INTERNATIONAL INDIAN OCEAN EXPEDITION

NEWSLETTER

INDIA

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INTERNATIONAL INDIAN OCEAN EXPEDITION

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INDIA

No. 3 DECEMBER, 1963

Indian Programme

The Indian participation in the International Indian Ocean Expedition for 1963 includes the monsoon and post-monsoon cruises of the ships INS Kistna and R. V. Varuna

INS Kistna

The monsoon cruises of INS Kistna as mentioned in the previous Newsletter were completed towards the end of September, 1963. The last one of the planned cruises had to be abandoned following a minor accident while towing of NOMAD weather Buoy. Below are given the details of observation and collection so far made since September, 1962 to date:

1) Total No. of cruises — 15 (including the training cruise).
2) Areas covered — Arabian Sea, Southern & Central Bay of Bengal, Northern Indian Ocean between 70°-85°E.
3) No. of stations occupied — 352
4) No. of water sampling & Plankton stations — 352
5) Total No. of Bathythermograph lowerings — 620
6) Temperature observations — 4500
7) No. of salinity analysis completed — 4342
8) No. of estimations for dissolved oxygen — 4045
9) No. of analysis for nutrients — 1340
10) *p*H. determination — 55

In addition, in all these stations Radiometric studies, collection of surface meteorological data and studies of upper atmosphere by sending up radio-sondes, were made.

Besides this, during some of the earlier cruises, micro-biological work was also carried out to study the various physiological groups of micro-organisms present in the marine environment of the Indian Ocean with special reference to the study of the sulphate-reducing organisms which are stated to be responsible for the occurrence of various "Abiotic Zones." A summary of these observations is presented below:—

Twenty-eight sea-water samples were collected by Nansen reversible bottles from various depths ranging from 70—3000 meters, between

longitude 60°-70° East and latitudes 15°-18° North.

After preliminary inoculation of the samples into various media which also included enrichment media for the isolation of sulphate reducing, nitrate-reducing and cellulolytic organisms, the cultures were brought to the shore laboratories.

This isolation process resulted in forty-four pure cultures and their detailed study of morphological and physiological activities, in turn, resulted in the identification of 29 different isolates which included mostly Gram-negative and Gram-positive bacilli belonging to the Pseudomonas, Achromobacter, Flavobacterium and Barvibacterium. These bacteria are found to form the normal flora of the ocean and have been reported in almost all types of marine environments.

R. V. Varuna

The monsoon programme of R. V. Varuna was completed as scheduled and has started her post-monsoon cruises. The details regarding the observations and collections during monsoon cruises are yet to be received.

DATA Centre

Preliminary work connected with establishing a Data Centre (Indian Ocean Data Centre—I.O.D.C), as was mentioned in the Newsletter No. 2 is in progress. The rate of arrival of data from various participating institutions/organisation is still very slow. It is, however, expected that within the next few months sufficient data would have been received and the work of classification and storage would commence at the Centre, although dissemination would take some more time.

Indian Ocean Biological Centre: Ernakulam

The Indian Ocean Biological Centre showed satisfactory progress in all of its activities. Its staff position has improved and more persons are now available for the sorting of standard collections. A slightly modified procedure for the sorting of samples is being tried by the Curator with a view to speeding up the sorting work. According to this, sub-sampling and sorting of a certain percentage of the total sample (depending upon the displacement volume and other factors) is being done, instead of sorting of the entire samples. The detailed report on the sorting of samples for this quarter from the Curator is awaited.

Sorting of samples in progress at Indian Ocean Biological Centre.

International Meteorological Centre: Bombay

The research vessels "ANTON BRUUN" "ATLANTIS II" and "JALANIDHI" transmitted surface and radiosonde reports while surface reports were received from "DISCOVERY II".

The following computer programme has been written and tested:—

1) Checking coded radiosonde message and recomputing for 50 mts intervals.
2) Checking ship observations and computing the heat budget.
3) Computing divergence and vorticity using Bellany's triangle method.
4) Computing particle trajections from wind data.

Other programmes are being developed;

30,000 ship observations and 6,000 radiosonde observations have been entered on punch cards. Microfilming and back-plotting of data are also under way.

New Stations at Diego Garcia (61967) and Mahe in the Seychelles (63981) began radiosonde ascents early in September 1963. The Diego Garcia station is operated by the Mauritius Meteorological Service with help from the U.S. National Science Foundation. The station at Mahe is an important United Kingdom contribution to the International Indian Ocean Expedition.

