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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)

First Session

Paris, 14-18 January 1985

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Unesco

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1. OPENING

The Secretary of IOC, Dr. Mario Ruivo, called to order the First Session of the IOC-UN(OETB) Guiding Group of Experts on the Programme of Ocean Science in Relation to Non-Living Resources at 10.00 on Monday, 14 January 1985, in Unesco Headquarters, Paris, France. On behalf of the two sponsoring organizations, he welcomed Members of the Guiding Group and Observers. (The List of Participants is given in Annex I). The Secretary of IOC emphasized the technical character of the meeting, encouraging active participation by all present in elaborating further this new major programme of the Commission and in developing the strategy for its implementation. He recalled the relatively greater importance for developing countries of nearshore problems as compared with those of deep sea and the need for strengthening, in this perspective, the collaboration between the sponsoring bodies and other concerned organizations, namely with Unesco through the Division of Marine Sciences, particularly at the regional level. Supporting Training, Education and Mutual Assistance (TEMA) components are also extremely important in this context. (*)

The Representative of the UN Ocean, Economics and Technology Branch (OETB), Mr. Robert Gruszka, endorsed the views expressed by the Secretary of IOC and briefly described the OETB involvement in the OSNLR Programme.

2. ADMINISTRATIVE ARRANGEMENTS

2.1 ADOPTION OF THE AGENDA

The Guiding Group agreed on an agenda to guide its work.

2.2 ELECTION OF CHAIRMAN AND DESIGNATION OF A RAPPORTEUR FOR THE SESSION

Dr. Hassan Siddique proposed Prof. Michel Vigneaux as Chairman. This proposal was seconded by Prof. Noriyuki Nasu. The Guiding Group designated Prof. Vigneaux Chairman for the Session.

The Guiding Group designated Dr. Mahmoud El-Sayed Rapporteur for the Session.

2.3 CONDUCT OF THE SESSION

The IOC Assistant Secretary, Dr. Fernando Robles, acting as Technical Secretary for the Session, informed the Group of the arrangements for the meeting, introduced the Provisional Timetable and briefly reviewed the Provisional List of Documents. He informed the Group that Prof. I.S. Gramberg and Dr. D.E. Hayes were unable to attend due to unavoidable commitments but they had confirmed their intention to participate in the Group. He also informed the members of the nominations to the Group of Dr. B.U. Haq and Dr. S. Calvert, by the Commission for Marine Geology (CMG) and the Scientific Committee on Oceanic Research (SCOR), respectively. Drs. Haq and Calvert were unable to attend the present Session.

(*) A list of Acronyms and Abbreviations is given in Annex IV.

3. REVIEW OF REGIONAL AND OTHER ACTIVITIES RELEVANT TO THE PROGRAMME

The Chairman invited the Group to comment on ongoing OSNLR regional activities. He explained that the final purpose of the Guiding Group is to help IOC in establishing a basic scientific programme aimed at the development of OSNLR (Annex II contains the text of IOC Resolution XII-2 on OSNLR including the Terms of Reference of the Guiding Group of Experts). To this end, it appeared that a practical approach was to examine, from the basic information made available to the Group, the different regional components relevant to the Programme (Annex III contains a review of IOC regional activities concerning OSNLR).

The review that follows is based upon personal knowledge and experience of participants and cannot be considered as an exhaustive one.

3.1 WESTERN PACIFIC

Prof. N. Nasu elaborated on WESTPAC activities in geology and geophysics. He noted that WESTPAC has shown a trend to put more emphasis on basic research problems as compared with investigations undertaken by other organizations with IOC in the region (such as CCOP and cooperating CCOP SOPAC which have a more applied orientation.

During the Third Session of WESTPAC (Townsville, Australia, September 1983), the Programme Group adopted two research proposals known as SET (Sea level, Environments and Tectonics) and MAP (Margins of Active Plates), and decided to recommend to the IOC the creation of a Group of Experts on Marine Geology and Geophysics in the Western Pacific. WESTPAC is maintaining liaison with relevant activities of CCOP and CCOP(SOPAC) through the CCOP-IOC Joint Working Group on post-IDOE Studies on East Asia Tectonics and Resources (SEATAR) and the CCOP (SOPAC)-IOC Joint Working Group on South Pacific Tectonics and Resources (STAR), respectively. Prof. Nasu mentioned the recent cruises undertaken in the framework of WESTPAC by the S.V. Takuyo of the Hydrographic Department of Japan, and by the R.V. Hakuhomaru of the Ocean Research Institute of the University of Tokyo. The former made a SEA-BEAM bathymetric survey in the Mariana Trench, the results of which were presented to the Guiding Group, and the latter vessel made a similar survey in the Palau Trench. Three numbers of the RNODC Newsletter for WESTPAC have been published by the Hydrographic Department of Japan. An equal number of WESTPAC Newsletters have been published by the Australian Institute of Marine Science and the Australian Department of Science and Technology.

3.2 CARIBBEAN AND ADJACENT REGIONS

Prof. M. Schwartz introduced the results of an ad hoc Consultation on Coastal Dynamics and Shoreline Stability held in Curaçao, N.A., 15-17 August 1984, prior to the First Session of the IOCARIBE Sub-Commission. The Recommendations of the Consultations which were endorsed by the Sub-Commission, addressed, among others, the following requests to IOC and interested Member States:

(i) to convene a training workshop on coastal current measurement techniques including an arrangement for the compilation and publication of a manual on coastal measurements and sampling techniques with appropriate co-ordination with similar efforts of the UN(OETB) and the Unesco Division of Marine Sciences;

(ii) to find the means to convene a training workshop on techniques for monitoring beach changes ocnsidering, and co-operating with, a similar project of UN(OETB) and the Unesco Division of Marine Sciences;

(iii) to inform IOCARIBE Member States of the availability of relevant training courses in a timely manner.

3.3 CENTRAL EASTERN ATLANTIC

Dr. B. Akpati informed the Group about the activities in this region.

Referring to the report of the IOC Workshop on Regional Co-operation in Marine Science in the Central Eastern Atlantic (West Africa), (Tenerife, December 1983), he noted that the Member States do not have active research programmes in marine sciences, especially marine geology. The main reasons for this are the lack of training facilities in local universities of the region and few employment opportunities for marine scientists as a whole. The problems faced by Member States in training their scientists in advanced countries, for example, are scientists from the region who are trained abroad tend to be frustrated when they return home to work in less sophisticated laboratories, and with less sophisticated equipment and research vessels. This has resulted in the loss of trained personnel to the host countries or to the employment of trained personnel in fields unrelated to their training. To minimize this problem, technical training should, as much as possible, be conducted in the region using local available facilities.

In terms of research vessel facilities, he stated that at the present time, most of the research vessels in West Africa are fishing trawlers. However, these vessels can be modified to carry out hydrographic and geological research. Training in the use of shipboard equipment should be conducted for the region to facilitate and promote effective operation of available research vessels. Taking into account the potential resources of the continental shelf of the area, regional training centres, similar in conception to the existing Regional Aquaculture Training Centre in Nigeria (FAO Project), should be established with the purpose of obtaining the needed manpower in marine sciences, especially marine geology.

Regarding erosion, he indicated that this problem has caused extensive destruction of facilities along West African coasts. Unesco/IOC workshops and training of personnel on this topic, including the forthcoming Unesco/UN(OETB)/UNEP workshop on coastal erosion (Dakar, March 1985) will contribute to enabling the region to develop the skills to solve this acute problem.

3.4 SOUTH WESTERN ATLANTIC

Dr. L. Martins informed the Group about relevant studies in this region. He indicated that in the South-Western Atlantic there are several activities that can be implemented through OSNLR. Among them he mentioned the following ongoing or possible activities and problems:

(i) COMAR/COSALC Pilot Project on Coastal Lagoons. As result of several regional meetings (Caracas, November 1982; Porto Alegre, December 1983; and Mexico City, June 1984), a COMAR/COSALC Pilot Project on Coastal Lagoons for Latin America has been established. Taking into consideration the present state of knowledge, the lagoons of Terminos (Mexico), Unare-Tacarigua-Piritu (Venezuela) and Patos (Brazil) were selected for this purpose. The component of the project related to non-living resources could be implemented through OSNLR. Geological mapping (1:50,000) and detailed studies on peat, heavy minerals, diatomite and construction material, are considered on the various phases of the project.

(ii) Studies on submerged Pleistocene shorelines and placers along the continental shelf.

(iii) Surveys with the purpose of establishing regional detailed bathymetric charts.

(iv) Studies on short-term sedimentological episodes (like storms on continental shelf and gravity flows on the slope).

