continent, the other addressing problems in the region now covered by STAR.

5.3 SOUTH-WEST ATLANTIC

54 Since Professor Luis Martins, a Member of the Guiding Group working in the region, was unable to attend the Session, the IOC Consultant, Dr. Claude Latouche, presented this Item.

55 In the south-west Atlantic region, an Expert Meeting on the Development of the Programme on Ocean Science in Relation to Non-Living Resources (OSNLR) was held in Porto Alegre, Brazil (7-11 April 1986). The report of this meeting will be published as IOC Workshop Report No. 46. This meeting followed a preparatory one, held in Buenos Aires, Argentina, 25-29 November 1985 (Document: IOC/OSNLR ad hoc-SWATL-I/3). The Porto Alegre meeting was attended by 14 experts from three IOC Member States (Argentina, Brazil and Uruguay) and from two international organizations (IOC,ECOR). The detailed proposals based upon the Porto Alegre meeting are given in Annex V.

56 On the basis of the priorities discussed at the ad hoc meeting in Buenos Aires and from the research proposals formulated by the participants, the Expert Meeting proposed the following two major

cooperative regional research projects for submission to the Second Session of the Guiding Group of Experts on OSNLR;

Project No. 1; Environment and Dynamics of Models of Typical Coastal Systems in the South-west Atlantic.

Project No. 2; Geology and Recent Palaeogeographic Evolution of the Coastal Zone and Continental Shelf off Eastern South America between 30° and 40° S.

57 To facilitate the implementation of these projects and to enhance the co-operation between scientists of the region, the Expert Meeting proposed to develop technical co-operation (using techniques such as remote sensing, ^{14}C data, etc.) and to encourage presentation of co-operative scientific contributions in international journals. The expert Meeting also proposed to enhance co-operation with other international programmes, particularly with IGCP (Projects 156 and 200, in particular).

58 The Expert Meeting considered the organization of the following activities as being important to the implementation of OSNLR in the region: A Workshop on the Regional Implementation of OSNLR (possibly to be held in July 1987 in Montevideo); a Symposium on the Regional Implementation of OSNLR and Related Programmes (tentatively to be held in September 1988, in Mar del Plata or Niteroi); a Training Course on Phosphorites and Offshore Mineral Exploration with the joint co-sponsorship of IOC and IGCP (1988 or 1989, see Item 6.1).

59 The Expert Meeting also made recommendations concerning the assistance that IOC could provide for the implementation of the programme through: co-operation with international programmes and organizations relevant to the regional development of OSNLR (e.g. ODP, WHO); improvement of the scientific and technical potentialities in the region (human resources, assistance for the development of a regional data centre); and, implementation and standardization of ocean mapping at the regional level.

60 The Guiding Group noted with satisfaction the progress made in implementing OSNLR components in the south-west Atlantic region and emphasized their relevance to achieving overall objectives of OSNLR, particularly regarding components of CZAR and SUSD.

61 The Guiding Group restated the desirability of co-ordinating on-going regional COMAR/COSALC research and training activities with those of the OSNLR regional components.

5.4 CENTRAL EASTERN ATLANTIC (IOCEA)

62 Proposals relevant to OSNLR submitted to the First Session of the IOC Regional Committee for the Central Eastern Atlantic (IOCEA) (Praia, Cape Verde, 19-24 January 1987) were introduced by Dr. Michael Collins.

Documents from UNEP, UNESCO, UN(DIESA) and OAU were used in the preparation of the proposals. These documents emphasize that, for the West Africa region, there is an extensive quantity of scientific information on coastal erosion and mineral distribution in the EEZ. These proposals for OSNLR regional components in the central eastern Atlantic are based upon two kinds of problems:

(i) The development of the scientific basis for coastal management and protection from coastal erosion and/or siltation. This problem concerns more particularly States that have a narrow continental shelf and high energy waves with coastal currents; these forces induce active erosion of the littoral zone.

(ii) Economic deposits (sands and gravels, placers, carbonates, phosphorites). This problem concerns more particularly coastal States with a wide and sandy shelf and/or with coastal upwelling systems.

63 On the basis of these considerations, the Regional Committee for the Central Eastern Atlantic adopted the following pilot research projects (details are given in Annex V):

Project No. 1: Coastal Erosion of the Bight of Benin

Project No. 2: The Effect of Damming Rivers on the Supply of Sediment to the Coastal Zone.

Project No. 3: Relationship Between Upwelling and Phosphorite Deposits.

64 The Guiding Group noted the high relevance of the project proposals to the OSNLR Programme, particularly in regards to the coastal zone.

65 The Guiding Group being aware that there is a lack of basic equipment in this region for the development of scientific research, recommended that IOC regional subsidiary bodies, through regional groups of experts, identify organizations that would be willing to become the host for regional equipment pool(s) and other appropriate regional facilities required for the effective implementation of OSNLR components; and that IOC assist in providing funds from extra-budgetary sources or mobilize support from IOC/VCP for the basic equipping of these regional facilities in the framework of TEMA.

5.5 INDIAN OCEAN

66 Dr. Bilal Haq outlined the deliberations and recommendations related to OSNLR of the Workshop on Regional Co-operation in Marine Science in the Central Indian Ocean and Adjacent Seas and Gulfs, held under the auspices of IOC and Unesco in Colombo, Sri Lanka, 15-20 July 1985 (Document: IOC Workshop Report No. 35). The Workshop strongly endorsed the research programme suggested by the Guiding Group of Experts on OSNLR at its First Session, and in particular the various aspects of the SETMY Programme, which were considered to be highly relevant to coastal countries around the central Indian Ocean. The Workshop recommended

several projects on the coastal zone of special importance to these countries. Highest priority was assigned to the geological assessment of the continental margins to determine their economic potential and to enhance understanding of coastal erosion and accretional reef growth and destruction. In view of the enormous life and property values at stake, high priority was also assigned to the study of coastal dynamics such as effects of waves, tides and storm-surges. The study of the effects of damming rivers was also strongly recommended. The Indus River in Pakistan and the Mahaweli River in Sri Lanka, which have been recently dammed, were identified as two possible objects of study that could provide models for similar river studies elsewhere.

67 The Workshop also endorsed the ongoing deep-sea projects, especially the Ocean Drilling Programme (ODP). Recognizing the great expense of deep-sea work, the Workshop recommended that IOC foster collaboration between Member States of the region in this field. IOC's role was also seen as important in facilitating the participation of ocean scientists from the Indian Ocean region in the ODP, in particular in the drilling cruises planned for the Indian Ocean in 1987.

68 The Technical Secretary announced that an IOC Training Course on Marine Geology and Geophysics on-board a research vessel and at an onshore laboratory was planned to be held in Sri Lanka in 1986 with the financial assistance of the Government of the Federal Republic of Germany. However, it has been postponed at the request of the host institute. A training course on bathymetric mapping utilizing a research vessel is planned for 1987 in the western Indian Ocean.

5.6 OTHER REGIONS

69 After the review of current regional activities related to the OSNLR Programme undertaken by IOC subsidiary bodies, the Guiding Group noted that development of the Programme on the regional level has been satisfactorily undertaken. However, it recognized the need to create a regional component of OSNLR in the Eastern Pacific (Mexico to Chile) in consultation with CPPS. The Eastern Pacific is a region with unique common geological/geophysical features (ocean-continent subduction margin, sites of volcanism and strong earthquakes, mountainous coastlines, high rate of sediment supply to the coastlines, narrow continental shelves with steep continental slopes, modern phosphorite formation) which will require adequate scientific examination for eventual development of its coastal ocean resources.

70 The Guiding Group recommended that the IOC regional subsidiary bodies consider the formation, if appropriate, of regional networks of institutions /experts selected from Groups of Experts or Task Teams as the case may be to promote regional components of OSNLR, taking into account regional geological settings, and that arrangements be made for Members of the Guiding Group of Experts to provide advice to them when required.