Programme of other countries

FRANCE

The Naval ship *Commandant Robert Giraud* carried out hydrographic observations and dynamical studies in the north western region of the Indian Ocean from 3rd July to 19th October, 1962. During its voyage of 1556 miles the following observations were made:

One hundred and eleven hydrographic stations forming 19 sections between the Gulf of Aden and Latitude of 25° S; 2,250 water samples for salinity determinations and 2,250 temperature measurements:

Recording of surface currents with GEK during about 50% of the total cruise, particularly in the Mozambique channel; total of 61 GEK current measurements;

113 temperature recordings by Bathythermograph; 16,400 cards and current floats release; meteorological observations at each hydrographic station.

The preliminary results of the surface temperature analysis indicate evidence of important upwelling along the African coast near 8°N.

INDONESIA

The Indonesian Research Ship "*Jalanidhi*" has brought the flag of Indonesia into the fleet of scientific vessels participating in the IIOE. (A brief description of the vessel already finds mention in the IIOE Newsletter No. 2) This year, in three cruises, the *Jalanidhi* has been able to study salinity, temperature and oxygen & phosphate contents of waters of the Indian Ocean off the western coast of the Island of Sumatra. The data have been forwarded to International Data Centre serving the Indian Ocean Expedition. There they will be compared against observations made by vessels operating at the same time in other parts of the Indian Ocean.

SOUTH AFRICA

Research ship *Africana II* carried out a third cruise (273) in April 1963, from Cape Town to Marion Island and back to Cape Town. During the cruise the following disciplines were investigated on the outward passage: Temperature and salinity 23 stations; oxygen 21; phosphates 20 (total phosphurus 6); zooplankton 23; phytoplankton 12; phytoplankton productivity measurements 15 and gravity coring at two stations. Continuous observations were made of birds, animals and surface fish, waves, sea surface temperature (thermograph), local weather and bottom contours (echo sounding). Rock samples were collected by scuba divers at Marion Island.

U.K.

RRS Discovery and *HMS Owen*.—Carried out geological and geophysical studies between late August and early December. The studies largely are concerned with the Ocean floor in the Arabian Sea. Scientists from the Department of Geodesy and Geophysics from Cambridge University and the National Institute of Oceanography have taken part in the cruises under the leadership of Dr. M. N. Hill of Cambridge University.

Among the several problems whose solutions have been sought, one of the most important is to obtain evidence as to movements, during geological time of the seafloor of the ocean and of continental blocks over this floor. In the Arabian Sea there is a great opportunity of finding out

more about these movements. Another important problem is concerning the mid ocean ridges like the Carlsberg Ridge and to elucidate information on the following lines:—

"What forms these mid ocean ridges? How old are they and why do they occur parallel to the continental boundaries in so many parts of the world? How is it that at the northern end the Carlsberg Ridge at first sight appears to disappear in Arabia?"

Investigations have been carried out on the thick sedimentary formation at the shore line of East Africa. More detailed information on the nature and causes of this formation will be obtained from the joint work of *Discovery* & *Owen* using the seismic method of exploration (which involves firing a chemical explosive in the sea and recording, at a distance, the waves from these explosions which have travelled through the sea floor). It was planned that in this joint exploration *Owen* would be using 100 depth Charges. *Discovery* also planned single ship and shorter-range seismic operations using 10 tons of explosives.

The following details of the seismic operations carried out jointly by *RRS Discovery and HMS owen* have been furnished by Lt. Cdr. I. J. Bharadwaj, I.N., who participated in the programme.

"Seismic Operations"

Object: The main purpose of seismic investigations was to determine the crusted structure between the gently sloping ocean floor between Kenya and Seychelles, since there is geophysical evidence (gravity and magnetic) that this area, though deep ocean, in general is not typically 'Oceanic'.

Operations: (a) *R.R.S. Discovery* moved to the profile position and moored a Dan buoy with radar reflector in about 2,000 fathoms of water. She then carried out a quick current check and then laid a set of radio sono buoys on either side of the dan in a N.E.—S.W. direction, slightly towards the direction from which the current was flowing. She then moved towards the dan and lowered one hydrophone to the bottom of the sea and another midships to about 200 fathoms depth.