(v) Studies on marine geochemistry, mainly related to "upwelling" areas and carbonate and phosphate deposits.

As far as training is concerned, and as part of the COSALC pilot project, a course on coastal geology will be conducted in CECO, Porto Alegre, in March 1985. Other short-or medium-term courses could be implemented in the framework of OSNLR.

He added that with the purpose of improving OSNLR activities in the Western South Atlantic, the Guiding Group should encourage the establishment of a Regional Programme Group in the region.

3.5 RED SEA

Dr. M. El-Sayed summarized on major ongoing activities in this region.

He mentioned that the presence of metalliferous mud in some hydrothermal pools along the axial trough of the Red Sea, renewed earlier attention to the exploration of these sediments. A regional programme has been implemented since 1975 to explore, and then exploite these metal-rich sediments within the framework of the Saudi-Sudanese Commission for Development of Red Sea Resources. Therefore, earlier regional activities started in the

area on this particular aspect, and the know-how of several specialized organizations, were applied to this problem. Other regional programmes have been adopted through national institutions or through the Red Sea Programme of ALECSO. These combined efforts produced an excellent base of knowledge on the type and distribution of metalliferous sediments in the Red Sea. Activities encompassed training of national experts, publications, exchange of experience at different levels (basic and applied) and international co-operation, in general.

In spite of these activities, the coastal area has received little attention. Only in three areas is coastal marine research known to be actively underway; namely: Aqaba, Jeddah and Chardaga. Some little activity is known to be conduced in Port-Sudan.

The search for non-living resources in the coastal areas of the Red Sea, particularly coral reefs and carbonate sands/construction materials, is by far the most promising direction. Coral reefs by themselves are sites of water sports. Besides, they have a relationship to oil reservoirs and to retention of radioactive material.

The coastal stretch of the Red Sea, delineated by coral reefs for about 2,700 km on both sides, requires a detailed and thorough investigation. This could be fulfilled through:

(i) Training of scientists;

(ii) Training of technicians;

(iii) An adequate integrated regional programme;

(iv) Technological facilities.

At present, the Red Sea and Gulf of Aden programme (ALECSO) is co-ordinating activities in the area. IOC and ALECSO (Red Sea Programme) co-ordination is much required in the context of regional coastal studies. The Red Sea also presents an excellent opportunity for training individuals in the field of exploration and exploitation of metalliferous sediments in co-ordination with the Saudi-Sudanese Commission for Development of Red Sea Resources and the national bodies concerned.

3.6 MEDITERRANEAN SEA

Dr. M. El-Sayed was also invited to comment on this ocean region. He stated that erosion problems along the Mediterranean coastal stretch of Egypt have been pointed out since the beginning of the century.

Several environmental factors have led to the continuous erosion of the Nile Delta. A UNDP/Unesco programme was adopted in 1970 to study this problem and to provide the governmental organizations concerned with basic studies to help decision makers to establish a strategy to protect the area. This programme, which was started in 1971 and ended by 1978 has resulted in: basic studies, training of national scientists and technicians, and two workshops to review the progress in the study.

Egypt took this opportunity to organize its Institute of Coastal Protection which has continuously surveyed the areas of most serious erosion.

Coastal erosion is one side of the problem. The other is the loss of black sands (rich in rutile, zircon and opaques) due to reductions in the annual discharge of river deposits. Intensive mining of black sands increased the erosion of large areas. The suggested solution for the increasing demand for these materials is the study and exploitation of offshore placer deposits or old beach formations. This would require IOC cooperation to provide facilities for personnel to be trained especially as regards high resolution seismicity and techniques for routine analysis. A related workshop in general coastal geomorphology also would be very useful.

3.7 SOUTH-EAST PACIFIC

The IOC Technical Secretary briefly described some activities in marine geology and geophysics off the west coast of South-America. He pointed out that research efforts have been so far very limited, even for the coastal zone. He called the attention of the Group to the lack of communication between the governmental organizations that carry out or contract marine geological and geophysical surveys (including national oil companies) and marine geologists at academic institutions.

3.8 DEEP SEA DRILLING

Dr. P. Rothe and Prof. Nasu, were invited to provide input on this topic. They recalled that the Deep Sea Drilling Project (DSDP), by using D/V "Glomar Challenger" of the USA, started in 1968 and terminated its operations in 1983. In 1975, the exercise became known as the International Phase of Ocean Drilling (IPOD) when five countries joined the USA operation.

Drilling in the World's Oceans has caused a revolution in the earth sciences, the concept of plate tectonics was confirmed, earthquakes and volcanism can now reasonably be explained, and mountain building is no longer an enigma.

Geoscientists of many disciplines from all over the world have worked together and the project is probably one of the best examples of co-operation in international science.

The scientific results are now also applicable to economic geology. Some mineral deposits are located at or near plate boundaries, the role of passive continental margins during formation of hydrocarbons was recognized, and active ridges and spreading centers were found to be the locations of recent ore formation. Deep Sea Drilling therefore has an immediate impact on the future OSNLR programme.

At present, a somewhat modified continuation of the DSDP/IPOD programme is in a well-advanced planning stage. This new programme is known as the Ocean Drilling Programme (ODP). It requires a larger drilling vessel than the Glomar Challenger, and therefore the SEDCO/BP 467 was selected to enable scientists to drill deeper holes, and also to work in the more hostile waters of higher latitudes. Drilling techniques, at an advanced stage in the new programme, will also include riser-drilling.

Today Canada, France, the Federal Republic of Germany, Japan, and possibly the UK intend to join or have already signed the respective memorandum of understanding. It si most likely that the results of the ODP operations will again have an impact on the exploration of the earth's mineral resources, particularly those expected to be found in the oceans.

Therefore, IOC and UN(OETB) should follow closely, during further planning of the OSNLR programme, the activities and outcomes of this new Ocean Drilling Programme.

4. CONCEPT AND GENERAL STRATEGY FOR THE IMPLEMENTATION OF THE PROGRAMME

4.1 GENERAL STRATEGY

In order to identify areas where scientific research might be undertaken in support of non-living resources, the Group: (i) identified the types of deposits and materials that are now being exploited in the offshore or might be exploited at some time in the future; (ii) attempted to provide some indication of the existing relationship between worldwide development potential of these materials and the level of scientific attention given to them; (iii) considered the significance of the results in terms of discrepancies between the economic importance of the various deposits and the level of scientific attention given to them and; (iv) discussed efforts that could correct the imbalances, including the type of scientific work required, related IOC projects relevant to regional capabilities and equipment and, finally, implications from the standpoint of training.

4.2 REVIEW OF NON-LIVING RESOURCES

The Guiding Group compiled a "shopping list" of commercially interesting materials. Although it recognized that some materials, such as glauconite, are, on occasion, mentioned as having some economic potential, they were judged to be too speculative for consideration in the context of the Group's overview. The Guiding Group, therefore, did not wish to imply that the list is exhaustive.

Other types of deposits, including consolidated, hard rock or lode deposits (such as coal), were felt to be more relevant to onland resources in that they are exploited by underground extensions from land and did not need to be addressed in the context of marine science. Similarly, offshore deposits of sulphur and evaporites should, perhaps, be considered in the context of oil and gas in view of their structural and genetic relationship and the similarity of exploration/development techniques.

Because it was difficult to categorize some deposits such as phosphorites or manganese crusts into "seabed" or "shelf" deposits, the Guiding Group decided to compile a general annotated list that could, subsequently, group the materials into appropriate categories to correspond to scientific programmes and other efforts that might be undertaken.

The materials considered are graphically depicted in fig.1 and include:

SAND AND GRAVEL

Offshore supplies of sand and gravel are now supplementing land-based sources in many countries around the world (Canada, Cuba, Denmark, France, Netherlands, Japan, Nigeria, Sweden, USA, United Kingdom). Japan obtains about 33% (70 million tonnes in 1981) of its total sand requirements from offshore. In Great Britain, about 16% of its total sand and gravel production, or 10 million cubic metres, were dredged from the seafloor in 1979 and indications are that these percentages have increased substantially since then. Locally, the contribution of marine-derived sand and gravel can far exceed national averages; a case in point is London and southeast England where shortages of inland sources have led to more than 40% of the total regional consumption being derived from the seafloor. In addition, sand and gravel in the offshore can be an important source of construction materials for major projects such as the oil and gas drilling islands in the Beaufort Sea.