71 To facilitate development of the OSNLR Programme, the Guiding Group recommended that the IOC and UN(OETB) assist the networks and the related regional Groups of Experts or Task Teams established under IOC regional subsidiary bodies to:

(i) Collect, synthesize and make available maps and bibliographies that can be used as a basis for resource assessment and for identifying and planning relevant scientific programmes;

(ii) Explore means of exchanging information on relevant regional scientific research activities and on selected related technical and economic developments;

(iii) Review the need to establish or strengthen regional data management systems through the IODE System or other appropriate systems with a view of promoting required services for adequate implementation of OSNLR;

(iv) Review training requirements and the availability of programmes in light of the regional situation and requirements with a view of promoting training in support of OSNLR components;

(v) Explore means of obtaining the required training.

72 The Guiding Group also recommended that the regional subsidiary bodies of IOC, through regional networks, Groups of Experts, or Task Teams, as the case may be, with the assistance of IOC and UN(OETB):

(vi) Review the scientific Sub-programes of OSNLR;

(vii) Identify regional components that are relevant to their respective regions;

(viii) Advise on and promote the means of implementing these components.

6. COOPERATION WITH RELATED PROGRAMMES AND ORGANIZATIONS

6.1 INTERNATIONAL GEOLOGICAL CORRELATION PROGRAMME (IGCP)

73 The Vice-Chairman of the Guiding Group introduced this item. The IGCP is a joint venture between the International Union of Geological Sciences (IUGS), a non-governmental scientific organization, and Unesco, to encourage and facilitate all types of geological research. The IGCP is interdisciplinary, concerned not only with geology, but also with geophysics and geochemistry and disciplines related to the geological sciences such as biology, meteorology, oceanography and hydrology. Limited funds are available for IGCP Project Leaders to assist with the organization of international meetings to run research projects, but IGCP does not provide funds in support of primary research, publication of results, or

other research related activities. A meeting between OSNLR Officers, IOC Secretariat, and IGCP Secretariat on the co-operative actions between IOC and IGCP, particularly regarding IGCP Project 156 (Phosphorites) and Project 200 (Sea-level Changes), was held during the intersessional period. IOC supported the attendance of one participant to the "Ninth International Field Workshop and Symposium of IGCP-156 Phosphorites" (Caracas, Venezuela, 16-25 March 1986).

74 A Joint IOC/IGCP Workshop on Phosphorite and Offshore Minerals is scheduled to be held in Porto Alegre, Brazil, in 1988 or 1989 (see Item 5.3).

75 The Guiding Group recommended that co-operation with the International Geological Correlation Programme (IGCP) be further developed, especially through IGCP Projects 156 (Phosphorites) and 200 (Sea-level Changes), and that Officers of the Guiding Group and the Secretary IOC approach the Chairman of IGCP and the leaders of these projects to enhance this co-operation.

6.2 OCEAN DRILLING PROGRAMME (ODP)

76 Dr. Charles Helsley summarized the history, membership, and general objectives of ODP. The Ocean Drilling Programme (ODP) is an international partnership of scientists and governments that have joined together to explore the structure and history of the earth beneath the ocean basins. ODP brings scientists from all over the world to participate in a series of scientific cruises to retrieve core samples from the ocean floor. These cores help scientists to understand better the age of ocean basins and their development, the rearrangement of continents, the structure of the earth's crust, the evolution of life in the oceans, and the history of world-wide climatic changes.

77 The Ocean Drilling Programme is funded by the United States of America through the National Science Foundation and by co-operating governments. The Joint Oceanographic Institution, Inc. (JOI), which is a non-profit consortium of ten major oceanographic institutions of the United States, serves as manager of the Programme. The Joint Oceanographic Institution for Deep Earth Sampling (JOIDES), constituted by ten U.S. oceanographic institutions and representative institutions of ODP Member Countries, provides overall planning and advice on the Programme. The ODP Planning Committee has agreed in principle to make a limited number of berths aboard the drilling ship available to participants from developing countries. Details of selection and funding of these participants remain to be worked out between IOC and the ODP management. Identification of drilling targets depends upon a strong advocacy by scientists and it is likely that the objectives of OSNLR can only be incorporated in the ODP on the basis of strong scientific need and support.

78 Subsequent discussion of the Guiding Group focussed upon identifying the best ways that IOC can assist in implementing participation in the ODP. It is a common ODP procedure that scientists participating in

cruises also co-operate during the post-cruise phase in preparing the publication of the results. This requires shore-based research in qualified, high standard laboratories that exist only in limited countries. Even if IOC is able to sponsor the participation of scientists in the cruises, this difficulty remains. To meet the rules of participation and especially to ensure the availability of qualified personnel for future deep sea research within the countries concerned, additional financing (e.g. research grants) is needed to enable the cruise participants to pursue the required shore-based studies in adequate laboratories.

79 Since a balance must be achieved between cost of support for the participation in the ODP Programme and support available for other OSNLR programmes, and since the importance of participation may vary from country to country, the Guiding Group recommended that the Secretary IOC carefully consider the emphasis being placed upon participation in the Ocean Drilling Programme, and that the Secretary approach the ODP Planning Committee with a view to facilitating the participation of scientists from developing countries in ODP cruises and in pre- and post- cruise activities.

6.3 OTHER ORGANIZATIONS

80 Dr. Bilal U. Haq informed the Guiding Group that during 1986, the Commission on Marine Geology (CMG) of the International Union of Geological Sciences formed its own Sub-Commission on Non-Living Resources of the Ocean and invited Dr. Bilal U. Haq to chair the Sub-Commission. The role of the Sub-Commission is an advisory one, to identify important marine scientific issues of economic potential to CMG. CMG plans to organize an International Workshop on Marine Geoscience for late 1988 or early 1989. This Workshop will be devoted particularly to continental margins and shallow seas, including their non-living resources. It is suggested by CMG that the IOC-UN(OETB) Guiding Group of Experts on OSNLR meets at the same time to benefit fully from the deliberations on scientific summaries of the state of the art that will be presented at the Workshop.

81 As requested at the First Session of the Guiding Group, the Representative of ECOR, Mr. Donald Lennard, introduced the Report on the Production of Energy from the Marine Environment, which was prepared by Dr. T. Homma, Chairman of the ECOR Working Group on Ocean Energy System at the request of IOC.

82 The information on ocean characteristics that need to be obtained with respect to ocean energy extractions include: (i) Wave climate (wave-energy spectra in coastal environments, and internal wave amplitude and direction); (ii) Ocean currents (magnitude and direction in surface and to depths of 1000 to 2000 metres); (iii) Ocean temperature distribution from the surface to depths of 1000 metres; (iv) Rock characteristics, for sites where an OTEC cold waterpipe could be drilled from shore to depth through the rock; (v) Narrow beam bathymetry of steeply shelving coastal sites; and (vi) Influence of sea-level rise.

83 The Guiding Group noted that the nature of the measurements of ocean characteristics required with respect to ocean energy exploration gave considerable scope for the involvement of scientists from developing countries.

84 The Guiding Group recognized the importance of the wave-energy extraction devices to coral atoll situations and more generally to a significant number of developing countries and also noted the importance attached to OTEC by the UN as evidenced by their report entitled "A Guide to Ocean Thermal Energy Conversion for Developing Countries" published in 1984.

85 The Representative of the Unesco Division of Marine Sciences, Dr. Alexei Souzyoumov, presented the Division's activities in the field of OSNLR under Programmes X.4 and X.5: (i) manpower development; (ii) strengthening of capacities of marine science institutions, and (iii) dissemination of information. The Division of Marine Sciences is also promoting coastal zone studies under the Unesco Major Interregional Project on Research and Training Leading to the Integrated Management of Coastal Areas (COMAR). To this end, the Division co-operates with a number of non-governmental organizations, such as: INQUA, IUGS, IGU and SCOR. It co-sponsored several major meetings in 1986: A meeting on Global Changes in Africa during Quaternary. During this meeting, a Unesco Workshop on Coastal Changes in Africa during Quaternary was also convened with INQUA; A meeting with IGU on Coastal Changes in the Mediterranean Region; A meeting with CGMW on the Geological Map of Africa and Surrounding Waters; and two meetings, one of Deans of African Universities, and the other on Marine Science Education at the Undergraduate Level, devoted, in part, to problems of education in marine geology. The Division also organized, in 1986, three training workshops in the field of marine and coastal geology: in Brussels (Belgium), Malindi (Kenya), and Porto-Alegre (Brazil).