The forward hydrophone wire had a 'pinger' attached to it at 200 meters from the hydrophone which had a mercury switch to activate it. The pinger gave the depth of water and so indicated if the hydrophone was resting on the bottom or not. Five minutes before the firing of the charge, the hydrophone was lowered to the bottom, the mercury making the electric contact when it became horizontal.

The sono buoys contained hydrophone receivers, amplifier and transmitters.

(b) During this period *Owen* would move on to the starting position which was generally 040°-15 miles from the dan buoy. She then steered 040° course firing one depth charge every half hour.

(c) The echoes of the explosions were received by *Discovery* on her main recorder directly by her hydrophone and from the sono buoys as transmitted by them. The recorder is a 12 channel galvometer recorder, recording on photographic paper sensitive to ultraviolet light. No developing is needed as the records become immediately visible.

(d) When the sound reaches one of the sono buoys or ship's hydrophones it penetrates a varying voltage which is amplified and transmitted and received by the main recorder.

(e) The first event recorded on *Discovery* is the noise of the shot radioed from *Owen*. The ground waves come next and finally the direct sound which has travelled through the sea water.

(f) The sound passes through water and bottom rocks. While passing through the rocks, the sound waves are refracted depending on the acoustic properties of the rocks and are finally received by sono buoys. As sound travels faster in rocks than in sea water the ground wave is received earlier than the water wave.

(g) The records are then analysed to find the velocity of sound in the layers of earth under the

sea."

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The summary of the preliminary findings of *RRS Discovery* during her biological work in the upwelling region along the North East Arabian coast has been obtained from the Report of the British National Committee on Oceanic Research and is given below:—

In the first cruise the ship sailed from Aden on 23rd June to commence the survey off the South Arabian Coast. Plan of survey consisted of six lines of stations about 200 miles long running normal to the Arabian Coast at intervals of about 120 miles. The first of these lines commenced at Ras Fartak (52°E) and this point was reached at 1600 hrs on June 25.

The station routine consisted of the following:

1. Water sampling at standard depths: 0, 10, 20, 30, 50, 75, 100, 150, 200, 250, 300, 350, 400, 450, 500, 550, 600, 650, 700, 800, 900, 1000, 1200, 1400 1600, 1800, 2000, 2500, 3000 m etc.
2. Bathythermograph lowering to 720 m.
3. Current profile to 100 m with attached temperature/salinity/depth probe.
4.* Chlorophyll measurements at fixed depths, 0, 20, 40, 60, 80 and 100 m.
5. Vertical haul with 50 cm diameter phytoplankton net (N50V) from 100-0 m.
6. Vertical hauls with 70 cm diameter 200 μ mesh zooplankton net, metered for depth and flow, in the layers 50-0, 100-50, 200-100, 500-200, 1000-500 m.
7.* Vertical haul with Indian Ocean Standard Net from 200-Cm.
8.* Bottom grab (0-1 m² spring grab).
9. On completion of station, a 15 min. tow with a neuston net at 5 kt.

Underway observations between stations and between lines of stations consisted of continuous echosoundings, half-hourly BT Lowerings and Neuston net hauls in selected positions. The first survey had shown the general distribution of the upwelled water along the Arabian coast and pointed to the presence of comparatively intense upwelling in the vicinity of Ras al Madraka Islands —Pronounced discoloration caused by the bloom of *Gonyaulax* was observed in the month of August in the vicinity of these stations.

*These observations were usually made only at alternate stations.

Meteorology

Throughout the cruise, continuous records were maintained of wet and dry bulb air temperature, total incident radiation and net radiation flux. Further instrumental and visual observations of barometric pressure, wind direction and velocity, cloud cover etc., were recorded at four hourly intervals and at all station positions.

The period during which the ship was working in the Arabian Sea was the time of greatest intensity of the south-west monsoon and indeed clear of the Gulf of Aden the wind was remarkably constant in direction blowing from 210-220° true with an average strength of force 5-6. In general the wind seemed to be stronger away from the coast and, on some lines of stations, gales of up to force 9 were encountered in the region well off shore. Close to the coast the weather was generally fairly calm but winds up to force 9 were encountered around the Kuria Muria Islands. The coastal weather appeared to be characterized by more variability and comparatively rapid changes occurred. This may to some extent be related to the actual position of the Intertropical Convergence which evidently runs along the south coast of Arabia.