CARBONATE MATERIALS

In the offshore, interest in carbonates has focused on oolites, coral and shells. Offshore deposits of calcium carbonate supply raw material for aggregate and cement in a number of countries around the world, including Iceland, India, Fiji and the United States. The largest such operation is, at present, an industrial grade aragonite sand mining project off Cat Cay in the Bahamas. This huge deposit supplies segments of the US market for agricultural lime, cement, glassmaking, acid neutralization and stack scrubbers. Calcareous sands are also dredged from the coastal waters off the northwest and west of France for direct application to the acidic soils of Britanny. Also coral reefs (which are both a living and non living resources, depending on the perspective of the scientist) form not only an important source of offshore carbonate in some areas but also are a unique, fragile and finite environmental and recreational resource which requires continuous scientific investigations to ensure its effective management.

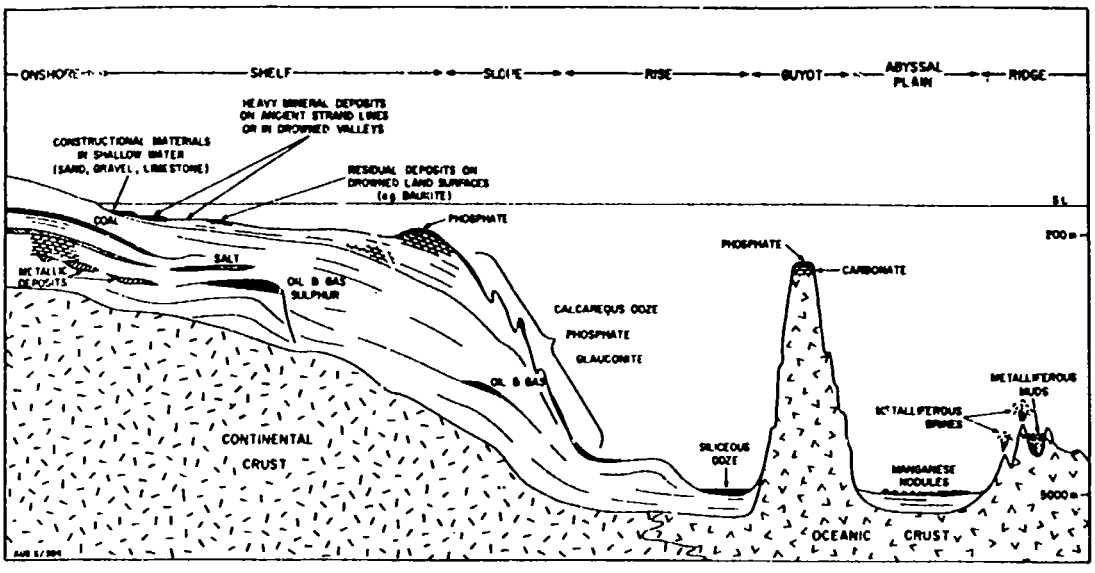

FIG. 1, - Schematic representation of the structure of the continental margin and adjacent ocean, and the location of mineral deposits.

From COOK, P.J. (1975) "Minerals from the Oceans" in 'Resources of the Sea', a Symposium arranged by the Royal Society of Tasmania, November 1974.

TABLE 1: Summary of global beach and offshore mining activities

Commodity	Country	Current Status
cassiterite (tin)	Indonesia; Thailand; U.S.S.R.;	offshore mining
	United Kingdom;	offshore pilot-scale mining
	New Zealand;	offshore exploration
	Australia	previous beach and offshore exploration
chromite (chromium)	U.S.A.;	previous beach mining and offshore exploration
	Mozambique	previous offshore exploration
diamonds	Namibia	beach and offshore mining
gold	Canada; New Zealand;	previous beach mining/offshore exploration
	Philippines;	previous offshore mining; present status unknown
	U.S.A.;	previous beach mining, offshore exploration and mining
	U.S.S.R.;	Offshore exploration/mining?
	Fiji;	estuarine mining operation
	India	offshore exploration
iron sands	Brazil;	beach mining
	Fiji; South Africa;	beach mining
	Japan;	previous beach and offshore mining
	Australia; New Zealand; Florida, U.S.A.;	previous beach mining
	Philippines;	previous beach mining, present status unknown
	Mozambique; S.W. India;	previous or ongoing offshore exploration
	Sri Lanka	beach mining, offshore exploration
monazite (rare earths and thorium)	Australia;	previous beach mining
	S.W. India;	offshore exploration
	Brazil; Sri Lanka;	beach mining
platinum	U.S.A.	previous beach mining, and ongoing exploration
rutile	Australia; Brazil; S.W. India; Sri Lanka;	beach mining, offshore exploration
	Canada	previous offshore exploration
zircon	Sri Lanka;	beach mining, offshore exploration
	Canada;	previous exploration
	Australia;	previous offshore exploration
	Mozambique	

Adapted from HALE, P.B. and Mc LAREN, P. (1984) "A Preliminary Assessment of Unconsolidated Mineral Resources in the Canadian Offshore", Bulletin of the Canadian Institute for Mining and Metallurgy, October 1984.

PLACER MINERALS

Placer deposits occur in such a wide variety of marine environments (see Table 1) that there is a correspondingly large number of possible origins. In low-latitude tropical and sub-tropical regions, intense chemical weathering of bedrock produces a thick overburden that may contain concentrations of gold, platinum, diamonds, and cassiterite. Other placer minerals include iron sands, rutile, zircon and monazite. However, thick soil cover and dense vegetation impede transport to the coast with the result that offshore placers tend to occur near river mouths or where the source is close to the present day shoreline.

In temperate and arctic climates, mechanical weathering is generally more important than chemical weathering in liberating heavy minerals from their parent bedrock. Furthermore, in glaciated regions appreciable volumes of material were transported to the continental shelves and then deposited as till and glacio-fluvial or glacio-marine sediments, leading to the formation of placers far removed from their sources. Further reworking by fluvial, coastal and marine processes is usually necessary to concentrate the placer minerals for economic exploitation.

PHOSPHORITES

Phosphorites, composed of calcium fluoro-apatite, occur as boulder to sand-sized particles that commonly form deposits on the continental shelf in several regions. Deposits offshore of southern California, Mexico (Baja California), Peru-Chile, Australia, Chatham Rise, the Southeastern United States, West Africa and other areas have received commercial attention. Although a combination of factors including market size, cost of recovery and institutional constraints, have inhibited exploitation, offshore sources offer an interesting alternative in phosphate poor regions.

The phosphorite deposits in the deeper waters of the open ocean occur on seamounts. Some are believed to be guano and subsided platform deposits which were then submerged due to a rise of the sea level or to tectonic events, and replacement of carbonates by the phosphate in upwelling waters. The distance to markets, depth of occurrence and comparatively small extent, may rule out the possibilities of their exploitation in most cases, although it could be locally important.

SILICA SANDS

Sands, composed mostly of quartz grains, are a potential source of silica for glass making and, possibly, foundry molds. Several generations of reworking are generally required to produce high quality material. Although significant deposits occur in offshore Finland and Canada, high quality deposits appear to be of limited regional extent.

SILICEOUS OOZES

Siliceous oozes, composed mainly of radiolarians and/or diatoms, cover large areas of the sea-bed below the calcium carbonate compensation depth (CCD). Even though the composition of these oozes is similar to pure siliceous sediments utilized on land, the great depth of occurrence will be a major constraint for their economic exploitation.

CALCAREOUS OOZES

Calcareous oozes composed mainly of foraminifera and clay minerals, cover large areas of the seabed in the tropics and sub-tropics above the CCD. As in the case of siliceous oozes, the great depth of occurrence is a major constraint to their exploitation.

POLYMETALLIC NODULES

Occurrences of polymetallic nodules are reported in almost all the world's oceans. The largest and most widespread occurrences are reported at depths of 3,000 to 5,000 meters in the Pacific, Indian and Atlantic Oceans. However, deposits with relatively high abundance and enriched in nickel and copper, are limited to parts of the Pacific and Indian Oceans.

METALLIFEROUS SEDIMENTS

Since the discovery of the Red Sea brine pools in 1949, several expeditions have studied this area and, in particular, the metalliferous sediments in the ATLANTIS-II Deep that are rich in several metals (eg, Fe, Mn, Cu, Zn, Ni, Ag, Au). While the ATLANTIS-II Deep has received the most attention owing to the presence of metalliferous sediments, many "deeps" containing metalliferous sediments have been discovered along the axial valley of the Red Sea and are being studied.

The Saudi-Sudanese Commission for the Development of Red Sea Resources is responsible for the exploration and exploitation of the metalliferous sediments. Several agencies are also cooperating with the Red Sea Commission e.g. Preussag, BRGM, USGS, etc. . The work to date has included a pilot mining operation and pilot plant for the recovery of metalliferous sediments and extraction of different minerals. The exploration phase for ATLANTIS-II Deep is nearly completed.