86 The following publication was prepared and distributed in 1986: Principles of Marine Geological Mapping with Special Emphasis on Waters Surrounding Africa and Evolution of Africa and South America during the Quaternary. The IMS Newsletter was also used to distribute operational information in different regions.

87 The following marine geological activities of the Division are planned: a Training Course in Marine Geology for Africa ("Cours de geologie marine en Guinée", Conakry, 16-26 March 1987); COLOCEAN-II meeting (Madagascar, April 1987) in which a marine geological component will be included; and preparation of a manual on coastal erosion monitoring in West and Central Africa (in co-operation with UNEP).

88 The Guiding Group welcomed the report presented by the representative of the Division of Marine Sciences, and stressed the need to develop further closer co-operation between OSNLR and the relevant activities of the Division.

7. SUPPORTING ACTIVITIES FOR THE PROGRAMME

7.1 EXCHANGE OF DATA

89 The IOC Senior Assistant Secretary, Dr. Iouri Oliounine, introduced the International Oceanographic Data Exchange System (IODE). He reported, in particular, on the involvement of the IODE in geological and geophysical data management, paying special attention to the activities of the IODE Task Team on Exchange of Marine Geological and Geophysical Data, and the accomplishments of the World Data Centre for Marine Geology and Geophysics (WDC-A-MGG) during the last few years. The Task Team has identified the needs of the international community for marine geological and geophysical data exchange and formulated recommendations on the ways to meet them; it considered exchange formats related to newly developed technology and assisted the IODE Group of Experts on Format Development in the development of GF3 outsets for geophysical data, e.g. multi-beam echo sounders.

90 The data base and bibliography have expanded considerably with input from many sources. Currently the data base contains 5 218 stations with analyses of manganese and 146 434 elemental oxide analyses in the file. The bibliography now contains over 10 000 references. During 1985, the bibliography became current for references to manganese, sulphides and phosphorites, and, as of 1 October 1986, is current for all topics, including placers/heavy minerals.

91 The IOC Assistant Secretary gave a detailed description of marine geological and geophysical data files. The Centre, mentioned above, currently maintains roughly 1000 data files with analysis of 148 457 ocean floor sediment and rock samples. Data from 516 cruises amounting to 1.8 million cruise-miles and 6.1 million digital records have been added to the Geophysical Data System known as GEODAS. Current holdings are 10.2 million cruise-miles of data yielding 21.2 million digital records from 2 551 cruises world-wide. This represents a 25% increase during the last three years.

92 Marine boundary files currently maintained in the WDC-A-(MGG) include world geography, national economic zones, and various plotting sheet systems. Of particular interest are the GEBCO boundaries added in 1984-85. They include the British Admiralty plotting sheet limits, the limits of the GEBCO areas of responsibility, and the limits of the 5th edition of GEBCO. With these boundaries incorporated in GEODAS, the plotting sheets affected by new data acquisitions can be readily ascertained. When data are assimilated into GEODAS, inventory information as to which regions have new data is automatically added to files. This substantially reduces the effort required to report acquisition of new data to the IHO.

93 One of the goals set for WDC-A-(MGG) at the time of its inception was the establishment of a publication series. Reports MGG-1 and MGG-2 have been published; Report MGG-3 is expected in late 1986 or early 1987, and Reports MGG-4, 5 and 6 have been identified. The report series is intended to serve the marine geoscience community by disseminating scientific and technical reports, data sets and reference materials of broad interest.

94 The Senior Assistant Secretary stated that there are some stated that there are some ways to obtain direct access to the WDC, at the regional level, through the telemail system of information printed in the Unesco International Marine Science Newsletter.

95 The Guiding Group noted the information given regarding the data exchange, and expressed its hope that such useful information could be made available to regional bodies as an Information Document or another appropriate form.

96 The Guiding Group recommended that the IOC and UN(OETB), in the framework of its IODE System through ASFIS and other appropriate means, assist regional networks and related Groups of Experts or Task Teams established under the IOC regional subsidiary bodies to prepare inventories of information, bibliographies of reports and publications related to the OSNLR Programme.

7.2 OCEAN MAPPING

97 Dr. Viktor Sedov, IOC Senior Technical Secretary in charge of mapping introduced this Item. Ocean mapping has received increased attention by IOC in recent years, since it constitutes an important component of any oceanographic scientific study and a basis for exploration and exploitation of living and non-living resources.

98 Overall co-ordination of ocean mapping activities within the IOC is provided by the IOC Consultative Group on Ocean Mapping. The main task in recent years has been the digitization of the GEBCO contours and the work of the Sub-Committee on Digital Bathymetry on plans for a digital data base from which the 6th edition of GEBCO will be prepared.

99 A Geological/Geophysical Atlas of the Indian Ocean was published about ten years ago. Similar atlases of the Atlantic and Pacific Oceans are now in preparation. A publication describing the contents and state of preparation of both Atlases is being prepared. It is expected that the Atlantic Ocean Atlas will be published in 1988, and the Pacific Ocean Atlas two years later.

100 The IOC is also involved in the preparation of large-scale bathymetric charts of some regions of the World Ocean. The International Bathymetric Chart of the Mediterranean was published in 1981. The following geological/geophysical overlay sheets for use with the Chart are

in preparation: Bouguer gravity anomalies, seismicity, magnetic anomalies, Plio-Quaternary/Messinian structure, and recent sedimentation. The first of these overlay sheets will be published in 1988.

101 The First Session of the Editorial Board for the International Bathymetric Chart of the Caribbean Sea and Part of the Pacific Ocean off Central America (IBCCA) was held in Aguascalientes, Mexico, 29 September 2 October 1986. General criteria and an assembly diagram for 21 sheets on a 1:1 million scale were agreed and specifications for the IBCCA were adopted. Some countries offered to prepare specific plotting sheets for this Chart, and Mexico offered to assure responsibility for final drafting and printing of the Chart.

102 The IOC Regional Committee for the Central Eastern Atlantic during its meeting in Praia (Cape Verde), 19-23 January 1986, adopted a recommendation to the forthcoming session of the IOC Assembly to convene a meeting of experts to study the feasibility of preparing an International Bathymetric Chart of the Central Eastern Atlantic (IBCEA) and, if so, to establish in due course an Editorial Board. The Delegate of France informed the Regional Committee of his country's readiness to take the lead in the preparation and publication of this Chart.

103 A Regional Training Course on Bathymetric Charting in the Western Indian Ocean Region is planned with the assistance of FRG, to be held in a Member State of the region with on-board training on RV METEOR in June/July 1987; this is considered to be a prerequisite to the preparation of an International Bathymetric Chart of the Western Indian Ocean.

104 A project for a Bathymetric Chart for the Red Sea and Gulf of Aden was prepared at the Institute of Oceanographic Sciences (IOS), Wormley, United Kingdom, but financial constraints have yet to be overcome.

105 Taking into account the need for more detailed and larger scale charting in support of OSNLR projects, the Guiding Group noted the plans for preparations and editions of such regional charts, and the support given to these projects by regional subsidiary bodies concerned.

7.3 ADVANCED TECHNOLOGY FOR RESEARCH AND SURVEY RELEVANT TO OSNLR

106 Under this Item, the Guiding Group considered the following two main technologies available:

(i) Side-Scan Sonar

107 Dr. Bernard Biju-Duval, when introducing this item, emphasized the crucial importance of this tool for the OSNLR Programme, and, in a more general way, for the exploration of national economic zones. He presented the different systems used at present. The best known is GLORIA, a U.K. System which provides, with a resolution of 100 to 200 m, detailed information on the bottom morphology. More accurate systems such as the SeaMARC side-scan sonar vehicles (SeaMARC I and II) can map, by accoustic reflection, the sea floor over wide areas (5 to 10 km swath width), and

resolve sea-floor relief features of a few metres, These systems provide, at the same time, a bathymetric map of the area. A key point controlling the use of these instruments is the need for great accuracy in positioning systems.