Air temperatures were typically high in the offshore region, usually ranging between 25° and 27° C whereas close to the coast temperatures of 22° to 23° C were regularly encountered. Humidity throughout the region was consistently high and frequently in the vicinity of the coast thick mist or even fog was encountered—a typical atmospheric characteristic of most upwelling regions.

Radio-sonde ascents in the Arabian Sea could not be made due to heaviness of the weather.

Echo soundings

Soundings were obtained along most of the ship's track during the cruise. All soundings have been entered on plotting sheets which have already been given a limited circulation and bathymetric profiles have been drawn from each line of stations.

Currents :

The following observations were made during the cruise:

70 Vertical profiles of relative currents using direct-reading meters, in most cases to 100 m depth, some to 200 m. At 25 of these, radar fixing was sufficiently accurate to make allowance for the ship's movement thereby giving absolute currents.

81 surface-current vectors deduced from the discrepancies between dead reckoning and observed positions. Leeway due to the transverse component of wind has been allowed for, using a factor deduced from current-meter observations when lying to.

6 surface drogues were followed for periods of 3 to 12 hours each.

6 neutrally-buoyant floats, at depths between 75 and 360 m, were tracking for periods of 14 to 65 hours.

Summarizing the current measurements, we have predominantly north-eastward flow at the surface close to the coast, turning more towards south-east farther offshore. At depths of the order of 100 metres, there appears to be movement in towards the coast at stations near the continental slope. with relatively weak currents farther out. At about 200 m depth, the currents are weak and tend to be opposed to the prevailing surface current.

Off Karachi, a *Trichodesmium* bloom was encountered, lying in a long lane down wind. Samples were being collected. It was found a convergence of 3 cm/sec. into the lane, with less than 1 cm/sec. shear across it in the direction of the wind.

Temperature and Salinity

Observations on temperature indicate that the coldest surface waters were confined to the immediate proximity of the coast and away from the coast the temperature rose irregularly. Detailed survey made around Kuria Muria Islands shows the presence of large eddies at some points along the coast. A tongue of warmer water was found extending east from Gulf of Aden.

Salinity was worked out at different sections but over-all features are common to most of the sections—a highly saline surface layer offshore and separated from the coast by water of lower salinity. At greater depths there was a irregular but pronounced salinity maximum at the level of out flow of water from end Red Sea and Gulf of Aden.

On a number of occasions during the passage of the ship, very sudden changes of surface temperature accompained by similar discontinuities in salinity occurred over short distances.

Besides salinity, routine analysis were made for dissolved oxygen, inorganic phosphates, nitrate and silicate. Some specialized analysis were also made at some selected stations. These include estimation of ammonium nitrogen, albuminoid nitrogen, trace metals and permanganate oxidizable material in filtered water. Measurements were made of ultra-violet absorption of filtered samples and of the volatile fraction of filtered water and samples were taken for particulate carbon, nitrogen and phosphores estimations. Details were being worked out from these observations.

A collection of about four or five hundred insects of different orders was made during the survey. The only truly pelagic insect, *Halobates*, was well represented in the collections of the neuston net and this material should provide some useful distributional information.

U.S.A.

The second part of the 4th cruise of R.V. *Anton Bruun* started from 11th November, 1963 from Bombay under the leadership of Dr. A. T. Pruter and is still on covering the northern part of the Arabian Sea. Besides, the routine observations on oceanography, greater emphasis is being laid on fishing programme by different type of gear. The Indian National Committee on Oceanic Research has nominated three Indian scientists—Dr. C. V. Kulkarni, Dr. H. G. Kewalramani both from Government of Maharashtra and Mr. J. R. Naidu from Atomic Energy Establishment, Bombay to participate in this cruise of Anton Bruun. This cruise is scheduled to terminate at Karachi.

U.S.S.R.

Information on the observations and findings by the U.S.S.R. Ship R.V. *Vityaz* during her 35th cruise in the eastern Indian Ocean is now available. The cruise, which lasted 5 months from 23rd June, 1963 was under the leadership of Prof. B. L. Bezrukov, a well known Russian marine geologist.

Major scientific tasks of the expedition were the following:

i) Characteristics of the surface and deep water circulation in the tropical zone of the Indian Ocean during the summer monsoon; process of turbulent mixing.
ii) Study of oceanic frontal zones;
iii) Zonal structure of the ocean along the meridional section 91°E.
iv) Hydro-optical characteristics of the water masses;
v) Study of the geological structures of the bottom and sediment thickness by acoustic & seismo-acoustic methods;
vi) Distribution of sediments and mineral resources of the ocean bearing upon its geological history.
vii) Primary production.
viii) Study of the biological structure of the ocean and locating new fishing grounds.
ix) Chemical process in the Ocean.
x) Radio-activity analysis.