MANGANESE CRUSTS

Manganese crusts, sometimes enriched in cobalt, occur as coating on hard substrates such as basalt, in several regions. Typically found on seamounts where there is only a modest sediment influx, these deposits are being considered as a possible source of both manganese and cobalt. Some of the best known deposits are found at various depths on seamount chains in the central and western Pacific Ocean and Indian Ocean.

POLYMETALLIC SULPHIDES

Deposits of zinc and copper rich sulphides have attracted considerable attention in recent years. Commonly associated with the oceanic ridge system, particularly the fast spreading centres of the eastern Pacific, the deposits are formed of mounds and chimneys, often localized at the base of fault scarps. The discovery of active venting (black smokers for example) and the associated biological communities have become a focus of much scientific research. These deposits, and related deposits on slow spreading centres (manganese rich) and back arc basins, offer the possibility of learning new information on the genesis of sulphide deposits that seems likely to assist on-land exploration. At present we do not have sufficient information to assess the longer term economic potential of these deposits.

OIL AND GAS

At present, hydrocarbons are by far the most important marine mineral resource. It is now estimated that 30 to 40% of the remaining oil still to be discovered will be found offshore.

The formation of oil and gas requires the presence of organic source rock, a certain maturity stage and the presence of traps in form of protected porous sediments. Until now, such environment has been expected in marine environments not far from the continents which show organic rich sediments and high sedimentation and subsidence rates. In the near future, research on hydrocarbon resources in the marine environment will extend out to the deeper water areas along the continental margins. Down slope transport events on steep continental margins (e.g. slumps and turbidites) have been shown to be important mechanisms in bringing organic water sediments into the deep sea floor and in preserving the embedded organic water by rapid burial.

COASTAL ZONE (*)

The Guiding Group felt that mention should be made of the coastal zone as a non-living "resource". Because approximately 70 per cent of the world's population live in the coastal zone, there are tremendous pressures and demands exerted upon this fragile environment. It is, in fact, one of the most exploited and endangered regions on earth.

For a variety of natural causes, more of the world's shoreline is eroding than is accreting and, at the same time, there is a rapidly accelerating rate of development (residential, recreational, and industrial) along the coast. Mining of beach sands, construction on and across beaches (groins, jetties, bulkheads, seawalls, inlet channels), demolition of dunes, and extending buildings onto the foreshore, may only aggravate an already serious problem.

Pollution (human and industrial wastes) of beaches, estuaries, and the nearshore zone is intense in many areas and is, in many parts of the world (i.e. the Mediterranean Sea), rapidly exceeding all capacities for absorption. Ground water supplies in coastal areas and on oceanic islands are being endangered by salt water intrusions by over exploitation of coastal aquifer systems.

In this zone, dissolved and particulate fluvial inputs and their modifications during transits through estuaries and coastal waters are essential factors of the chemical budget of the Ocean. In large parts of the oceans, biological production is a function of the flux of nutrients and organic substances from the coastal zone.

(*) The Group defined the term 'coastal' to include the littoral zone and the shallow marine area extending to the shelf break.

4.3 ANALYSIS AND CONCLUSIONS

As a second step, the Group attempted to identify possible anomalies between economic significance and scientific effort for non-living resources on an average, global basis as opposed to a regional or national basis. Regional analyses is better left to individual groups whose regional information base far exceeds that available to the Guiding Group.

The analysis was done by means of a relative ranking that takes into account the Group's present appreciation of selected "measures". While regional information was discussed, the aggregate evaluation is more relevant to formulating global recommendations that could serve as guidelines for the broader IOC community. The consensus of the Group is presented in Table 2.

4.3.1 Grouping of resources in terms of scientific and/or economic importance:

Table 2. indicates that commodities can be considered to fall into three groups:

(i) those which are of no great economic or scientific interest on a global basis (silica sands, carbonate and siliceous oozes). The Guiding Group does not see this category of materials as warranting any global priority by IOC although it recognizes that these commodities may be important in some areas;

(ii) those which are of no immediate economic interest but are of considerable scientific interest: polymetallic sulphides, metalliferous muds, and polymetallic nodules and crusts. These merit consideration by IOC and UN(OETB) in the context of scientific research in support of longer term assessment and development;

(iii) those which are of economic interest but with a scientific interest ranging from high as in the case of oil and gas; intermediate as, for example, in the case of carbonate sediments, the coastal zone and phosphorites; to low scientific interest as in the case of placers, sand and gravel. The Group concluded that this third category, whilst of variable scientific interest, merits the highest consideration by IOC and UN(OETB) for the world as a whole because of its more immediate economic potential.

Table 2 : Comparison of Economic Significance and Scientific Effort

	ECONOMIC SIGNIFICANCE		SCIENTIFIC EFFORT	
	Availability	Economic Potential	Contemporary Interest	Level of Effort
Sand and gravel	A	A	C	C
Carbonate materials	A	B	C	C
Placer minerals	A	A	C	C
Phosphorites	B	B	B	B
Silica sands	C	B	C	C
Siliceous oozes	A	C	C	C
Calcareous oozes	A	C	C	C
Polymetallic sulphides	B	B	A	A
Metalliferous sediments	B	B	B	C
Manganese crusts	C	C	B	B
Polymetallic sulphides	B	B	A	A
Oil and gas	A	A	A	A
Coastal zone	A	A	B	A

Explanation of Table 2

"Availability" is intended to indicate how widespread, throughout the world ocean, deposits of the material are known or likely to be:

(A) abundant - in most or many of the regions
(B) common - in several regions
(C) limited - in only a few regions

"Economic potential" is intended to indicate the likelihood that some proportion of these deposits are now being exploited, or could be exploited in response to market forces at some time in the foreseeable future, say within 20 years:

(A) high - a significant number of deposits are being exploited and/or are likely to be exploited in the foreseeable future;
(B) medium - a few deposits are being exploited and/or may be exploited in the medium term or longer term
(C) low - it is unlikely that deposits will be exploited for quite some time

"Contemporary interest" is intended to indicate the rate of increase of scientific interest in the deposits and the number of researchers that are being attracted to closely related subjects:

(A) high - substantial increase in interest and scientists
(B) moderate - modest increase in interest and scientists
(C) low - little or no increase in interest and scientists

"Level of effort" is intended to indicate the relative amount of scientific effort that is presently being directed towards closely related subjects:

(A) high - a high level of effort
(B) moderate - a substantial level of effort
(C) low - a modest level of effort

4.3.2 Preliminary Regional Resource Assessment

The Guiding Group recommended that the IOC regional subsidiary bodies be encouraged to evaluate their own situation in order to identify needs and scientific projects that could form a regional approach to scientific research in support of non-living resources. Good planning was considered to be an essential first step to undertaking specific regional or national scientific programmes on non-living resources. This might include an assessment of their existing geological data base and an assessment of regional resources potential. A methodology for doing this on the basis of existing information has been developed by UN(OETB), successfully applied in at least two areas (West Africa and northern North America) and should be applicable to other regions such as Southeast Asia and the Caribbean.

An evaluation of the present level of ongoing scientific work relevant to offshore non-living resources and assessment of the availability of equipment and scientific personnel would also be valuable planning tools.

The Guiding Group concluded that IOC and UN(OETB) should encourage and assist Member States and the IOC regional subsidiary bodies, and organizations cooperating with the Commission, to compile data and carry out a preliminary resource assessment for planning purposes.

5. POSSIBLE WAYS FOR THE SCIENTIFIC IMPLEMENTATION OF THE OSNLR PROGRAMME

Based on their discussions, the Guiding Group reached some conclusions to be implemented by IOC and UN(OETB), which are summarized in the following sections.

5.1 GLOBAL PROGRAMME FOR NON-LIVING RESOURCES IN THE COASTAL ZONE

5.1.1 General

The Guiding Group stressed that the economic significance of both placers and sand and gravel was not consistent with the level of scientific effort devoted to them. For instance major oceanographic institutions are not, at present, involved in the study of these materials. It was suggested that these resources could be a subject which study should be encouraged regionally. In the case of phosphorites, the potential economic significance in some regions also suggested that deposits of this type warrant attention.

Because of the occurrence of placers, sand and gravel and phosphorite on the shelf and the general importance of the coastal zone, the Guiding Group felt that a significant scientific effort focusing on recent processes affecting the shelf and nearshore area (such as marine transgressions and sea level changes) could provide valuable scientific information. The Guiding Group also noted that because many relevant scientific projects can be undertaken with relatively inexpensive ships and equipment and can provide excellent training opportunities, high priority should be given to a scientific programme relevant to these "resources" and that possibilities for local, on-site, training opportunities should be explored.