(ii) Satellite Imagery

103 Dr. Michael Collins outlined the potential use of satellite imagery in OSNLR Programmes, and introduced a report entitled "Opportunities and problems in satellite measurements of the sea" (Document: Unesco Technical Papers in Marine Science No. 46). Imagery within the thermal and visible ranges of the spectrum can be used successfully for nearshore and offshore investigations. Thermal imagery can detect freshwater inputs to the ocean, the presence of different water masses, and areas of upwelling where cold nutrient-rich waters are present at the ocean surface. Satellite imagery which could be used in such studies are: Tiros N: AVHRR (Advanced Very High Resolution Radiometer), for visible and infra-red scanners; Nimbus 7: CZCS (Coastal Zone Colour Scanner), mainly useful for determination of chlorophil and suspended sediments; and LANDSAT 1-5: TM (Thematic Mapper) for visible and infra-red scanners.

109 Some of these satellites were launched in the 1970s and are now coming "off-line"; however, other systems are being launched presently. The existing satellites have generated a wealth of archived imagery, which, in some cases, is better analysed from enhanced image rather than photographic photographic projects. Other data useful to OSNLR Programmes were generated by the SEASAT mission in 1978. Data from the altimeter sensor have been shown to be relevant to determining bathymetric features in deep water areas. Similarly, shallow water topography can be identified through its modification of coastal flow patterns and changes in the surface wave patterns. Satellite imagery provides an alternative approach to the understanding of coastal hydrodynamics. Other synoptic flow patterns can be identified from satellite imagery; these are sometimes difficult to identify through conventional oceanographic instrumentation.

7.4 PROMOTION OF THE PROGRAMME

110 Dr. Claude Latouche introduced this Item. He explained that the IOC planned to publish a brochure on OSNLR. He and Dr. Cook have carried out some preliminary work on this project and collected some documents and material for inclusion in the proposed brochure. The main topics of the OSNLR Programme would be highlighted and the World Map of IOC Regional Subsidiary Bodies would be presented. The brochure would be illustrated by photographs of different non-living resources of the sea; e.g. manganese nodules, reefs, beaches, black sands and others.

111 Another promotional action planned by IOC is the publication of a newsletter to facilitate liaison, communication and exchange of information between the various regional components of the Programme and related activities. Nevertheless, such a publication is a highly time-consuming activity and until a post for a marine geoscientist in the IOC Secretariat is established, it would be difficult to publish such a newsletter.

112 The Guiding Group recognized the usefulness of a brochure and recommended its preparation and publication by IOC.

113 For the time being, in view of budgetary and staff restrictions, the Guiding Group recommended, as an alternative, the publication by IOC of a Newsletter, as well a more active use of the IMS Newsletter of Unesco to disseminate some information on OSNLR.

8. TRAINING, EDUCATION AND MUTUAL ASSISTANCE (TEMA)

114 The Technical Secretary for the Session outlined training activities currently carried out by the Commission. There are two categories of training: individual training under which marine scientists from developing countries receive study grants to participate in international workshops/training courses as well as shipboard training; and group training activities organized by the IOC, sometimes with direct financial assistance from Member States. During the last year, two relevant training courses were organized: one was the Training Workshop on Ocean Engineering and its Interface with Marine Science held in Madras (India), 17 March to 5 April 1986, and the other is the Orientation Course on Management of the Coastal Zone held in Haarlem (The Netherlands), 14-25 14-25 April 1986. He explained that about one third of IOC's budget is allocated to TEMA activities, which include the provision of individual study grants, the organization of workshops and training courses, as well as experts mission to advise developing Member States.

115 Besides such Regular Programme activities, Member States provide IOC with extra-budgetary assistance in the form of Funds-in-Trust contributions or voluntary contributions. Examples of Funds-in-Trust contributions are those made by the Japanese Government for the implementation of WESTPAC Programmes, and by the Federal Republic of Germany and France for organization of training courses and other activities.

116 Unesco executed, through IOC, an UNDP funded project on "Strengthening the National Aquatic Resources Agency (NARA) of Sri Lanka" (SRL/84/008), amounting to US $833,000 for 1985/86 which included, among others, activities to develop marine geological/geophysical research capabilities in this Agency, mainly through the provision of basic equipment

for a research vessel, such as an echo-sounder, sparker, and grab-sampler, and of training of research staff. This resulted in the implementation of bathymetric and geological surveys of the continental shelf and upper slope of selected areas, and in the description of placer deposits.

117 The Guiding Group acknowledged with satisfaction the TEMA activities carried out by IOC, and encouraged IOC and UN(OETB) to continue to promote and provide support to these most important activities.

118 The Guiding Group also noted that prolonged contact and area-specific field studies are extremely beneficial in helping local scientists to obtain "hands-on" training and in producing reports and maps that have immediate interest and application. Such contact could involve a scientist or advanced student spending a longer period of time working in a specific country and interacting with a small number of selected "students" and scientists from the host country; a minimum of six months would be a preferable period of time. Such work could be supported by both the donor and host Member States.

119 The Guiding Group recommended that the IOC continue to mobilize extra-budgetary funds to assist in the funding of training programmes, particularly field training activities and participation of scientists from developing countries in research cruises, including those under the Ocean Drilling Programme. It also recommended that the IOC continue to encourage, and, where appropriate, co-sponsor regional workshops relevant to OSNLR in a given region.

8.1 TRAINING COURSE ON RESOURCE ASSESSMENT

120 The Guiding Group of Experts, at its First Session, recommended that countries and regions examine their oceanographic economic potential in the context of OSNLR. At the request of several developing countries, the International Centre for Ocean Development (ICOD) of Canada is sponsoring a two-week course on "Offshore Non-fuel Mineral Resources and Development and Planning", in co-operation with the Canadian Department of Energy, Mines and Resources, and with UN(OETB). The course is designed to provide participants with training in: (i) offshore non-fuel mineral assessment and formulation of appropriate plans and policy in their own countries; and (ii) the organization and teaching of a similar course in their region. The course will be held in Halifax, Canada, from 1 to 15 March 1987. The eleven participants are senior geologists or technical officials from Argentina, China, the Cook Islands, Fiji, Gabon, Ghana, Jamaica, Tanzania, Thailand, Tonga, and Trinidad and Tobago. ICOD is sponsoring eight participants. The Canadian International Development Agency (CIDA) is sponsoring three participants from the South Pacific region. Dr. David Pasho, the course organizer, provided the Guiding Group with a draft of the course manual for comments because consideration is being given to sponsoring a limited number of follow-up courses in some regions. Suggestions regarding mechanisms for implementation were also solicited from the Group.

121 The Guiding Group welcomed the efforts made by the Canadian authorities and expressed its hope that similar training opportunities will be offered by other Member States and aid Agencies.

9. IOC PROGRAMME AND BUDGET FOR 1987 AND REQUIREMENTS FOR THE FOLLOWING BIENNIUM

122 The IOC Assistant Secretary, Mrs. Natalie Philippon-Tulloch, provided an overview of the current budgetary situation. There are several budgetary constraints; at present the total budget for IOC (excluding salaries) is about US $1,7 million, of which approximately 3.7% is set aside for OSLR and OSNLR. Additional funds are also provided through the IOC Trust Fund. The OSNLR component for the 1986/76 biennium is about US $62,000. In addition to budgetary constraints, there are also severe staff constraints on IOC in general and OSNLR in particular. These contraints have resulted in a number of positions being "frozen". It has been hoped to appoint a marine geoscientist to IOC to look after OSNLR. This has not been possible to date and this has presented major problems to the IOC Secretariat in providing technical backstopping for OSNLR. There is an urgent need to address this problem either through the appointment of a marine geoscientist to the IOC Staff or by the secondment of such a professional by a Member State.

123 There is also a need to develop projects that have been costed and assigned a priority. Such proposals can then be used as a basis for framing the forward budget.