Apart from these problems the Research Vessel *Vityaz* took part in international intercalibration work on methods of hydrochemical analysis and primary production in Perth, Australia, and carried out comparison of performances of different kinds of plankton nets.

During this cruise, the total length covered was 20,800 miles, total length of echo-sounding tracks 19,100 miles and the total number of stations covered was 137.

Main scientific findings of the cruise can be summarized as follows:—

System of water circulation in the region was found to be very different from that in the period of the winter monsoon. It comprises the following major elements:—

a) the weak current caused by westerly winds occupying a wide zone south of 10° S,
b) the trade wind current between 5° and 10° S;
c) the monsoon current north of 5° S;

The maximum measured speed of the monsoon current was 180 cm. per second towards the east. Under this current a deep westward counter current was found with a maximum speed of about 70 cm. per second.

Geological studies during this cruise were particularly extensive. The region of the so-called Mary Augustine Bank between Sunda strait and Australia was studied and though the position of this Bank indicated on the map was not confirmed, two steep underwater mountains rising from depths of 5500 m to 2474 m and 3726 were found and scientists considered that the existence of a shallow bank in this region is not impossible.

The deep underwater troughs were followed one along 30°—32° S towards the west from Australia with maximum depth of 5761 m and another, called the Chagos trough, previously discovered by the 33rd cruise of *Vityaz* with maximum depth of 5408 m.

Analysis of data collected during three cruises of *Vityax* and also during some other expedi-

tions led to the conclusion of the existence in the north east part of Indian Ocean of a vast meridional ridge running from the south eastern part of the Bay of Bengal to 32°—34° S covering a distance of 2600 miles.

Considerable work was done on the sediments and also on ferro-manganese nodules.

The ichthyological group obtained during the cruise a very good collection of deep water and pelagic fishes comprising no less than 325 species of 115 families. Other results of fishes' studies may lead to certain conclusions concerning future grounds of Tuna fishing. Particularly extensive were collections of pleuston.

NEWS : FOREIGN

Intergovernmental Oceanographic Commission

1) *Special wave lengths proposed for automatic stations used by oceanographic Research Buoys.*

The allocation of special radio wave lengths to automatic data stations used in oceanographic research has been recommended by oceanographers and tele-communication specialists from sixteen countries in a meeting held in September in Unesco House, in Paris.

The meeting, called by the Intergovernmental Oceanographic Commission, was attended by experts from Belgium, Canada, Chile, China, Cuba, the Federal Republic of Germany, France, India, Italy, Monaco, the Netherlands, Norway, the Philippines, the United Kingdom, the United States of America and the U.S.S.R.

Oceanography is now making use of observations by fixed buoys equipped with instruments and transmitting data automatically by radio. However, the development of this technique, considerably cheaper than oceanographic vessels for certain purposes, is hampered by the fact that the frequencies used by these buoys have already been completely allocated. In other words, there is a risk that the buoys will be jammed by other stations or, in fact, that they will act as "Pirate Stations."

Only an administrative Conference convened by the International Tele-communications Union has the power of reallocating ferquencies and granting oceanographers the wave lengths they require. Since no conference of this nature is planned for the near future the experts meeting at UNESCO suggested that, as an interim measure, a 3.5 kilocycle band be allocated to automatic data stations from frequencies allocated to Maritime Mobile service.

It was also suggested that a plan for the use of frequencies by automatic data stations be developed by the International Tele-communications Union so that Oceanographers will be able to extend their use.

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Special Committee on oceanic research

A detailed report of the symposium on general scientific Framework for the comprehensive study of world oceans held at the Bedford Institute of Oceanography, Halifax, Canada on April 6 and 8, 1963 is now available. One of the most interesting items in the report is a brief note presented by Bochnecke on the testing of current meters.

Two ways of testing current meters are possible.

1) Use of a channel or tank, in which the instrument is towed with a certain speed over a certain distance. A presumption for this method is that the channel is long, wide and deep enough so that the influence of the random eddies along the bottom or the walls may be avoided. This method gives only the response of the current meter to the speed but not to the direction.