The Guiding Group concluded that a world-wide programme should be conducted under the auspices of IOC/UN(OETB) in collaboration with other bodies such as CMG and Unesco to examine global sea-level changes and neotectonics over the past one million years and to establish the effects of these and related phenomena on depositional environments of the coastal and shallow marine zone and on the accumulation of non-living resources within that zone.

Understanding of the origin and formation of these deposits is considered vital for the development of deposit models and exploration concepts. It is therefore extremely important that basic scientific research on various types of marine mineral deposits be a component of any programme. Such studies would also provide an insight into the formation of similar mineral deposits in the geological past. Topics such as sea level changes have great bearing on an understanding of the accumulation of placer deposits, construction materials, carbonates (especially coral reefs) and of coastal zone dynamics, all of which are subjects of great economic significance to developed and developing countries alike. Similarly a resource-oriented study of placers, for example, may have an important "spin-off" in terms of understanding sea level change. Therefore it appears that there is a need of a project/programme which should be global in scope and which should bring together topics that should be both scientifically and economically important. The Group concluded that a global programme should be developed which will address the topic of coastal zone processes and the accumulation of non-renewable resources within that zone: this topic should be pursued within the framework of a broadscale scientific project entitled Sea-level changes, Environments and Tectonics during the past Million Years - SETMY.

5.1.2 Communication and Training for SETMY

The need for communication among all scientists, and for training of scientists from developing countries as part of SETMY is self-evident. For the most part, meetings and training courses should be conducted on a national or regional basis. However, half way through SETMY and also at the conclusion of SETMY, it may be desirable to hold meetings which would be global in scope and involve co-ordination with other relevant projects. The Guiding Group concluded that within the framework of SETMY, IOC and other interested bodies should endeavour to provide funding to encourage relevant meetings, workshops and training.

5.1.3 Training on Placers

The search for construction materials, notably sand and gravel, and the utilization in general of the coastal zone, are of great economic importance and should certainly not be neglected by IOC, UN(OETB) and other international bodies. However, the evidence before the Guiding Group indicates that for the world as a whole, placer deposits (heavy mineral sands, cassiterite, gold, diamonds) are considered by the developing countries to be of highest priority at this time. In view of the marketability of most of the placer-type commodities, the scale of the methods needed to explore for and extract these commodities (which overall is not "high tech") and the relatively low cost of these techniques, this perception would seem to be reasonable. Ways to proceed would include workshops, or, possibly, engaging a placer expert to provide advice and training courses and to conduct preliminary exploration and assessment programmes for placer deposits in developing countries. The Group concluded that a priority should be placed on training, exploration and assessment aimed at the search for and exploitation of placer deposits in the coastal zone.

5.1.4 Coordination with Related Phosphate Programmes

A number of developing countries are eager to locate indigenous sources of phosphate rock. IGCP Project 156 has been underway since 1977 and has developed a comprehensive programme on the geology of phosphate deposits on a world scale including phosphate exploration training courses for developing countries. The project now involves more than 30 countries.

Involvement in such a project would not only provide access to a large number of phosphate experts but would also be a cost-effective means for IOC and UN(OETB) to promote the participation of marine geologists from developing countries in the workshops and training courses conducted by Project 156 rather than attempting to organize its own phosphate project. As the emphasis of Project 156 will, for the next few years, be neogene to recent phosphorites, particularly those in the Caribbean, South American and African regions, it appears to be an appropriate time for IOC-UN(OETB) to explore this option probably as part of the TEMA programme of IOC. This should be done as soon as possible prior to the May 1985 meeting of Project 156.

The Guiding Group concluded that the IOC and UN(OETB) should explore the possibility of being co-sponsors of other international projects on phosphorite deposits, such as the IGCP-Project 156.

5.2 GLOBAL PROGRAMME FOR NON-LIVING RESOURCES OF THE DEEP SEA FLOOR

Scientific research as well as the exploration and exploitation of deep sea mineral deposits require large vessels, sophisticated equipment and trained scientific and technical manpower. Deep sea programmes on non-living resources will therefore require substantial funding, and advanced technology and know-how which, at present, are found in only a few countries.

It is expected that there will be an increase in interest in the scientific study and exploration of the deep seabed. The Guiding Group believed it is desirable that scientists from many countries have the opportunity to participate and contribute to research on the deep seabed and its resources. This will require greater co-operation between the scientists of many countries. The Guiding Group concluded that IOC and UN(OETB) should foster and encourage broader national involvement in deep seabed research and exploration and support appropriate training programmes by regional bodies and countries. In this context, it may be desirable for the IOC to be associated with the IGCP Group on Manganese Deposits. The Guiding Group also estimated it would be useful that in the framework of OSNLR, IOC and UN(OETB) encourage environmental and paleoenvironmental studies associated with the DSDP/ODP programme. This programme appears to the Group as one of the most relevant to develop knowledge on the mineral resources of the deep sea floor. The Guiding Group considered it would be likewise very useful to encourage participation of scientists of developing countries in this project.

5.3 OIL AND GAS

The identification of oil and gas resources, whether on land or offshore, is regarded as the highest resource priority by most countries. Because the search for oil and gas is so all-encompassing in its data requirements, new geoscience data may be relevant to oil and gas exploration. There is, however, no one field of investigation which could be pursued through IOC which would be likely to have a direct significant impact on a global scale. Nevertheless, the study of organic matter and organic geochemistry of sediments were considered important to the understanding of the maturation and formation of hydrocarbon deposits - particularly those of deep sea fan systems - and to provide an insight into the association of trace metals with sediments. Studies of this nature could be encouraged under various regional and national programmes.

Additionally, the geological requirements for the accumulation of oil or gas vary greatly from region to region. Consequently, the Guiding Group considered it would be desirable for each region to identify its own needs in terms of information and training and to develop its own programme directed at providing broad-scale geo-scientific information which will assist in the far search for oil and gas; the Guiding Group did not see the need to establish a global programme by IOC on this topic.

The Guiding Group concluded that regional groups should develop regional geological and geophysical programmes which would encourage and serve as a basis for the search for oil and gas and contribute to an assessment of development potential in their offshore and that IOC and UN(OETB) could provide appropriate assistance.

6. ENVIRONMENTAL CONSIDERATIONS

The Guiding Group considered that man is increasingly concerned with the possible impact of various activities on the marine environment as it is clear that some such activities will have undesirable effects. In this context it would be advisable to involve marine environmental scientists at the initial stages of a programme on non-living resources in order to identify potentially significant environmental effects and the type of baseline data to be collected. This approach, if linked with the early planning stage of commercial efforts, would help in developing better technology for mining and perhaps reduce the time required to bring an operation on stream. In addition, the data needed for environmental assessment are, in some cases, the same as those required for the scientific work on a deposit.

The Guiding Group recommended that the IOC and UN(OETB) consider contacting UNEP and invite their comments and possible involvement in this programme.

7. SUPPORTING ACTIVITIES FOR GENERAL AND REGIONAL COMPONENTS

7.1 EXCHANGE OF DATA

The Guiding Group was informed of the activities of the IOC Working Committee on International Oceanographic Data Exchange (IODE) by Dr. I. Oliounine of the Ocean Services Unit of IOC in advising the Member States on ways to encourage and increase the international exchange of marine geological and geophysical data and on technical matters involved in facilitating this exchange.

It noted with interest that WDC-A, Marine Geology and Geophysics (MGG), was established by ICSU during the last few years. Its data base on marine cores and dredges now contains over 50,000 entries and is being regularly used. The UN(OETB) continues to meet its obligations to Member States in the provision of data on deep-sea minerals and in the interpretation and evaluation of such data.

The Guiding Group invited Member States to take full advantage of available sources of information and data related to non-living resources, and stressed the importance and benefit for Member States in developing their own data bases related to non-living resources within their Exclusive Economic Zones.

In this regard, the Guiding Group recommended that IOC and UN(OETB) through WDC-A, MGG assist such efforts by providing data expertise, by identifying the types of data that should be collected, and by helping to design and establish national marine geological data management infrastructures.

7.2 OCEAN MAPPING

The IOC Technical Secretary introduced this item. He drew the Guiding Group's attention to Recommendation SC-IOCARIBE-1.4 for the preparation of International Bathymetric Charts for the Caribbean and the Pacific Coast of Central America at 1/1 M scale with the assistance of Mexico.

He informed the Guiding Group that IOC has formed a Consultative Committee on Ocean Mapping which is in charge of the co-ordination of all ocean mapping activities of the Commission.

