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INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
(of Unesco)

Twelfth Session of the Assembly

Paris, 3 - 20 November 1982

ANTON BRUUN MEMORIAL LECTURES 1982

Wednesday, 10 November 1982, Unesco House, Salle II

S U M M A R I E S

The BRUUN Memorial Lectures were inaugurated in memory of Dr. Anton Frederick Bruun (Denmark), first Chairman of the Intergovernmental Oceanographic Commission who died on 13 December 1961 whilst holding this office.
The lectures are held biennially during the IOC Assembly and this year will be on the theme "Ocean Science for the Year 2000".

14.30 - 14.40	Introduction	Dr. Neil J. Campbell (First Vice-Chairman)
14.40 - 15.20	Future Research on the Ocean Floor and What Lies Beneath It	Dr. M. Talwani (U.S.A.)
15.20 - 16.00	Future Research in Biological Oceanography	Dr. M.V. Angel (U.K.)
16.00 - 16.10	Break	
16.10 - 16.50	Future Research in Ocean Chemistry	Prof. Dr. D. Dyrssen (Sweden)
16.50 - 17.30	Future Research in Physical Oceanography and Climate	Prof. Dr. K. Hasselmann (F.R. Germany)

Texts of the lectures and a résumé of the discussions will be published in the IOC Technical Series.

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FUTURE RESEARCH ON THE OCEAN FLOOR AND WHAT LIES BENEATH IT

by Dr. M. Talwani
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ABSTRACT

Research in marine geology and geophysics - exploration of the floor of the ocean and what lies beneath it - will be full of excitement in the coming decades. There are challenging scientific problems which are sure to attract the best scientific minds and the research has important practical uses which should ensure its financial support. Among the research problems that will engage the scientists are:

The geological structure and history of continental margins, particularly with a view towards exploration for hydrocarbons.

The study of 'active' continental margins, the causes of earthquakes, volcanic eruptions and other natural hazards and their prediction.

The study of processes at the mid-ocean ridges by which new crust is produced and the generation of metallic ores at these locations.

The study of the deep ocean floor, the study of manganese modules that lie on it and consideration of the possibility of using the deep ocean as a site of radioactive waste disposal.

The study of sediments on the continental slopes and the suitability of such for such areas for locating man-made structures on the ocean bottom.

The study of sedimentary layering at the ocean bottom and the derivation from it of past climatic succession and the prediction of climatic variations in the future.

For many of the studies mentioned above the development of new technology and the deployment of present technology to large unexplored parts of the ocean, is essential. The history of marine geology reveals that most major advances have resulted directly from major technological advances and that connection is certain to continue to exist in the future.

FUTURE RESEARCH IN BIOLOGICAL OCEANOGRAPHY

by Dr. M.V. Angel
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ABSTRACT

There are three main objectives for the sensible and rational use of the oceans firstly to protect the processes which maintain life in the oceans, secondly to manage its renewable resources so that they sustain maximum yields, and thirdly the maintenance of genetic diversity. To attain these objectives biological oceanography needs to develop a predictive capability. It needs to pass through three main phases a) descriptive, what occurs where, b) functional understanding, how does the ecosystem function and how fast are the processes taking place, and c) predictive understanding, the development of a body of theoretical knowledge that can be used to predict the short and longer termed effects of natural and man-made perturbations of the system.

Biological oceanography faces a range of problems, some but not all in common with other branches of oceanography. There is the shear volume of the oceans, the complexity of biological systems, the dependence of biological work on a fundamental understanding of physical and chemical processes which force many of the biological responses, and the slowness with which biological sampling is converted into data.

There are five main areas where advances are needed in 1) the understanding of lower food web dynamics particularly in the measurement of primary production, the appreciation of the significance of primary production by nanno- and picophytoplankton, and the role played by micro-organisms and microzooplankton; 2) higher food web dynamics, how food webs are structured, and how energy, nutrients and organic material

flow and cycle through food webs; 3) how ecosystems function as a whole, to establish how experience and knowledge gained from one system can be applied or extrapolated to others; 4) the importance of time/space scales in influencing our concepts of oceanic ecosystem function, is it possible to extrapolate from scales that relate to an individual organism's ambit or life expectancy to those that reflect year-to-year or longer-term climatic or geological-time scale variations. A trend at one scale may be merely noise at a larger or longer scale. 5) The special problems of coastal ecosystems which are the main interface between the oceans and man's exploitation for food, transport, disposal of waste, recreation, energy, minerals and land reclamation, these problems are highlighted by the designation of E.E.Z's giving management of ocean resources to coastal states which lack the skilled manpower and research resources they need, to avoid making the same mistakes made by the states whose rapid industrial development outstripped their marine management skills.

The development of interdisciplinary interaction within oceanography is proving to be a real stimulus to scientific advance. Biological oceanography is providing important contributions to general biological knowledge and theory. It also offers the best potential source of information on the factors controlling recruitment to fish stocks; our inability to predict recruitment is the major stumbling block to our efforts to manage these stocks effectively.

Advances in science are very much dependent on advances in technology. Biological oceanography is inhibited by the inadequacy of techniques for measuring primary productivity, pelagic and benthic sampling, the capture and maintenance of living oceanic organisms, the conversion of samples into data and the management and dissemination of the data. Much of this technology is relatively trivial compared with the technology required for the Big Sciences of astronomy, fundamental physics, and defence science. Yet, in the long term, Mankind is more likely to survive on this, our only planet, because of the advances in biological oceanography, than anything achieved in the more spectacular sciences.

FUTURE RESEARCH IN OCEAN CHEMISTRY

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ABSTRACT

Marine chemistry deals with seawater as a medium for chemical reactions and their dependence on pressure and temperature. Chemical oceanography is concerned with the distribution of seawater constituents. This distribution is not only governed by general chemical relationships (laws), but to an equally great extent by biological, geological and mixing processes. The study of ocean chemistry has therefore not only a great impact on ocean sciences including the best use of ocean resources, but may also increase our basic knowledge of chemistry and natural products.

Pollution research during the last decade has deepened our understanding of essential natural processes and pathways of different elements and substances in the sea. At the same time our ability to evaluate and cope with pollution hazards has been improved. Pollutant measurements will certainly be carried out also during the next two decades. The sampling and analytical capabilities have improved considerably during the last decade and will continue to do so. The advance of our knowledge in the chemistry of the oceans will depend on the ability of the oceanographers to use up-to-date knowledge in different branches of chemistry and maintain an analytical capability by continual upgrading and incorporation of new techniques. The most advanced computerized techniques are costly, which calls for the

establishment of a few well-equipped international laboratories. The sites of these laboratories should cover economical important areas, and they should also provide training courses for advanced research in ocean science to the benefit of all nations. In addition research vessels should be designed with clean sampling areas and clean air laboratories that can accomodate advanced instrumentation and allow first-rate trace chemistry work on board.

FUTURE RESEARCH IN PHYSICAL OCEANOGRAPHY AND CLIMATE

by Prof. Dr. K. Hasselmann
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ABSTRACT

Understanding the role of the oceans in climate has been repeatedly stressed as one of the most urgent priorities of the world climate research programme. An attack on this problem requires a new approach to ocean modelling and a long term ocean measurement strategy. This in turn must be guided by the models. New techniques for remote sensing of the ocean from satellites could aid significantly in a global ocean measurement strategy. However, an optimal sampling strategy for long term ocean measurements based on a combined system of conventional instruments and satellites has yet to be defined. The problems are discussed and illustrated with some results from an ocean climate model.