2) Field test in the open sea. Here a "fixed point" is necessary. This can be given either by anchoring a ship or a buoy or a number of buoys (taut wire, slack wire, or a combination of both for mooring the instruments) to which the instruments are attached. For the types of free floating bodies (Swallow, Drogues) the fixed position could be obtained either by a marker buoy or one of the modern navigational aids developed recently.

It is suggested to carry out these field tests in two regions:

(a) On the continental shelf in an area with tidal currents, flat bottom and small turbulence. This procedure could give the opportunity to compare current meters at various speeds (zero to, say about, three knots) and varying directions during a tidal period of 25 hours.

(b) at a larger depth of the ocean (possibly on a sea mount), where currents are slower and have irregular directions in the course of time.

For (a) a period of 3 or 4 days ships-time excluding the way to and from the selected position could be sufficent.

For (b) a period of about one week is proposed.

For both experiments a region and season should be chosen where the weather is fairly good and the sea not too rough. One or two ships could do some useful work and throw a new light on the complicated problem of current measuring.

Before starting such experiments an inquiry should be made on those types of current meters which are mainly used in our days, so that obsolete ones could be neglected.

Lomonosov Counter Current

G. P. Ponomarenko of the USSR's Marine Hydrographical Institute, describes an attempt to discover an undercurrent in the Atlantic Ocean corresponding to the Cromwell countercurrent in the Pacific Ocean. The measurements were made during the tenth voyage of the *Mikhail Lomonosov*. The measurements were made by automatic current device attached to anchored buoys; these operated to a depth of 1200 m for periods from 26 to 62 hours and recorded at 5-minute intervals. At six stations the currents were measured simultaneously with two buoys spaced 24 miles apart. From 4,500 current measurements taken at 17 stations it was established that there is a deep countercurrent in the Atlantic corresponding to the Cromwell counter current; this has been named the "LOMONOSOV DEEP EQUATORIAL COUNTER CURRENT." However, according to Ponomarenko, the Lomonosov and Cromwell counter currents differ in the following respects:—(a) the Lomonosov counter current is considerably less strong than the Cromwell current, (b) the maximum velocity of the Lomonosov counter current—116 cm/sec.—is at a depth of about 50 m whereas in the Cromwell counter current maximum velocity of 150 cm/seç. is at a depth of about 100 meters, (c) the lower boundry of the Lomonosov counter current is above 200 m, whereas in the Cromwell countercurrent it is at about 300 m; (d) at a distance of about 2 miles to the south of the Equator and near 30° W the Lomonosov countercurrent lower boundary is less than 100 m. In the Atlantic ocean near the western boundary of the Gulf of Guinea, at a depth of 800 m, there is a second deep countercurrent with a maximum velocity of 15 cm/sec. and a direction of 42°. Ponomarenko recommends that an effort be made to find an equivalent countercurrent in the Indian Ocean.

(N.O.D.C. Washington, D.C., U.S.A. Newsletter No. 8—63)

Automatic Oxygen Measurements

Even in this mechanical age, the oceanic research workers cannot help the slowness of research vessels and the time consuming measuring technique. But radical improvements in instrumentation are appearing. As in case of Thermistor Chain and Salinometers which gave complete pictures of temperature structure of the upper water layers and salinity and temperature respectively, it is now possible to do the same for oxygen. A small electrode mechanism attached to the end of the hydro wire can indicate continuously oxygen tension in the ship's laboratory as the wire is payed out. The electrode can also be used to measure the oxygen in a water sample brought on deck in a Nansen bottle.

The electrode is nothing more than a small button of platinum and a surrounding ring of silver. These are covered by a thin film of poly-

ethylene. A drop of alkali is contained behind the film. The drop is the liquid medium in which the electro-chemical action of the polarographic measurement takes place. The device depends entirely on the property of the plastic film. It allows oxygen to pass through but excludes the salts of the sea water. Thus the platinum polarograph can operate behind the polyethelene without the usual interference from these salts. A small battery which supplies a polarizing potential, completes the apparatus. A current is generated which is directly proportional to the oxygen tension. The platinum 'sees' through the oxygen-permeable plastic film. One can read this current on a meter or have it continuousy traced on a recorder.

This method has been applied to such tasks as monitoring the oxygen in a whale's breath and so to measuring photosynthesis in sea weeds under Arctic ice.