GEBCO is publishing charts at 1/10 M scale which is less relevant for the OSNLR Programme. Larger scales are needed. From the experience of IBCM, various regional projects to compile bathymetric charts at 1/1 M scale are in progress in addition to those of IOCARIBE: West Africa (with the technical assistance of France), East Africa (with the technical assistance of the Federal Republic of Germany), and the Red Sea and Gulf of Aden (probably with the technical assistance of the United Kingdom).

The Guiding Group emphasized the need for more detailed and larger scale charting in support of future OSNLR projects, including the possibilities offered by new technologies such as sea-beam instrumentation. In this context it would also be desirable that IOC strengthen its liaison with the Commission for the Geological Map of the World (CGMW), its Sub-Commission for Sea Floor, in particular.

7.3 TEMA COMPONENTS OF THE OSNLR PROGRAMME

Dr. K. Kitazawa, IOC Assistant Secretary (TEMA), introduced this item. He pointed out that TEMA activities on non-living resources have been so far rather limited and mainly concentrated in the WESTPAC region. He added that the present TEMA policy is to ask for the definition of relevant regional activities by countries concerned, preferably through specific project proposals.

The Guiding Group considered that Training, Education and Mutual Assistance form an important component of the OSNLR Programme. Such activities could be described as follows:

7.3.1 Assistance to regional bodies/countries to develop OSNLR capacities

The Guiding Group noted that many Member States do not have active research programmes in the marine sciences especially marine geology. The reasons for the lack of active research are (a) lack of training facilities in local universities, (b) lack of employment opportunities for marine scientists as a whole.

To minimize this problem, the Guiding Group concluded that technical training should, as much as possible, be conducted in institutions of the regions with facilities available.

It also noted that some Member States acquire research equipment or vessels too sophisticated for their effective use/management. The IOC could provide on request expert advice on matters concerning research vessels and their multipurpose use.

Most of the Member States do not have sufficient financial support for requiring and maintaining sophisticated equipment and research vessels, and, if possible, consortia of research institutes and universities from Member States should be encouraged to conduct research in the different regions.

7.3.2 Related activities of the Unesco Division of Marine Sciences

Dr. A. Souzioumov (Unesco Division of Marine Sciences) was invited to present activities of the Division which are related to OSNLR. He explained that some of these activities have been undertaken in co-operation with other UN bodies or non-governmental associations and more are planned for the future. He reviewed ongoing activities as follows:

(i) 1982-1983

Unesco undertook a training workshop on methodology of interdisciplinary studies applied to estuaries and mangroves of West and Central Africa. This was undertaken within the framework of the COMAR project and had a coastal geological component. Furthermore, consultancy missions were carried out in two different countries of these regions in order to study coastal geomorphology and coastal processes.

A six-week intensive training course in offshore petroleum exploration was organized in Norway by Unesco, in co-operation with IOC, for countries of Africa and South Asia.

(ii) 1983-1984

In co-operation with the IOC, the Mabahiss/John Murray Symposium on the N-W Indian Ocean was convened (Alexandria, Egypt, 3-7 September, 1983). The results have been published and include a distinctive geological component.

A geological training programme for Mediterranean countries was organized, in co-operation with the IOC, at the Moscow State University. The programme consisted of shipboard training and research in shore-based centres.

A UNEP-funded project "Control of Coastal Erosion in West and Central Africa" has been executed in co-operation with UN(DIESA). A training workshop in coastal erosion processes took place in Togo in 1984. Two other workshops are scheduled for 1985.

(iii) Ongoing activities:

A preparatory phase for a training activity in the field of geological mapping of the continental shelf of Africa at a national level has been started with the preparation of a manual on the subject.

Other ongoing activities related to the OSNLR programme may be mentioned, such as preparatory activities for a seminar on the frontiers of marine geoscience and a seminar on passive continental margins and their natural resources. It is also planned to undertake a global survey of marine geoscience teaching and curricula at the post-graduate level.

7.3.3 Recommendations for TEMA components of OSNLR

The Guiding Group considered that, in some fields, especially in the scientific study and exploration of deep sea deposits, co-operation by means of pooling resources may be advisable (e.g., vessels, equipment and manpower). Such an approach should be fostered and encouraged.

The Guiding Group considered that a series of workshops and training programmes could benefit a number of countries and their scientists. The following subjects were identified for such workshops and training programmes:

(i) Planning for marine mineral exploration

(ii) Exploration for placer minerals

(iii) Studies of coral reefs and recent carbonate sediments

(iv) Marine geoscientific surveys from smaller craft

(v) Coastal zone processes

(vi) Scientific studies and exploration of the deep sea floor

The Guiding Group considered that these workshops/training programmes, especially those on placers, should be taken as a priority and that the IOC should approach some agencies of Member States (such as ICOD of Canada) to explore the possibility of supporting these programmes. In the same context, it stressed the usefulness of a co-ordination with the training facilities of the Unesco Division of Marine Sciences.

8. SUMMARY OF RECOMMENDATIONS

The Guiding Group emphazised the relevance and the need for scientific research in support of non-living resource development and expressed a number of general recommendations that reflect the global need for an increased effort and broad scientific involvement on the subject.

Recommendation 1

At the present time the Guiding Group suggested that priority, on a global basis, be given to non-living resources of coastal zones through SETMY and that countries and regions examine their economic potential, their needs and their expertise for involvement in this programme.

Recommendation 2

Training, particularly as it relates to coastal zones, placers, sand and gravel and carbonates, is given a high priority and should be a focus of effort by TEMA. Some training on phosphate deposits is also recommended.

Recommendation 3

The Guiding Group believes that IOC and UN(OETB) should be encouraged to play a significant role in assisting the regional subsidiary bodies of the Commission, and other appropriate regional bodies, in carrying out scientific investigations which will provide a basis for planning resource assessment, data collection and management, training and co-ordination.

Recommendation 4

Investigation of non-living resources of the deep sea floor comprises scientific challenges of high level. At present this research involves scientists from a few countries and there is clearly a need to actively work to expand opportunities for participation and training in deep sea research, particularly by scientists from developing countries.

9. IMPLICATIONS FOR PROGRAMME AND BUDGET OF THE CO-SPONSORING BODIES

The Secretary of IOC introduced this item. He informed the Guiding Group about the various sources of funding available to the Commission, namely: Unesco Regular Programme, contributions of Member States to the IOC Trust Fund and contributions in kind of organizations and Member States, such as secondment of experts to the Secretariat in Paris and/or to the regional subsidiary bodies of the Commission. The Secretary (and later Dr. Robles) gave some approximations of the level of funding assigned by IOC to the OSNLR programme during 1985 and also for the 1986-87 biennium, and emphasized that

these funds were mainly used to cover the activities of the Guiding Group, regional task teams, workshops and, if the programme evolves into specific project proposals, some consultancy time. The financing of projects was mainly envisaged from contributions of interested Member States.

Mr. R. Gruszka informed the Group that UN(OETB) has included in its regular budget, a budget line to support the activities of the Guiding Group and if project initiatives materialize in the future, it would be possible to consider some limited funding for them.

The Guiding Group appreciated this information and urged Member States and relevant organizations to provide adequate funding for project proposals emerging under the OSNLR programme.

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

Dr. N. Nasu proposed Prof. M. Vigneaux as Chairman for the intersessional period. This proposal was seconded by all participants and the Guiding Group unanimously elected Prof. Vigneaux as its Chairman for the intersessional period and the next Session.

Dr. M. El-Sayed proposed Dr. P. Cook as Vice-Chairman. This proposal was likewise seconded by all participants and the Guiding Group unanimously elected Dr. Cook as its Vice-Chairman.

11. DATE AND PLACE OF NEXT SESSION

The Guiding Group recommended that it meet again in about one to one and a half years, possibly at Unesco Headquarters, Paris or at UN Headquarters, New York, the final date and place to be arranged between the Group's officers and the Secretariats of IOC and UN(OETB).

12. ADOPTION OF THE SUMMARY REPORT

The Guiding Group adopted the Summary Report.

13. CLOSURE

In closing the Session, the Chairman expressed his appreciation to the Members of the Guiding Group for contributing to what has been a lively and efficient discussion. He underlined the need of developing sound scientific bases along with the exploitation of Non-Living Resources of the Ocean. He stressed the importance of determining the most pressing scientific priorities and he ensured Members of the Guiding Group that the Vice-Chairman and himself will do their best to give the OSNLR programme an appropriate follow-up.

He thanked the Secretary of IOC and the IOC staff involved, particularly the Assistant Secretary in charge of the Session, for the excellent arrangements provided. He extended his commendations to the representative of UN(OETB) for his active participation to the success of the meeting.