124 After discussion regarding the current and future budget, the Guiding Group recommended that Unesco open for recruitment, at the earliest opportunity, the marine geoscientist post approved in the 23 C/5 at the IOC Secretariat which is currently "in reserve", and that IOC considers increasing the current budgetary allocation to OSNLR, since, without both of these steps being taken, OSNLR implementation would be considerably hampered.

125 The Representative of the UN(OETB) briefly reviewed the financial situation of the UN and described its effect on his Branch. As far as the OSNLR Programme was concerned, the main impact had been on the use of consultant funds allocated for support of the Guiding Group. As a result, the UN could finance the participation of only two, rather than three experts at the present Session. For the 1988-1989 biennium, his Branch had proposed the same level of funding for the Guiding Group as in 1986-1987. Apart from the budget line, there were no other substantial ways under existing UN budgetary practices for his Branch to provide support for activities under the OSNLR Programme, unless such activities were related to research in areas under the Branch's mandate and could be foreseen and introduced into its programme budget at the drafting stage. He informed the Guiding Group that the UN had agreed to translate into French and Spanish the Summary Report of the present Session, and he concluded by stating his belief that the present finanical difficulties at the UN did not call into question its co-sponsorship of the OSNLR Programme.

126 The Guiding Group recommended that the United Nations, as a co-sponsor of the OSNLR Programme, through its OETB, increase its present level of support, financial and otherwise, for the Programme, including the possible secondment, under the ICSPRO Agreement, of a professional staff member to the IOC Secretariat for better implementation of OSNLR and related activities.

10. ELECTION OF CHAIRMAN AND VICE-CHAIRMAN FOR THE INTERSESSIONAL PERIOD

127 Dr. David Pasho stated that the OSNLR Programme was launched remarkably in a very effective manner within such a short period of time due to the efforts made by the current Chairman and Vice-Chairman, and subsequently proposed that Professor Michel Vigneaux continue as Chairman. This proposal was seconded by all participants. Therefore the Guiding Group unanimously re-elected Professor Vigneaux and Dr. Peter Cook as Chairman and Vice-Chairman respectively for the inter-sessional period.

11. DATES AND PLACE OF THE NEXT SESSION

128 The Guiding Group of Experts recommended that the Group meets again in approximately two years. Possible suggestions for a meeting site were UN Headquarters in New York, Unesco Headquarters in Paris, or the University of Bordeaux I, in Talence, France. Dates and place will be decided by OSNLR Officers and the Secretariat of the sponsoring organizations.

12. ADOPTION OF THE SUMMARY REPORT

129 The Guiding Group adopted the Summary Report.

13. CLOSURE

130 In closing the Session, the Chairman OSNLR thanked the participants for their valuable contributions which made the Session lively and profitable. He also expressed appreciation for the work of the Guiding Group of Experts in outlining possible research topics under the OSNLR Programme. He stressed the importance of identifying priorities for implementation on the regional level; and, for this purpose, requested the regional groups of experts to take the necessary steps to implement regional projects. He assured the Guiding Group that he, together with the Vice-Chairman, will do their best to develop the OSNLR Programme.

131 The Chairman thanked the Secretary IOC and his staff for the arrangements made for the Session, and for their assistance in carrying out the intersessional activities. He also expressed his appreciation to UN(OETB) for their active participation in the Programme.

132 The Session was closed at 19h30 on 30 January 1987.

ANNEX I

AGENDA

1. OPENING

2. ADMINISTRATIVE ARRANGEMENTS

   2.1 ADOPTION OF THE AGENDA

   2.2 DESIGNATION OF A RAPPORTEUR FOR THE SESSION

   2.3 CONDUCT OF THE SESSION

3. MAJOR INTERSESSIONAL ACTIVITIES

4. FORMULATION OF THE SCIENTIFIC RESEARCH PROJECTS UNDER THE PROGRAMME

   4.1 SEA-LEVEL CHANGES, ENVIRONMENTS AND TECONTICS DURING THE PAST MILLION YEARS (SETMY)

      4.1.1 Resources

      4.1.2 Research

   4.2 DEEP OCEAN

      4.2.1 Resources

      4.2.2 Research

   4.3 HYDROCARBONS

5. REGIONAL COMPONENTS OF THE PROGRAMME

   5.1 CARIBBEAN AND ADJACENT REGIONS (IOCARIBE)

   5.2 WESTERN PACIFIC (WESTPAC)

   5.3 SOUTH-WEST ATLANTIC

   5.4 CENTRAL EASTERN ATLANTIC (IOCEA)

   5.5 INDIAN OCEAN

   5.6 OTHER REGIONS

6. COOPERATION WITH RELATED PROGRAMMES AND ORGANIZATIONS

6.1 INTERNATIONAL GEOLOGICAL CORRELATION PROGRAMME (IGCP)

6.2 OCEAN DRILLING PROGRAMME (ODP)

6.3 OTHER ORGANIZATIONS

7. SUPPORTING ACTIVITIES FOR THE PROGRAMME

7.1 EXCHANGE OF DATA

7.2 OCEAN MAPPING

7.3 ADVANCED TECHNOLOGY FOR RESEARCH AND SURVEY RELEVANT TO OSNLR

7.4 PROMOTION OF THE PROGRAMME

8. TRAINING, EDUCATION AND MUTUAL ASSISTANCE

8.1 TRAINING COURSE ON RESOURCE ASSESSMENT

9. IOC AND UN(OETB) PROGRAMME AND BUDGET FOR 1987 AND REQUIREMENTS FOR THE FOLLOWING BIENNIUM

10. ELECTION OF CHAIRMAN AND VICE CHAIRMAN FOR THE INTERSESSIONAL PERIOD

11. DATE AND PLACE OF NEXT SESSION

12. ADOPTION OF THE SUMMARY REPORT

13. CLOSURE

ANNEX II

RECOMMENDATIONS

Recommendation Number	Title
OSNLR-II.1	General
OSNLR-II.2	Scientific Programme
OSNLR-II.3	Regional Groups of Experts
OSNLR-II.4	Programme Support
OSNLR-II.5	Co-operation with Other Organizations

Recommendation 1

GENERAL

The Guiding Group of Experts recommends that the IOC endorse the modified OSNLR Programme and, through its regional subsidiary bodies, implement it at the regional level.

Recommendation 2

SCIENTIFIC PROGRAMME

Re-affirming the priority it had accorded at its First Session to the shallow marine environment and to the resources of sand and gravel, placer deposits, phosphorites, and the coastal zone as a resource in its own right, the Guiding Group of Experts recommends that:

(i) The current shallow-water marine sub-programme of OSNLR on Sea-level changes, Environments, and Tectonics during the past Million Years (SETMY), be modified to include Sedimentary Environments, Eustatic Changes, Tectonics and Resources (SETR) with the following main components:

   a) Study of natural and human effects on the coastal zone, including global sea-level rise, regional subsidence, extraction of ground water and hydrocarbons, and river-estuarine-coastal dynamics and interactions.

   b) Study of the dynamics of the coastal and shelf region (e.g. tidal monitoring, wave climate, storm surges, etc.)

   c) Mapping of the distribution and composition of superficial shelf sediments; the strand-lines of the last low (18,000 years BP) and high (125,000 years BP) still-stands should be delineated world-wide.

(ii) IOC promote a deep-sea sub-programme of OSNLR with the following main elements:

   a) The study of tectonic and magmatic processes of divergent and convergent plate margins, to provide the geological and geophysical framework for resource exploitation.

b) The study of the distribution and composition of cobalt-rich ferromanganiferous crust and hydrothermal sulphides.

c) The systematic mapping of the thick sequence of sediments in the marginal basin settings.

(iii) IOC, in the framework of its IODE System through ASFIS and other appropriate means, assist regional groups of experts or task teams established under the IOC regional subsidiary bodies to prepare inventories of information, bibliographies of reports and publications related to the OSNLR Programme.