(Oceanus—Vol. X No. 1-Sept. 1963)

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French oceanographic research vessel

The New French Oceanographic Research Vessel, "*Coriolis*," designed for expeditions in French oceania in the Pacific was launched on October 31, 1963 at the channel shipyards in Dieppe.

The 37 meter long ship equipped with physics and biology laboratories and electronic equipment will sail to its base, Noumea in New Caledonia next year, after a south west Pacific cruise.

("Statesman"—New Delhi)

Indian national committee on oceanic research

Two meetings of the Working Group on "Coastal and Nearshore Oceanography" constituted by the Indian National Committee on Oceanic Research were held at Cochin on 21st September, 1963 and New Delhi on 22nd November, 1963 to work out details of the scientific programme under this discipline. Among the various problems examined and suggested by Working Group, the most important were:

(i) Collection of wave data with the help of shore-based wave recorders.
(ii) Observations on coastal currents & Littoral movements.
(iii) Mud-Banks and their role in causing coastal erosion and silting.
(iv) Oceanographic data which will aid in evolving coastal protection measures.

Miscellaneous:

Dr. D. N. Wadia, Chairman of the Indian National Committee on Oceanic Research recently visited the Indian Ocean Biological Centre, Ernakulam, Indian Naval Physical Laboratory and Oceanographic Research Wing at the Naval Base, Cochin. He also went on a short cruise on board R/V *Varuna* to observe the operation of oceanographic and the other equipment on board the vessel.

Dr. D. N. Wadia at the Indian Ocean Biological Centre, Ernakulam.

Dr. N.K. Panikkar, Director, Indian Programme of the International Indian Ocean Expedition and Member-Secretary, Indian National Committee on Oceanic Research attended the inaugural ceremony of NOMAD at Madras harbour and said on the occasion that U.S. had a large share in the development of techniques to

set up unmanned weather and other observation stations.

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The Oceanographic Research Wing at Cochin hitherto under the National Geophysical Research Institute, Hyderabad has now been transferred to the organization of the Indian Ocean Expedition with effect from November 13, 1963. This is being renamed as Indian Ocean Physical Oceanography Centre (IOPOC) and will be engaged in physical oceanographic studies connected with the Indian Programme.

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It is proposed to bring out a number of scientific publications on marine Sciences, so that sufficient literature will be available in India for the benefit of research workers in different disciplines. For the purpose of the ready reference for the identification of copepods a booklet entitled "A Key to the identification of marine copepoda in the waters along the west coast of India" by L R. Kasturirangan has been published.

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Under the auspices of the Smithsonian Institution a two day Conference on "on distribution of specimens" was held in the National Science Foundation building in Washington, D.C. on Dec. 5-6, 1963, to discuss and develop policies concerning the distribution of specimens to taxonomists for research and/or identification for subsequent Museum curating of specimens. Approximately 40 persons representing various museums, Universities and agency personnel attended the Conference. The Indian Programme of the International Indian Ocean Expedition was represented by Dr. Vagn K. Hansen, Curator of the Indian Ocean Biological Centre and Dr. R. R. Prasad of the Central Marine Fisheries Research Sub-station, Ernakulam.

The main purpose of the Conference was to focus attention on the large volume of materials which will be received by the Smithsonian Oceanographic Sorting Centre from the International Indian Ocean Expedition, the International Co-operative Investigation of Tropical Atlantic, the U.S. Antarctic Research Programme and the many agency cruises that result in the collection of biological materials and to discuss about the distribution of collections including custody of materials, record keeping, distribution of type specimens and of representative series from collections, ownership of collections, the final distribution of specimens to appropriate repositories in the U.S. and abroad, selection of experts and screening of requests for specimens and publication of availability of specimens.

Publications received

1. International Marine Science—Nos. 1, 2 and 3
2. IIOE-Intergovernmental Oceanographic Commission—Information Paper No. 4.
3. UNESCO—Bulletin-No. 14, July 1963.
4. C.S.I.R. News—Vol. 13, No. 19-October 1963.
5. Introduction to the National Oceanographic Data Centre.
6. NODC-Washigton-Newsletter, No. 8--63.
7. IIOE Newsletter of Japan No. 3-1963.
8. Oceanus —Vol. VIII Nos. 1 to 4
   Vol. IX Nos. 1 to 4
   Vol. X No. 1
9. BNCOR—U.K. Scientific Programmes during IIOE-1961-64.

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