The meeting closed shortly before 13.00 on 18 January 1985.

ANNEX I

LIST OF PARTICIPANTS

MEMBERS OF THE GUIDING GROUP

Dr. P. Cook

Bureau of Mineral Resources,
Geology and Geophysics
P.O. Box 378
Canberra, ACT 2601
Australia
Tel: (062)499471
Cable: BUROMIN

Dr. M. Kh. El-Sayed

Department of Oceanography
Faculty of Science
Alexandria University
Alexandria
Egypt
Tel: 26242
Telex: 54467 UNIVY UN

Prof. I.S. Gramberg
(Unable to attend)

USSR Ministry of Geology
North Industrial Association of
Marine Geological Research
"Sevmorgeologia"
Naberezhnaya Moiky 120
Leningrad 190121
USSR

Dr. D.E. Hayes
(Unable to attend)

Department of Geological Sciences
Lamont-Doherty Geological Observatory
of Columbia University
Palisades, N.Y. 10964
USA
Tel: (914)3592900
Cable: LAMONTGEO

Dr. L.R. Martins

CECO/UFRGS
Instituto de Geociencias
Rua Gen. Vitorino, 255
90.000 Porto Alegre
Brazil
Tel: (512)21-70-33/21-04-69

Prof. N. Nasu

Technical Coordinator for Marine Geology and Geophysics, WESTPAC
University of the Air
Wakaba 2-Chome
Chiba, 260
Japan
Tel: 0472-76-5111

Dr. D. Pasho

Ocean Mining Division
Department Energy, Mines and Resources
COGLA
355, River Road
Ottawa
Canada K1A 0E4
Tel: (613)993-3760

Prof. P. Rothe

Geologie
Postfach 2428
Universität
D-6800 Mannheim 1
Federal Republic of Germany
Tel: (0621)292-5159

Dr. H.N. Siddique

National Institute of Oceanography
Panagi
Goa 403004
India
Tel: 4888
Telex: 0194-316
Cable: OCEANOLOGY, PANAGI

Prof. M. Vigneaux

Institut de géologie du Bassin d'Aquitaine
Université de Bordeaux I
351, Cours de la Libération
33405 Talence Cedex
France
Tel: (56)80-60-50

MEMBERS NOMINATED BY OTHER ORGANIZATIONS

Commission for Marine Geology (CMG)

Dr. B. U. Haq (Unable to attend)
Exxon Production Research Co.
P.O. Box 2189
Houston, Texas 77001
USA

Scientific Committee on Oceanic Research (SCOR)

Dr. S. Calvert (Unable to attend)
Department of Oceanography
University of British Columbia
6270 University Building
Vancouver, B.C.
V6T 1W5 Canada
Tel: (604)2283278

OBSERVERS

Prof. B.N. Akpati
Nigerian Institute for Oceanography
and Marine Research
Victoria Island
P.M.B. 12729
Lagos
Nigeria
Tel: 01-618-521
Cable: OCEANOGRAF LAGOS

Prof. M.L. Schwartz
Department of Geology
Western Washington University
Bellingham, WA 98225
USA
Tel: (206)676-3586

Dr. D. Krause
Director
Division of Marine Sciences
Unesco
7, Place de Fontenoy
75700 Paris
Tel: 568.39.69
Telex: 204461 PARIS
Cable: Unesco PARIS

Dr. A. Souzioumov
Division of Marine Sciences
Unesco
7, Place de Fontenoy
75700 Paris
Tel: 568.40.10
Telex: 204461 PARIS
Cable: Unesco PARIS

Dr. M. Stayaert
Division of Marine Sciences
Unesco
7, Place de Fontenoy
75700 Paris
Tel: 568.39.70
Telex: 204461 PARIS
Cable: Unesco PARIS

SECRETARIAT

IOC
Dr. M. Ruivo
Secretary
Intergovernmental Oceanographic Commission
Unesco
7, Place de Fontenoy
75700 Paris
Tel: 568.39.83
Telex: 20461 PARIS
Cable: Unesco PARIS

Dr. K. Kitazawa
Assistant Secretary
Intergovernmental Oceanographic Commission
Unesco
7, Place de Fontenoy
75700 Paris
Tel: 568.39.72
Telex: 204461 PARIS
Cable: Unesco PARIS

Dr. I. Oliounine
Assistant Secretary
Intergovernmental Oceanographic Commission
Unesco
7, Place de Fontenoy
75700 Paris
Tel: 568.39.78
Telex: 204461 PARIS
Cable: Unesco PARIS

Dr. F. Robles
Assistant Secretary
and Technical Secretary for the Session
Intergovernmental Oceanographic Commission
Unesco
7, Place de Fontenoy
75700 Paris
Tel: 568.39.79
Telex: 204461 PARIS
Cable: Unesco PARIS

IOC Consultant

Dr. C. Latouche
Institut de géologie du
Bassin d'Aquitaine
Université de Bordeaux I
351, Cours de la Libération
33405 Talence Cedex
France
Tel: (56)80-60-50

UN(OETB)

Mr. R. Gruszka
Senior Economic Affairs Officer
Ocean, Economics and Technology Branch
United Nations
2, U.N. Plaza
New York, N.Y. 10017
USA
Tel: (212)754-3926

ANNEX II

Twelfth Session of the IOC Assembly

Paris, 3-20 November 1982

Resolution XII-2

OCEAN SCIENCE IN RELATION TO NON-LIVING RESOURCES (OSNLR)

The Intergovernmental Oceanographic Commission,

A

Recalling Resolutions EC-XIV.19 and EC-XV.1 regarding a programme on Ocean Science in Relation to Non-Living Resources (OSNLR),

Having received with appreciation the report of SCOR on a Proposal on a Programme of Ocean Science in Relation to Non-Living Resources (document IOC-XII/8 Annex 2a) prepared with the assistance of the IUGS Commission for Marine Geology (CMG) and the Third International Workshop on Marine Geoscience (Heidelberg, July 1982) and submitted in response to the IOC request for advice on this programme,

Expresses its thanks to SCOR and the CMG (of IUGS), as well as to the ad hoc Group of Experts convened in the framework of the Third International Workshop on Marine Geoscience for their contribution to the formulation of the OSNLR Programme;

Adopts OSNLR as a new scientific programme of the Commission.

B

Recalling the endorsement by the Executive Council in Resolution EC-XIV.19 of collaboration between the IOC and the United Nations in the OSNLR Programme,

Noting that in preparation for OSNLR such collaboration has been initiated between the IOC and the Ocean Economics and Technology Branch (OETB) of the United Nations Department of International Economic and Social Affairs in the field of data on non-living resources, through the IOC Working Committee on International Oceanographic Data Exchange (IODE),

Noting further that a number of ongoing and planned activities of the United Nations (OETB) are directly relevant to components of the OSNLR Programme,

Invites the United Nations to co-sponsor the programme;

Requests the United Nations (OETB) to report to the Economic and Social Council on this programme;

Accepts with appreciation the offer of the Unesco Division of Marine Sciences to co-operate in specific components of the OSNLR Programme;

Establishes a Guiding Group of Experts on the Implementation of the OSNLR Programme, with terms of reference contained in the annex to this resolution;

Requests the group to report on progress to the Executive Council at its Seventeenth Session;

Requests the regional subsidiary bodies of the Commission to examine the OSNLR Programme with a view to identifying relevant components and to take measures for its implementation.

Annex to Resolution XII-2

TERMS OF REFERENCE OF THE GUIDING GROUP OF EXPERTS ON IMPLEMENTATION OF THE PROGRAMME OF OCEAN SCIENCE IN RELATION TO NON-LIVING RESOURCES (OSNLR)

1. To plan the further development of the OSNLR Programme, paying particular attention to methodological, technological and logistic aspects.

2. To provide scientific and technical advice to IOC regional subsidiary bodies involved in implementation of regional components of OSNLR.

3. To seek the co-operation of SCOR, CMG and the Unesco Division of Marine Sciences, as well as appropriate international regional bodies.

4. To liaise with IOC subsidiary bodies (e.g. the Working Committee on IODE) that might be able to contribute to various components of the OSNLR Programme.

5. To consider how best to ensure the participation of developing countries, by including TEMA components in the OSNLR Programme.