(iv) The Guiding Group recognized the value of advanced technology to the implementation of the OSNLR Programme and recommended that IOC encourage the exploration of the sea floor by side-scan sonar techniques and the application of satellite imagery to the OSNLR Programme and explore the possibility for surveys to be undertaken at the request of developing countries, under TEMA or relevant arrangements, as well as training of local experts.

Recommendation 3

REGIONAL GROUPS OF EXPERTS

To facilitate development of the OSNLR Programme, the Guiding Group of Experts recommends that:

(i) IOC regional subsidiary bodies consider the formation, if appropriate, of regional groups of experts or tasks teams to promote regional components of OSNLR, taking into account regional geological settings, and that such regional groups of experts or tasks teams consider, when required, arrangements for advice by members of the Guiding Group of Experts to provide advice to them when required.

(ii) IOC and UN(OETB) assist the regional groups of experts or tasks teams established under IOC regional subsidiary bodies to:

a) collect, synthesize and make available maps and bibliographies that can be used as a basis for resource assessment and for identifying and planning relevant scientific programmes;

b) explore means of exchanging information on relevant regional scientific research activities and on selected related technical and economic developments;

c) review the need to establish or strengthen regional data management systems through the IODE System or other appropriate arrangements with a view of promoting required services for adequate implementation of OSNLR;

d) review the training requirements and the availability of opportunities in light of the regional situation and requirements with a view of promoting activities in support of OSNLR components;

e) explore means of funding the required training.

(iii) The regional subsidiary bodies of IOC, through their groups of experts or tasks teams, with the assistance of IOC and UN(OETB):

a) review the scientific sub-programmes recommended by the Guiding Group of Experts;

b) identify regional components of OSNLR that are relevant to their respective regions;

c) advise on and promote the means of implementing these regional components of OSNLR.

(iv) IOC assist SEATAR in bringing its current programme to a successful conclusion and then consider developing in the WESTPAC region two sub-regional components of OSNLR, one through SEATAR addressing problems related to marginal basins near the Asian continent, the other through STAR addressing problems of regional interest to that sub-region.

Recommendation 4

PROGRAMME SUPPORT

The Guiding Group of Experts recommends that:

(i) IOC continues to mobilize extra-budgetary funds to assist in the funding of training programmes, particularly field training activities and participation of scientists from developing countries in research cruises, including those under the Ocean Drilling Programme.

(ii) IOC continue to organize and, where appropriate, co-sponsor regional workshops relevant to OSNLR.

(iii) IOC prepare and publish a brochure of the OSNLR Programme and disseminate information on OSNLR, either through the publication of a Newsletter, or, alternatively, through a more active use of the IHS Newsletter of UNESCO.

(iv) The IOC regional subsidiary bodies, through their groups of experts or task teams, identify organizations that would be willing to become the host of regional equipment pool(s) and other appropriate facilities required for the effective implementation of OSNLR regional components; and that IOC assist in providing funds from extra-budgetary sources or mobilize support from IOC/VCP for the equipping of these regional facilities.

(v) Unesco open for recruitment, at the earliest opportunity, the marine geo-scientist post approved in the 23 C/5 at the IOC Secretariat which is currently "in reserve", and that IOC consider increasing the current budgetary allocation to OSNLR, since, without both of these steps being taken, OSNLR implementation would be considerably hampered.

(vi) The U.N., as a co-sponsor of the OSNLR Programme, through the OETB, increase its present level of support, financial and otherwise, for the Programme, including the possible secondment, under the ICSPRO Agreement, of a professional officer at the IOC Secretariat for better implementation of OSNLR and related activities.

Recommendation 5

CO-OPERATION WITH OTHER ORGANIZATIONS

The Guiding Group of Experts recommends that:

(i) Co-operation with the International Geological Correlation Programme (IGCP) be further developed, especially through IGCP Projects 156 (Phosphorites) and 200 (Sea-level Changes), and that Officers of the Guiding Group of Experts and the Secretary IOC approach the Chairman of IGCP and the leaders of projects mentioned above to enhance this co-operation.

(ii) IOC consider favorably co-operation with the Ocean Drilling Programme (ODP), and accordingly that the Secretary IOC approach the ODP Planning Committee with a view to facilitating under TEMA the participation of scientists from developing countries in ODP cruises and in pre- and post- cruise activities.

ANNEX III

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ANNEX IV

GLOBAL RESEARCH SUB-PROGRAMMES AND PROJECTS

I. SHALLOW WATER

Project No. 1: The modification of the coastal environment

A concerted effort must be made to research and quantify the short-term and long-term effects of upstream damming or diverting of rivers which discharge into the coastal zone, causing a reduction in sediment and water supply. Such damming leads to accelerated coastal erosion, changes in longshore sedimentation, and (in terms of OSLR) modification of the coastal ecosystem and fishery resource potential. Some of the specific studies require: the monitoring of sea-level changes through the establishment of tide-gauge networks; observation of the wave energy dissipation at the coast line; and accurate description of flow patterns and sediment loads of rivers (before and after the damming).

The effects on groundwater must be studied. The rise of sea level can have a deleterious effect on coastal zone aquifers, resulting in salinization. The extraction of groundwater can also have deleterious effects such as accelerated compaction of certain sediments (clays) possibly leading to accelerated subsidence (also applicable to the removal of hydrocarbons) which could be significally greater than the effects of global sea-level rise, and landward encroachment of salt water can also occur, resulting in increased salinization of the ground water.

The documentation about the physical setting of organic reefs on a regional basis is also required because of their importance as recreational and direct economic resources and as barriers against waves and currents.

Project No. 2: The mapping of strand-lines

It is considered that such a map indicates strand-lines at the time of maximum sea-level withdrawal during the glacial, around 18 000 years ago; and the maximum transgression during the interglacial, around 125 000 years ago. Such maps (on a regional and global scale) would be a very effective basis for identifying the loci of deposition of seabed resources, and are a prerequisite for the study of the most interesting scientific problems, such as the interaction of eustatics and tectonics, isostasy, and rheology of the earth.

Project No. 3: Shelf and Upper Slope Dynamics (SUSD)

As an adjunct to similar studies in the coastal zone, it is proposed that research be undertaken aimed at understanding channel behaviour, sediment transport, and mass wasting of the slope. These topics are obviously important to such engineering issues such as the laying of undersea cables, locating drilling rigs, and other man-made structures. Monitoring of tides, waves climate, and storm surges would all be essential components of such a project because of their impact on erosion, transportation, and dispersion of sediments. This project will also generate an important data base that will form an important background for decisions on resource exploitation and utilization.

II. DEEP OCEAN

Project No. 1: Metalliferous crusts and sediments

(a) Cobalt-rich crusts: As a considerable amount of effort has been expended in the last two decades on the distribution, chemical composition and origin of manganese nodules, no additional emphasis on these deposits is needed at the present time, but cobalt-rich manganese crusts, which occur on the sediment-free upper slopes of islands and seamounts, have only recently begun to receive interest, and their formation and distribution is poorly understood, so that additional studies of the distribution, origin, and value of these deposits are needed.

(b) Metalliferous sediments: In as much as metalliferous sediments and massive sulphides have recently been discovered in open ocean and back-arc environments, and their distribution and value are poorly known, considerable additional work is needed to assess the economic potential of these mineral occurrences.

Regional IOC subsidiary bodies would be encouraged to incorporate studies of cobalt-manganese crusts and sulphide deposits in their work programmes, where appropriate, in order to increase the amount of information available on the occurrence and potential value of these deposits.

Project No. 2: Plate boundaries

This project would focus on aspects of the geological evolution of the complex active plate boundaries of the world's oceans. These (plate) boundaries are defined by zones of intense earthquake activity, and are the sites of creation or consumption of oceanic crust. Large-scale horizontal displacements and

crustal accretion within these regions lead to the formation of mountain fold belts. All active plate boundaries are in a state of evolution, and the fundamental driving mechanisms are poorly understood.