ANNEX III

REVIEW OF IOC REGIONAL ACTIVITIES CONCERNING OSNLR

1. WESTERN PACIFIC

During the Third Session of the IOC Programme Group for the Western Pacific (Townsville, Australia, 19-24 September 1983, Doc. IOC-WESTPAC-III/3), different aspects of the OSNLR programme were discussed by WESTPAC Member States. Prior to WESTPAC-III, an ad hoc experts consultation on OSNLR was convened in Townsville (Doc. IOC/WPOSNLR-ad hoc-I/3). The local experts proposed several programmes for the Western Pacific. They included two large scale research efforts, namely: studies on (i) Sea Level, Environment and Tectonics (SET), and (ii) on Margins of Active Plates (MAP). The experts group recommended that these two programmes should be considered as components of OSNLR in the WESTPAC region. These recommendations were adopted by WESTPAC-III.

At the CCOP/SOPAC-IOC-UNU Workshop on Basic Geo-scientific Marine Research Required for Assessment of Minerals and Hydrocarbons in the South Pacific (Suva, Fiji, 3-7 October 1983, IOC Workshop Report No. 35) three of the recommendations made, concern in particular the application of various technical and logistic possibilities:

- Recommendation No. 2: Desirability of the organization of an international expedition (Soviet proposal);
- Recommendation No. 3: Use of submersibles for the study of hydrothermal deposits;
- Recommendation No. 5: Improvement of satellite coverage.

The implementation of these recommendations could be beneficial methodologically to the development of the OSNLR programme. In pursuance of Recommendation No. 3, the organization of an International Workshop on the use of manned submersibles and remotely operated vehicles in the South Pacific has recently been announced. This Workshop, jointly sponsored by

CCOP/SOPAC-IOC-IFREMER-ORSTOM, will be held in Nouméa in September 1985. One of its objectives concerns the use of submersibles in the exploration of mineral resources.

Among the research projects reported on at the Suva Workshop, those covered by Committee B on "Distribution, Character and Genesis of Offshore Metallic Deposits" are directly relevant to the objectives of the OSNLR programme. They relate in particular to phosphorites, metallogenesis and volcanism, manganese crusts and nodules.

During the Workshop, an Ad Hoc Working Party on Mineral Resources of Nearshore Areas was also set up. Research objectives were decided on and ways of pursuing them were discussed. Lastly, a pilot project on sediment budgets in lagoons was planned.

At the Ninth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies in East Asian Tectonics and Resources (Kuala Lumpur, 11 November 1983, Document CCOP-IOC/SEATAR-(IX)/3), it was recommended that the SEATAR programme should be continued with the objective of filling in gaps in knowledge along the transects. It was requested that particular emphasis should be placed on the relations between tectonics and hydrocarbon and mineral occurrence. Lastly, it was recommended that special interest should be taken in the South China Sea region, regarded as a model for the evolution of a passive margin sedimentary basin.

2. CARIBBEAN AND ADJACENT REGIONS

Prior to the First Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions (SC-IOCARIBE-I), an Ad Hoc Expert Consultation (Curaçao, 15-17 August 1984, document SC-IOCARIBE-I/3, Annex IV) considered questions relating to coastal area dynamics which are, for various reasons, of very considerable importance to the different Member States in the region. They are also of direct relevance to the development of the OSNLR programme.

Among the questions considered, those concerning shoreline stability (erosion, growth) are of particular economic importance for many countries in the region. The need to establish detailed geomorphological charts as an essential basis for the monitoring of sedimentary processes led the group to put forward Recommendations Nos. 8 and 9 concerning respectively the organization of a workshop on techniques for the monitoring of beach evolution and the preparation of geomorphological charts.

The expert group also discussed questions concerning coastal pollution, environmental protection and resource management. With due regard for the diversity of the problems facing Member States and the disparities between their scientific and technological capabilities, the group recommended (Recommendation No. 12) that each state should define a pilot study area. In each of these areas, studies would be made of the various aspects of the sedimentary processes (sediment movements, associated pollutant transfers, accretions, erosions, etc.). Studied by local specialists, alone or in collaboration, these pilot areas would be open to other Member States or other states and would serve as models from which all the scientists involved in IOCARIBE could learn.

Lastly, the group recommended that a list of regional experts in coastal problems should be drawn up.

3. NORTH WESTERN AND CENTRAL WESTERN INDIAN OCEAN AND ADJACENT WATERS

During the First Session of the IOC Programme Group for the Co-operative Investigations in the North and Central Western Indian Ocean (Nairobi, Kenya, 4-9 October 1982, Doc. IOC/CINCWIO-I/3 rev.) it was agreed that it was important to have bathymetrical and geomorphological charts of near and offshore areas as a basis for regional investigations in mineral resources. Consequently, the Programme Group recommended the preparation of an International Bathymetric Chart of the Western Indian Ocean (IBCWIO) under the aegis of IOC, similar to other projects, such as IBCM.

At a symposium held on the occasion of the 50th anniversary of the MABAHISS/John Murray Expedition, 1933-34, (University of Alexandria, Egypt, 3-7 September 1983, Unesco Report in Marine Sciences, to be issued shortly), the development of marine sciences in the north-western Indian Ocean and adjacent waters was reviewed. Various papers were delivered and round-table meetings were organized, making it possible to state what had been achieved in the marine geosciences. Among the projects described, several are of particular relevance for the development of the OSNLR programme.

- Geology and geophysics:

  . surficial sediments in the Northern Red Sea and the Indian Ocean;

  . nature of aseismic ripples and plateaux;

  . exploration of marine minerals.

- Chemical oceanography:

  . chemical budgets in semi-closed basins;

  . chemistry of upwelling areas in the North Western Indian Ocean;

  . flows of the Indus;

  . base-line levels of heavy metals;

  . influence of deep sea mining in the Red Sea;

  . particles chemistry;

  . pollution.

4. CENTRAL EASTERN ATLANTIC

A workshop of Member States from Western Africa, convened in Tenerife (12-17 December 1983, Doc. IOC Workshop Report No. 34), expressed its views about the importance of high quality bathymetric charts in regard to OSNLR, coastal erosion in particular. It was stressed that bathymetric, sedimentary and structural data concerning the continental shelf should be gathered first, and then data about the margin and the slope. Mapping of mineralogical data was also recommended.

A recent report from the Nigerian Institute for Oceanography and Marine Research, Victoria Island, Lagos (Progress Report No. 2, April 1984, "Coastal Erosion Research Programme: Work accomplished in 1983") is a round-up of the studies carried out in 1983 on coastal erosion in Nigeria. It emerges from that report chat the combined effect of the presence of nearshore submerged canyons and the building of various coastal installations and river dams leads to a sediment deficit which is reflected in considerable coastal erosion and shoreline recession. For these degradations to be studied, a coastal sediment dynamics programme would have to be organized involving physical oceanographers, geomorphologists and sedimentologists. This type of study, designed to bring about an improvement in knowledge of sediment movements in nearshore areas, would offer an opportunity to develop the OSNLR programme.

ANNEX IV

LIST OF ACRONYMS AND ABBREVIATIONS

ALECSO	Arab Educational, Cultural and Scientific Organization
BMR	Bureau of Mineral Resources (Australia)
BRGM	Bureau de Recherches Géologiques et Minières (France)
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
CECO	Centro de Estudios de Geologia Costeira e Oceanica (Brazil)
CMG	Commission for Marine Geology
COMAR	Unesco Major Interregional Project on Research and Training Leading to the Integrated Management of Coastal Systems
COSALC	Coastal Systems of Latin America and the Caribbean
DSDP/IPOD	Deep Sea Drilling Project/International Phase of Ocean Drilling
DSDP/ODP	Deep Sea Drilling Project/Ocean Drilling Programme
FAO	Food and Agriculture Organization of the United Nations
GEBCO	General Bathymetric Chart of the Oceans
IBCM	International Bathymetric Chart of the Mediterranean
ICOD	International Centre for Ocean Development (Canada)
IGCP	International Geological Correlation Programme
IOC	Intergovernmental Oceanographic Commission
IOCARIBE	IOC Sub-Commission for the Caribbean and Adjacent Regions
IODE	International Oceanographic Data Exchange
OSNLR	Ocean Science in Relation to Non-Living Resources
RNODC	Responsible National Oceanographic Data Centre
SCOR	Scientific Committee on Oceanic Research
SEATAR	CCOP-IOC Joint Working Group on Post-IDOE Studies on East Asia Tectonics and Resources
STAR	CCOP(SOPAC)-IOC Joint Working Group on South Pacific Tectonics and Resources
TEMA	Training, Education and Mutual Assistance in the marine sciences
UNDP	United Nations Development Programme
UN(DIESA)	United Nations, Department of International Economic and Social Affairs
UNEP	United Nations Environment Programme
USGS	United States Geological Survey
WDC	World Data Center
WESTPAC	Western Pacific, Programme Group for the Western Pacific