(a) Objectives: (1) To define the history and kinematic framework of plate boundaries as a prerequisite to quantifying ridge, back-arc and collision tectonic processes; (2) To identify the structural, thermal, magmatic, volcanic, tectonic, and eustatic processes involved in ridge and back-arc sea-floor processes; (3) To identify processes of arc collision and terrane accretion through the identification of styles of structural deformation, including ophiolite emplacement, displaced terranes in collision complexes, mechanism and causes of plate boundary relocation/reactivation mechanisms for associated sedimentary basin evolution, and factors affecting vertical tectonics.

(b) Significance: (1) The world's volcanic arcs and active bark-arc basins are modern analogues of ancient fold belts where major ore bodies occur. An understanding of the modern processes may result in the discovery of significant sea-floor resources and provide keys to the exploration of old terranes; (2) This proposed project also has immediate application to exploration for petroleum and minerals in the present-day volcanic arcs and foldbelts, and will provide a tectonic framework for the understanding of geological hazards such as earthquakes, volcanic eruptions, tsunamis and landslides.

(c) Implementation: Implementation of the research needed to achieve the objectives should be formulated by regional groups. Initial efforts in this regard have been made by the CCOP(SOPAC)-IOC Joint Working Group on STAR, by the Group of Experts on Marine Geology and Geophysics in the Western Pacific, and by the Sub-Commission for IOCARIBE.

ANNEX V

REGIONAL RESEARCH PROJECTS

1. CARIBBEAN AND ADJACENT REGIONS (IOCARIBE)

The following regional research projects were submitted and endorsed at the Second Session of the Sub-Commission for IOCARIBE:

1.1 Coastal Zone

Project No. 1: Cartography of Surface Deposits

In addition to the bathymetric mapping, IOCARIBE Member States will further develop detailed geological maps of their coastal zones. The project activities will also include sampling and lithological analysis of sediments. The main objective will be to collect basic information for meaningful assessment of resource potential in the Exclusive Economic Zone of the Member States concerned. The project is relevant to the Global Project SETR and to its resource components, mineral deposits and CZAR.

Project No. 2: Preparation of Geomorphological Charts

Member States were invited to prepare geomorphological charts of their coastal environments depicting geographical distribution and main characteristics of different features such as lagoons, "restingas", mangroves, sandy beaches, reefs, capes and bayments, harbours, industrialized zones and others. The main objective of this project, which is relevant to SETR Global Project and which concerns CZAR, represents a prerequisite to the scientific basis for the management of the coastal zones.

Project No. 3: Beach Dynamics and Monitoring

Taking into account the importance of the beach environments for the Caribbean Member States, the Mini-symposium considered the development of research on sand hydro-dynamics processes an essential element of this project. A monitoring of several models of sandy beaches will be realized in order to protect this essential resource. This project, which also concerns CZAR, is also relevant to the Global Project SETR.

1.2 Deep Sea Environments and Palaeo-Oceanographic Studies

Project No. 1: Quaternary Palaeo-Oceanographic Studies

The objective of this project is to study and reconstruct the palaeogeographical evolution of the Caribbean deep sea sedimentary environments in relation with quaternary climatic changes and consequent affects (sea level changes, alternative dry and humid periods, variations of the fluvial imput to the ocean). The studies will be focused on "Fosa de Campeche" and "Cuenca de Yucatan", and open to all the scientists of the Region. They will be realized under the responsability of the "Direccion General de Geografia de la Secretaria de Programacion y Presupuesto de Mexico" for the bathymetric studies, and the "Universidad Nacional Autónoma de México (UNAM) for the geological studies. The objective of the project is the implementation of the regional knowledge on palaeoceanographic evolution of the Gulf of Mexico and the increase in the capability of regional scientists, particularly for stratigraphy, geomorphology, and geological mapping. This project is relevant to SETR and SUS Global Project, and could be particularly of interest to the 18 000 years BP Strand Line Project.

Project No. 2: Geotectonics, Morphostructural and Geodynamic Studies of Deep Sea Trenches

The Bartlett Trench is one of the most typlical geotectonic trenches at the margin between plates. It results from a suture zone between Caribbean Plate and Cuban Microplate. The mutlidisciplinary study of the structural morphology of the marine zone at the East of Cuba and of the emerged area off the suture zone (Islas Caimán Grande, Caimán Chico, Caimán Brac, Islas Swan, Jamaica, Hispanola y Puerto Pico) and of the Bartlett Trench will enable the study of the different stades of geodynamical and morphostructural evolution of the region. This reconstruction will constitute an evolutive model for the whole Mexicano-Caribbean Region. This regional project is relevant to the "Deep Ocean" Sub-Programme and to the Global Project relative to the study of tectonic and magmatic processes of divergent and convergent plate margins.

2. WESTERN PACIFIC REGION

2.1 Margins of Active Plates (MAP)

Project No. 1: Origin and Evolution of Microplates

The western Pacific is composed entirely of a large number of microplates that are completely or partly surrounded by seismic zones and/or active faults. The origins of these microplates are variable, and are as follows together with examples:

(i) orthogonal arc-arc collision (Izu peninsula); (ii) highly oblique arc-continent collision (New Guinea); (iii) back-arc spreading (Mariana-Bonin Through); (iv) fore-arc sliver by oblique subduction (southern Kurile arc); (v) ridge jump (Ontong Java plateau); (vi) trapped oceanic plate (Banda and Sulu basins); (vii) opening along suture zone (Woodlark basin); and there are presumably more.

Along the three kinds of boundaries of microplates (divergent, convergent and transform) distinct orogenic phenomena are observed such as mountain building, magmatism, sedimentation, deformation and formation of continental crust through regional metamorphism. The following characters should be investigated: (i) age, petrography, chemistry and physics of magmatism; (ii) stratigraphic record within each microplate; (iii) tectonic deformation along plate boundary specifically along convergent zone; (iv) uplifting of regional metamorphic rocks; and (v) sedimentation.

Project No. 2: Back-arc Tectonics

Actively spreading marginal basins in the region occur in the Mariana Through, Okinawa Through, Bismarck Sea, Andaman Sea, Woodlark Basin, North Fiji Basin and the Lau Basin. However, two areas stand out as regions where the processes of arc rifting and back-arc spreading can best be investigated. These are: (i) the Mariana-Bonin region, and (ii) the Woodlark-East Papua region.

Both of these areas allow an investigation of the spatial and temporal development of back-arc basins, from their initial rift stage to mature development. Understanding the processes involved in this development will particularly require detailed sea-floor geological sampling/observations. A comparative study of both areas would be particularly beneficial. Particular attention will also need to be placed on the determination of microplate/plate kinematics and their relationship to magmatic/hydrothermal activity, structural evolution and consequent crustal structure.

Project No. 3: Collision Tectonics

Several different types of collision zones are well developed in the WESTPAC region. Arc-continent collision is occurring in Taiwan, Timor, Mindanao-Molucca and northern New Guinea. A mosaic of "displaced" terranes has been assembled by strike-slip and collision tectonics in the Philippines, Borneo and central New Guinea. Microcontinental fragments, oceanic plateaus, aseismic ridges and seamounts are colliding with trenches along the entire western Pacific boundary from Japan to New Zealand. Studies in the following two areas are recommended:

(i) the Louisville Ridge collision with the Tonga Trench, and (ii) the late Tertiary arc-continent collisions in northern New Guinea. The latter could be compared very profitably to the SEATAR studies in the Philippines and the Indonesian-Australian mapping programme in Kalimantan. It represents a particularly complex problem involving a series of accretion and collision events.

2.2 Sea-level, Environment and Tectonics (SET)

Project No. 1: Sedimentary Evolution on Active Margins

This project aims to define the general principles for the evolution of sedimentary sequences in several key areas that are of major importance or unique to the western Pacific: (i) Trench-slope and fore-arc basins, particularly adjacent to major land masses; (ii) Intra-arc basins, an element of reversed arcs in the Solomon Islands, Vanuatu, Fiji and Papua New Guinea; (iii) The unique hierarchy of young and old marginal basins of the Pacific; and (iv) Slope-toe areas affected by western boundary undercurrents which may have oscillated in time and space

Understanding of these primary processes could be a significant contribution to understanding hydrocarbon generation in some basins and polymetallic nodules in slope-toe areas and adjacent ocean floors.

Project No. 2: Cenozoic Reef Evolution in Space and Time

In the western Pacific, more than in other parts of the earth, coral reefs have thrived in a wide variety of tectonic environments now and throughout the Cenozoic. The main objectives are: (i) To define and compare the geometric growth, the history and factors affecting evolution of reefs and their associated fore-reef and back-reef deposits along passive continental margins, offshore marginal plateaus, collision-overprinted passive margins and active margins; (ii) To define the interrelationships between carbonate and terrigenous sedimentation with changes of sea level and tectonic setting; (iii) To use the foregoing objectives for the precise analysis of older reef sequences, particularly as they are expressed in seismic reflection record sections; (iv) To consider reefs and their associated deposits as source rocks and reservoirs for hydrocarbons.

Outstanding areas for study are around the Coral and South China Seas, although useful research is possible throughout the western Pacific. With respect to the South China Sea, various shelf and slope basins in the region are, or have been, the focus of intense petroleum exploration, providing a still unpublished and largely unintegrated body of scientific data.

3. SOUTH-WEST ATLANTIC REGION

The following research projects and supporting activities have been proposed as regional components of OSNLR at the Porto Alegre meeting (7-11 April 1986):

Project No. 1: The Environment and Dynamics of Models of Typical Coastal Systems in the South-west Atlantic

The general objective of this project, relevant to CZAR, is to develop comparative and co-operative studies of different coastal models and processes for the region: coastal lagoons, estuarine environments, sandy beaches, coastal erosion and siltation. Short-term evolution of the coastal environment will be considered taking into account several factors such as sea-level variations and meterological phenomena.

Project No. 2: The Geology and Recent Palaeogeographic Evolution of the Coastal Zone and Continental Shelf off Eastern South America between 30° and 40° S.

This project is expected to contribute to the paleogeographical studies developped in the framework of the SETR Sub-Programme (SUS Component). The Expert Meeting proposed that regional scientific efforts should concentrate on developing a co-operative programme for non-living resources in the regional coastal zone and shallow marine area, extending to the shelf break, between 30° and 40° S. The general objective will be aimed at reconstructing the paleographic and sedimentary evolution of the continental shelf, but will cover the study of the distribution of heavy minerals, carbonates and phosphorites.

4. CENTRAL EASTERN ATLANTIC REGION (IOCEA)

At the IOCEA Meeting (Praia, Cap Verde, 19-24 January 1987), the following research projects have been proposed as regional components of OSNLR:

Project No. 1: Coastal Erosion of the Bight of Benin

The countries mainly concerned are Côte d'Ivoire, Ghana; Togo, Benin, and Nigeria. The Member States of the Bight of Benin have acquired appreciable experience and capabilities in the study of this phenomenon. However, such a sub-regional pilot project need not exclude other Member States having similar concerns and experience that could be shared or being in a position to offer training, education and mutual assistance. The phenomenon is complex, with various aspects: socio-economic (e.g. problems of coastal construction) and scientific (e.g. sediment supply and transport variations, hydrodynamic factors, especially wave

parameters). For such a project, even relatively unsophisticated techniques of measuring wave parameters (especially height, angle of approach to the coastline, breaking characteristics, etc.) and coastal bathymetry yield worthwhile indications of erosion problems at an early state of their evolution.

Project No. 2: The Effect of Dammning Rivers on the Supply of Sediment to the Coastal Zone

This is of particular concern in respect of the Niger River and rivers to the west of the Bight of Benin, but it is also an important consideration in the northern-most IOCEA Member States: Morocco, Mauritania, Senegal, the Gambia, Guinea-Bissau and Guinea-Conakry.

Project No. 3: Relationship between Upwelling and Phosphorite Deposits

The accumulation of deposits supposes a long-term upwelling regime, which implies the possibility of phosphorite deposits not necessarily associated closely with present-day upwelling. Brazil, for example, has phosphorite deposits on the coast but not over the continental shelf; nevertheless, upwelling has been observed along the edge of the Brazilian continental shelf. A similar situation may exist in the central eastern Atlantic. It may also be convenient to generalize such exploitation to placer deposits of economically important minerals including gold and diamonds. Regional co-operation in this project could be established particularly between Morocco, Mauritania, Senegal, Gambia, Guinea Bissau and Guinea Conakry.

ANNEX VI

LIST OF ACRONYMS AND ABBREVIATIONS

BP	Before Present
CCOP	Committee for Co-ordination of Joint Prospecting for Mineral Resources in Asian Offshore Areas
CCOP (SOPAC)	Committee for Co-ordination of Joint Prospecting for Mineral Resources in South Pacific Offshore Areas
CIDA	Canadian International Development Agency
CGMW	Commission for the Geological Map of the World (of IUGS)
CMG	Commission for Marine Geology (of IUGS)
COMAR	Unesco Major Inter-regional Project on Research and Training Leading to the Integrated Management of the Coastal System
COSLAC	Coastal Systems of Latin America and the Caribbean (of Unesco)
CZAR	Coastal Zone as a Resource
DHI	Deutsches Hydrographisches Institute (of FRG)
DSDP	Deep Sea Drilling Project
ECOR	Engineering Committee on Ocean Resources
FAO	Food and Agricultural Organization of the United Nations
FRG	Federal Republic of Germany
GAPA	Geological/Geophysical Atlases of the Atlantic and Pacific Oceans
GEBCO	General Bathymetric Chart of the Oceans
GEODAS	Geophysical Data System
GLORIA	Geological Long Range Inclined Asdic
IBCCA	International Bathymetric Chart of the Caribbean Sea and part of Pacific Ocean off-Central America
ICOD	International Centre for Ocean Development (of Canada)

IDOE	International Decade of Ocean Exploration
IGCP	International Geological Correlation Programme (of Unesco/IUGS)
IGU	International Union of Geography
IHO	International Hydrographic Organization
IMS	International Marine Science Newsletter (of Unesco)
INQUA	International Union for Quaternary Research (of IUGS)
IOC	Intergovernmental Oceanographic Commission
IOCARIBE	IOC Sub-Commission for the Caribbean and Adjacent Regions
IOCEA	IOC Regional Committee for the Central Eastern Atlantic
IOCINDIO	IOC Regional Committee for the Central Indian Ocean
IODE	International Oceanographic Data Exchange (of IOC)
IOS	Institute of Ocean Sciences (of UK)
IUGS	International Union of Geological Sciences
JOI	Joint Oceanographic Institutions, Inc. (of USA)
JOIDES	Joint Oceanographic Institutions for Deep Earth Sampling
MAP	Margins of Active Plates (WESTPAC Project)
NARA	National Aquatic Resources Agency (of Sri Lanka)
OAU	Organization of African Unity
OCE	Division of Marine Sciences (of Unesco)
ODP	Ocean Drilling Programme
OSLR	Ocean Science in Relation to Living Resources
OSNLR	Ocean Science in Relation to Non-Living Resources
OTEC	Ocean Thermal Energy Conversion
SCOR	Scientific Committee on Oceanic Research
SEATAR	Joint CCOP-IOC Working Group on Post-IDOE Studies on East Asian Tectonics and Resources

SET	Sea-level, Environment Tectonics (WESTPAC Project)
SETMY	Sea-level changes, Environments and Tectonics during the past Million Years (OSNLR Project)
SETR	Sedimentary environments, Eustatic sea-level changes, Tectonics and Resources (OSNLR Project)
SIO	Scripps Institution of Oceanography (of USA)
STAR	Joint CCOP(SOPAC)-IOC Working Group on South Pacific Tectonics and Resources
SUS	Shelf and Upper Slope
SWATL	South-west Atlantic Region
TEMA	Training, Education and Mutual Assistance (of IOC)
TOGA	Tropical Ocean and Global Atmosphere
UN-DIESA	United Nations, Department of International Economic and Social Affairs
UN(OETB)	United Nations, Ocean Economics and Technology Branch
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
WDC	World Data Center
WDC-A-MGG	World Data Center - A for Marine Geology and Geophysics
WESTPAC	IOC Regional Committee for the Western Pacific
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment