



No. 2, June 1979

DEEP-SEA NEWSLETTER No. 1 was very well received. The Editor acknowledges with thanks the considerable work by our voluntary "agents" in duplicating and distributing the newsletter in their home countries (which were listed in No. 1). I am still eager to receive suggestions for broadening the circle of countries and thus of persons receiving - and contributing to - the newsletter.

Quite honestly I had hoped to receive more contributions to the present issue, both before and after a reminder. Well, everything takes its time, and we should all be grateful to those who did initiate us in the progress of their work.

The next issue will be ready around the turn of the year, provided I receive contributions. The deadline is 1 December 1979. I look forward to receiving contributions from institutions, groups or individuals, either reports as the present ones, interesting details from own research, information about not easily available publications, research requests, etc.

Torben Wolff
Editor

PUBLICATION OF FOUR SYMPOSIA

held during the Joint Oceanographic Assembly, Edinburgh, September 1976

The papers read at four of the Symposia held during the Joint Oceanographic Assembly (Edinburgh, 13-24 September 1976) have now been published by the International Council for the Exploration of the Sea as volume 173 of its *Rapports et Procès-Verbaux* series, after revision by the authors and editing by the conveners.

The four symposia are:

- S 11 Controlled Ecosystem Experiments (Convener: Dr. T.R. Parsons)
- S 8 Dynamics of Ecosystems (Convener: Professor B.-O. Jansson)
- S 5 Biological Effects of Ocean Variability (Convener: Dr. A.R. Longhurst)
- S 7 Oceanography and Fisheries (Convener: Mr. G. Sætersdal)

The title of the volume is *Marine Ecosystems and Fisheries Oceanography*. It contains 240 pages with 200 illustrations. The price of the volume is Danish Kroner 100,- plus mailing costs, and it may be obtained from the Secretariat of the International Council for the Exploration of the Sea, Charlottenlund Slot, DK-2920 Charlottenlund, Denmark.



Seabed Working Group - Fourth meeting, Albuquerque, 5-7 March, 1979

The Seabed Working Group, a sub-group of the Radioactive Waste Management Committee of the Nuclear Energy Agency of the OECD, was established in 1976 to co-ordinate the various national research efforts on the problems of seabed disposal of high level radioactive waste. The SWG covers all aspects of seabed disposal of high-level waste and is organised into a number of Task Groups to consider specific areas, including one dealing with biology. At this fourth meeting of the Group the biology Task Group had the following representation:

Art Yayanos	Scripps, U.S.A.	Chairman
Bob Hessler	Scripps, U.S.A.	
Leo Gomez	Sandia Labs., U.S.A.	
Yves Belot	Centre d'Etudes Nucleaires, Fontenay-aux-Roses, France	
Myriam Sibuet	COB, Brest, France	
Werner Feldt	IBF, Hamburg, Germany	
Barry Hargrave	Bedford Institute, N.S., Canada	
R. Ichikawa	Nat.Inst.Rad.Sci., Chiba, Japan	
Mike Holden	MAFF, Lowestoft, U.K.	
Tony Rice	IOS, Wormley, U.K.	

Although only the USA have an existing research programme specifically to investigate the biological problems of high level radio-active waste disposal, several countries, including France, W.Germany and the U.K. in Europe, seem to be on the verge of beginning such programmes. Moreover, the existing deep-sea programmes in all of those nations represented on the Task Group include aspects which are directly relevant to the waste disposal problem even though they may not be specifically directed towards this end.

During the two days of Task Group meetings the representatives exchanged information on current and planned programmes in their institutes or nations and went on to identify the following main areas of research requirements, assigning each to one of three broad categories of priority. (The order is mine and not that in which they were considered by the meeting.)

High priority:

1. Basic biological studies (including reproductive strategy, migrations, trophic relationships and longevity)
2. Primary productivity
3. Standing stock profiles
4. Sediment trap experiments
5. *In situ* metabolism experiments
6. Microbiology
7. *In situ* experiments with radionuclide tracers, with neutron activatable elements and with trace elements
8. Measurements of concentration factors
9. Theoretical analysis and models

Medium priority:

1. *In situ* biocorrosion
2. Radiosensitivity

Low priority:

1. Effects of containers on the ecosystem
2. Chemical effects of waste on the ecosystem

International collaboration

This was the first meeting of the Biology Task Group to include representatives from all member and observer nations of the S.W.G. Although the need for collaboration at many levels, including internationally, was clearly recognised, no specific plans for such collaboration were made at the meeting. However, in the discussion of *in situ* tracer experiments a strong recommendation was made for an international and interdisciplinary workshop on the possibilities of tracing radioactivity in deliberately labelled marine ecosystems to be held within the next two years.

Next meeting

This was tentatively scheduled for England, March 3-6, 1980.

A.L. Rice, IOS, Wormley, U.K.

News from the Institute of Oceanographic Sciences, Wormley

Forthcoming Cruises

May/June 1979, *Challenger*. Nigel Merrett will join John Gordon (SMBA) in a cruise to trawl in the Rockall Trough and Porcupine Sea-Bight.

June/July 1979, *Challenger*. IOS Benthic/Midwater cruise. Porcupine Sea-Bight.

Sept./October 1979, *Discovery*. IOS Physiology cruise, but with benthic and deep mid-water sampling in the Porcupine Sea-Bight and off the north-west African coast.

Gear

Continuing our quest for a more efficient quantitative gear to collect benthic and near-benthic macro-fauna, we have produced yet another version of our epibenthic sledge, this one with an additional opening/closing net above the original sledge hopefully to catch animals swimming about 1 metre above the bottom. The resulting increase in height of the sledge frame will allow us to mount the camera more nearly vertical and should produce better photographs than hitherto. The new gear will be used for the first time during the *Challenger* cruise of June/July and, with luck, we should be able to report on its effectiveness in the next issue of the Newsletter.

Research

As usual, our research topics are progressing more slowly than they should and we have nothing significant to add to what was included in the first Newsletter.

One piece of work, however, is inexorably drawing to same kind of conclusion. The INCAL samples collected during the joint cruise on the *Jean Charcot* during 1976 are now sorted. It is very doubtful whether the results are at all significant, but we will be joined at Wormley by our colleagues from Brest for two days during May to try to sort out the data. At the end of the meeting we will probably throw the numbers away in desperation!

Recent French deep-sea activities

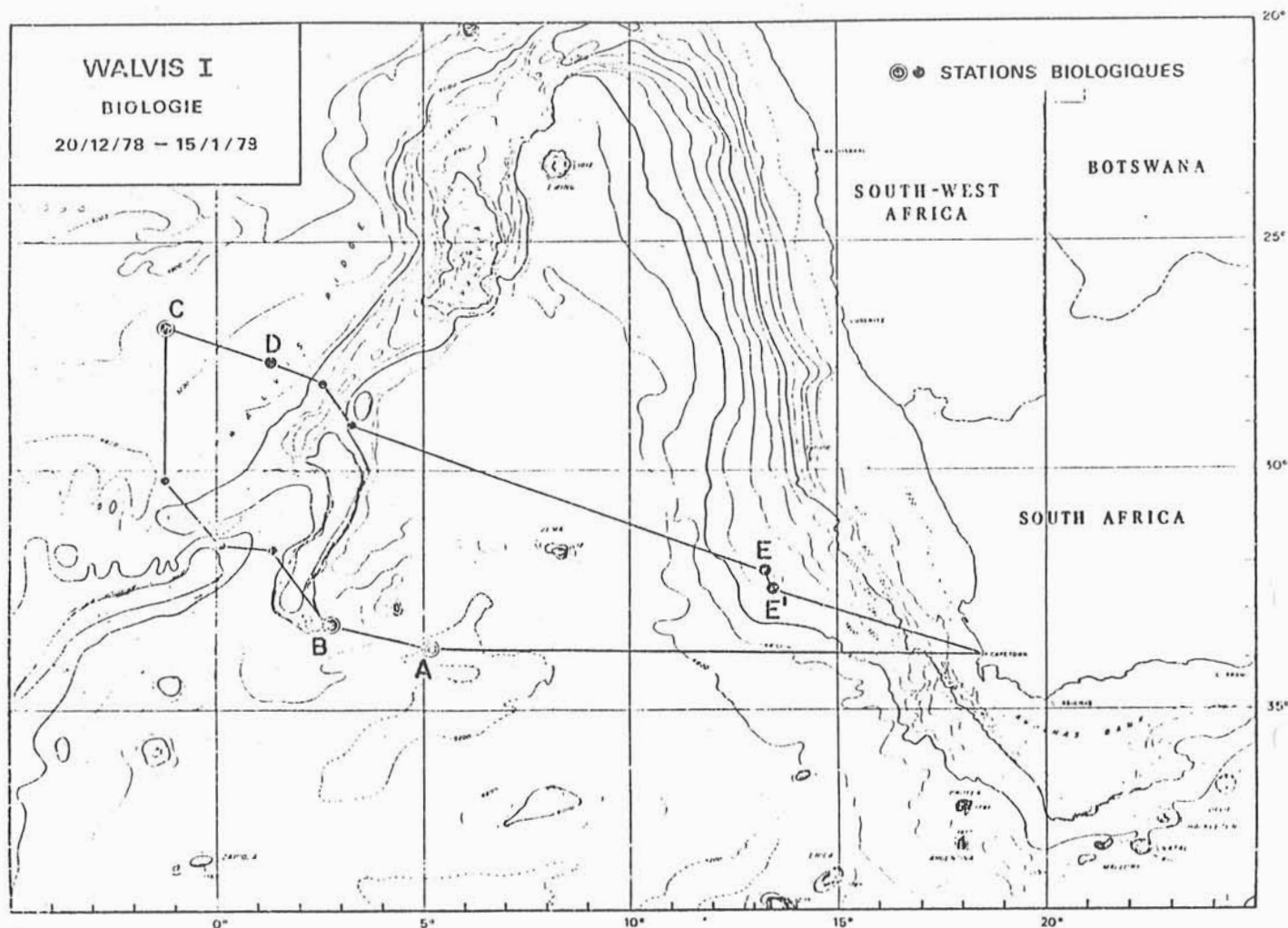
The French scientists involved in the study of the deep-sea benthos have become associated since 1977 in a combined subdivision of the CNRS: the cooperative research programme 462 entitled: "Recherches écologiques et biologiques sur les communautés benthiques profondes". This subdivision is co-directed by L. Laubier (CNEXO) and C. Monniot (Museum national d'histoire naturelle). The teams come from several organizations, such as the Natural History Museum in Paris, CNEXO, CNRS and Universities.

Since October 1978 we completed two cruises, Walvis 1 and Ecoflot. Two others are planned in the near future: Biogas 8 and SAFARI.

The end of the sorting of Biovema and Biogas 7 cruises allowed us to draw up syntheses which are in press.

1.- Walvis 1

This cruise took place in December 1978 and January 1979 on the N/O "Jean Charcot" (Chief scientist M. Sibuet). The main purpose was to compare the abyssal plains of the Cape of Good Hope and of Angola, which are separated by the Walvis ridge. Three heavy stations (A, B, C on the map) were undertaken. In each of them acoustic transponders were placed to obtain a very precise location of the devices on the bottom. A topographic map was realized with a "Sea Beam". An intensive sampling was undertaken for all sizes of the benthos. We use a rather large number of devices: "Hydro-cast" bottles at the proximity of the bottom (microbiology), Reineck and "USNEL" corers (microbiology, organic matter, meiobenthos, small macrofauna), epibenthic sledge (macrobenthos) and beam trawl (macro and megafauna). Autonomous traps were used to sample carnivorous and necrophagous animals. During this cruise, we developed a collaboration with the microbiology team of Maryland University (Prof. Colwell), to study the microflora in simulated "in situ" conditions, temperature and pressure. Belgian, Italian and South African scientists joined our national team. The total of successful samplings during this cruise: 10 automatic traps, 15 beam trawls, 14 Reineck cores, 15 USNEL cores, 6 epibenthic sledges.



2°- Ecoflot

This short cruise took place in March 1979 on the N/O "Cryos". The purpose was to place on the bottom an automatic device containing an abyssal sediment get azoic. This module was put down on the Meriadzeck plateau at 2100 m depth. It will be released in November 1979. (Desbruyeres chief scientist).

3°- Biogas 8 (D. Desbruyeres)

Planned in May and June 1979 this cruise is a part of the pluriannual program Biogas for the dynamic study of a deep-sea ecosystem in four stations between 2100 and 4800 m in the Bay of Biscay. The purpose of the next cruise on the "Noroit" is the study of meio- and macrobenthos microdistribution in the less deep stations (2100 and 3000 m).

4°- SAFARI: Sédiments Abyssaux et Faune Associée. Relations dans l'océan Indien (Chief scientists: L. Leclaire, geology; C. Monniot, biology)

This cruise will be conducted in August and September 1979 between 30° and 40°S and 40° and 60°E, on the ship "Marion Dufresne". Its purpose is to study in 4 stations the history of the sedimentation in 3 basins: Mozambique, Madagascar, Crozet and the relations between the deep-sea fauna and the sediments. Samplings will be made with a piston corer, a SIPAN corer (surface 1 m²), epibenthic sledges, beam trawls and automatic traps.



Publications in press:

- Desbruyeres, D. Sphaerodoridae (Annelides Polychètes) profonds de l'Atlantique Nord-Est. - Bull. Mus. natn. Hist. nat. Paris.
- Dinet, A. & A. Khripounoff. Rapports quantitatifs entre le meiobenthos et la matière organique sédimentaire en zone abyssale. - Colloque intern. CNRS "Biogéochimie de la matière organique à l'interface eau-sédiment marin; Marseille 25-27 avril 1979.
- Khripounoff, A. Alimentation du macrobenthos et transferts d'énergie en milieu abyssal. - Thèse 3^e cycle, Univ. P. et M. Curie, Paris.
- Khripounoff, A., D. Desbruyeres & P. Chardy. Les peuplements benthiques de la faille Vema: données quantitatives et bilan d'énergie en milieu abyssal. - Oceanologica Acta.
- Monniot, C. & F. Monniot. Some antarctic deep-sea Tunicates in the Smithsonian collections. - Antarct. Res. Series.
- Muir, T. Lumbrineridae (Annelides Polychètes) recueillis au cours des missions du CNEXO en Atlantique de l'Est. - Bull. Mus. natn. Hist. nat. Paris.

Change of address:

L. Laubier, CNEXO, 66 avenue d'Iena, F-75116 Paris, France.

F. Monniot, Paris

The German Red Sea Programme

The Red Sea Programme started in 1977 is continued by the Institut für Hydrobiologie und Fischereiwissenschaft der Universität Hamburg throughout the year 1979. These studies are related to the proposed mining of metalliferous sediments in the Atlantis-II-Deep beyond the hot brines, which were discovered in the mid-sixties. Our research work aims at an estimate of the environmental risk possibly involved in the processes of mining and of the separation of metallic components by a flotation method and in the dumping of tailings back into the sea. For a comprehensive survey the research programme covers all water depths from the surface to the greatest depth of little more than 2000 m.

Our research is funded by the joint Saudi Sudanese Commission for the Exploitation of the Red Sea Resources and by the Bundesministerium für Forschung und Technologie der Bundesrepublik Deutschland.

This year the so-called Prepilot Mining Test is running during the months of March to June. The drilling ship "Sedco 445" pumps muds up from the Atlantis-II-Deep, the muds are processed on board the ship and are then pumped back into the sea.

Hydrographical and chemical research is performed by Preussag AG, the main contractor in the mining tests, together with scientists from several institutions. The environmental investigations were started with a cruise of R.V. "Sonne" in 1977 and are now continued with R.V. "Valdivia". The work covers the hydrographic structure of the central Red Sea including current measurements and investigations in the nutrient distribution. Models were set up for the sinking and drifting of the tailing plume and the plume's behavior is presently studied in order to receive data for better risk prediction. These studies concentrate partly on a surface plume and partly on a plume in a depth of 400 m. This deep plume study is the more realistic one because the dumping of tailings is suggested to be done beyond the biologically active zone.

The biological programme contains plankton and benthos investigations as well as base line studies on metal contents in organisms from all depths. The working area centers around the Atlantis-II-Deep, however, some sampling of zooplankton (Dr. Weikert), mainly done with a multiple-closing-net, is performed in the southern and the northern Red Sea. Benthos sampling with grabs, trawls and traps expands the 1977 work from the Sudanese side to the Saudi Arabian slope. However, this part of the programme has severely been impaired by administrative restrictions through harbour authorities and by the loss of photographic equipment. In the plankton and benthos sampling programme the material is preserved for metal analyses, and tests are undertaken to observe the influence of muds and tailings on organisms (Dr. Karbe). These tests will be supplemented using reef animals from an additional shallow water pro-

gramme, which is carried out in cooperation with scientists from the Oceanographic Institute in Port Sudan.

All the data collected within this project are not only of interest under the mining and environment aspect. Very little is known on the Red Sea, its communities and its habitats. Most of former research concentrated on shallow waters and coral reefs. Quantitative data on the oceanic plankton and the deep-sea benthos are rare.

First results will be presented during a symposium to be held at Khartoum, Sudan, September 15-21, 1979, the "Symposium on the Coastal and Marine Environment of the Red Sea, Gulf of Aden and Tropical Western Indian Ocean". It is intended to reserve a whole day of the symposium to the presentation and discussion of the research work done in the Atlantis-II-Deep area.

Our results will be presented as well at the 14th European Marine Biology Symposium on Helgoland, September 26-30, 1979, which will be held under the title "Protection of Life in the Sea". During this symposium three deep-sea lectures will be given, i.e. by

BURNS, R.E., Seattle, on "Assessment of environmental effects of deep ocean mining for manganese nodules",

KARBE, L., H. THIEL & H. WEIKERT, Hamburg, on "The risk of mining metalliferous sediments from the deep Red Sea",

OTTOW, J.C.G. & C. SCHÜTT, Stuttgart-Hohenheim, on "Effects of manganese nodules mining on the microbiology of the sediment/water interface of the deep-sea".

Hj. Thiel, Hamburg

Latest news from hydrothermal and cold vents in the Pacific

A team of American scientists have been working this year on a study of the biology of the hydrothermal vents of the Galapagos Rift. We had a big cruise with the submersible ALVIN in January and February and will have another in November to tie things off.

Our work revolves around three basic questions. 1) Biogeography: What is the distribution of vent faunas? To what extent are the species that live there limited to vent environments? How wide-spread are vent species, and how do they disperse? 2) Ecology: What is the trophic structure of vent communities? What energy source gives base to the food chain? What do the various species feed upon, and how does this affect the structure of the community and the details of distribution of its various members? 3) Physiology: How are the organisms physiologically adapted to survive in the unusual combination of high temperature and pressure? What adaptations result from the need to cope with low oxygen concentrations found in many vents? How do the kinetics of their enzyme systems differ from those of shallow-water species?

A rather large number of investigators are involved: Grassle (expedition leader), Sanders, Jannasch, Wirsen from Woods Hole; Turner, Berg from Harvard; Rhoads, Lutz, Turekian from Yale; Childress from Univ. of California, Santa Barbara; Hessler, Smith, Somero from Scripps; and a whole bunch of systematists. Also, there was a bunch of geologists and marine chemists doing valuable related studies. The biologists have written an introductory paper to this study of OCEANUS, for those who would be interested in learning what we did in greater detail; it should be in press in July.

More recently, another geological expedition discovered hydrothermal vents on the East Pacific Rise, and similar (but not identical) communities were associated with them. The intriguing thing about this new locality is that some of the vent water had a temperature in excess of 300°C! Needless to say, we are eager to do some biology here as well, and steps are being taken to return in 1981. Finally, in May a vent of cold water was discovered just off San Diego. It also is colonized by a special community of which *Lamellibranchia barhami* is a dominant member.

All in all, it looks as though these vents are going to occupy the time of a lot of us for several years to come.

R.R. Hessler, SIO, La Jolla

Abyssal work in the Polar Ocean: The FRAM I drift-ice expedition 1979

As a joint U.S., Canadian, Norwegian and Danish project the FRAM I drift-ice station was manned from mid-March to mid-May 1979. The original plan called for a starting point at about 84°N 7°W and a southwards drift in the northern parts of the Fram Strait between Greenland and Spitsbergen.

The marine biological work onboard the ice-station was performed by the Zoological Museum, Copenhagen: primary productivity, nutrients, and hydrography by Ole Norden Andersen, holoplankton down to 3500 m by Lars Haumann, and benthos by Jean Just.

With regard to benthic work it was planned to concentrate the efforts around the very steep continental slope, which cuts into the northernmost part of the Fram Strait from NE Greenland. The ice, however, had other ideas! Instead of drifting south from a point close to that of the original plan it set out on a northwesterly course. The entire drift of about two months took the shape of a large anti-clockwise loop where scientific work was terminated only little further south than where it started.

As a result the biological benthic programme was turned into a series of samplings in truly abyssal environment between 84°20'N 8°20'W and 84°00'N 7°15'W, on a level plain at about 4000 m to 3300 m. A few last-minute samples were taken in the foothills of the Nansen Ridge around 83°40'N 6°50'W at depths as shallow as 2300 m. Dredgings were performed at 13 stations with a 1.5 m broad beam-trawl and a 1 m broad epibenthic sledge. The bottom was reached with a 4 mm Kevlar wire, breaking strength 2200 pounds.

The sampling programme met with several difficulties, primarily centered around the problem of getting anything at all up from the bottom. These difficulties were due partly to certain construction faults in the necessarily very light gear used (which could to a certain extent be corrected), and partly to the very slow drifting speed during most of the sampling period. It was normally necessary to keep the dredge on the bottom for up to 5 hours in order to cover about 200 m. But in spite of the problems a number of fairly good samples (5-12 liters of surface material per haul) were retrieved. All samples were screened down to 45 micron.

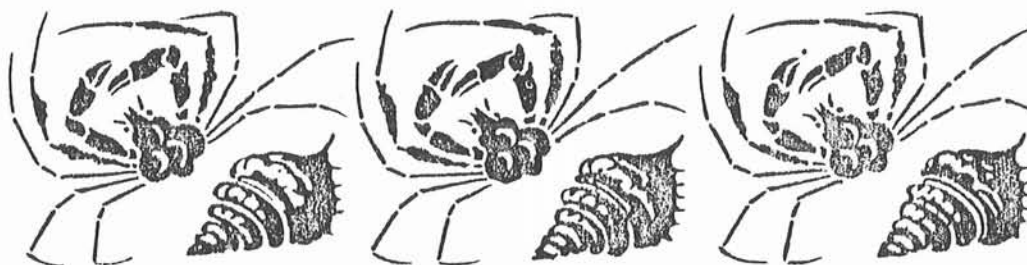
On the abyssal plain Foraminifera were dominating, but otherwise the fauna was exceedingly poor. Characteristically not a single elasipodan holothurian was found, and a maximum of three bivalves were collected in one haul. The material is practically devoid of nematodes and harpacticoid copepods, and not a single pycnogonid or living ostracod were observed. This is all in striking contrast to the results of recent work in the Norwegian Sea and the Greenland Sea. The 'dominating' group was found to be peracaridean crustaceans, particularly lysianassid amphipods and asellote isopods, of which about 15 species were found. The only echinoderm encountered is a species of brittle-star (*Ophiopyren striatum* Mortensen), which occurred at several stations.

The material is presently being worked up at the Zoological Museum, Copenhagen, and as a very preliminary comment it seems of interest to note that with a single exception all species so far identified (8) appear to be new to science, but in well known genera and with close affinity to more southern arctic and northatlantic forms.

Another interesting feature of the abyssal plain sampled is the consistent occurrence in the otherwise very fine sediment of a long variety of small terrigenous stones and pebbles, and the presence of many empty shells of extreme shallow-water bivalves (*Portlandia arctica*, *Astarte*, *Macoma*). These shells formed the only substrate on which bryozoans were occasionally found. Thus ice-rafting appears to be pronounced in this area.

In the lower reaches of the Nansen Ridge (around 3000 m) black, porous, slag-like lava was encountered, and at 2300 m black basaltic stones were found.

Jean Just, Copenhagen



New Norwegian Research Ship

In September 1976 the University of Bergen's research ship "Helland Hansen" was lost. Plans are now being made for a new ship of c. 500 gross register tons. It will be equipped for physical, chemical, geological and biological research and will have the most modern navigational instruments, echo sounder, etc. There will be a number of winches and hydraulic cranes. The largest winch will have 8000 m of 12-14 mm wire and the largest hydraulic crane a capacity of 25 tons at an extension of 1 m, with a greatest extension of 6 m. On shorter trips the ship can accommodate 14 scientists, on longer trips 9-10. The ship is expected to be ready by late spring 1980 and will be available to all marine departments at the University of Bergen. The Geophysical Institute, Department A, will be in charge of the practical aspects of running the ship.

Reproductive biology in deep-sea ophiuroids and holothurians from the Rockall Trough

From Dr. Paul A. Tyler, Dept. of Oceanography, University College of Swansea, the Editor has, through John Gage, received the following interesting report on echinoderm work based on samples obtained during the benthos programme of the Scottish Marine Biological Association, Oban. The Editor welcomes similar contributions to forthcoming issues of the Newsletter

Ophiuroids. Studies of the reproductive strategies of ophiuroids from the Rockall Trough are almost complete. Four ophiuroids have been examined:

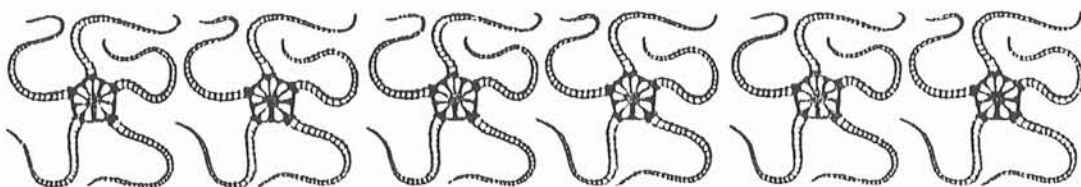
Ophiura ljungmani. This species collected from 2,900 m shows evidence of a highly synchronous reproductive cycle with the initiation of gametogenesis in March/April, active vitellogenesis in September-December and a spawnout in late January/February of each year. Evidence for the occurrence of a planktonic larva for this species is based on the small egg size, fecundity and the occurrence of post larval *Ophiura ljungmani* in oblique RMT samples down to 2,700 m in the Rockall Trough during June. The relationship of *Ophiopluteus ramosus*, which occurs in RMT samples during spring, and adult *Ophiura ljungmani* is still open to speculation.

Ophiomusium lymani. Evidence for the reproductive strategy in this species is still under discussion. Egg size and fecundity suggest an abbreviated possibly demersal larva. At present, evidence of reproductive periodicity suggests a low level continuous spawnout throughout the year but these speculations await confirmation from the latest samples.

Ophiacantha bidentata. This species has a relatively large egg and low fecundity suggesting direct development. However, no evidence of brooding has yet been observed although the more recent samples await examination. There is no evidence of a reproductive periodicity.

Ophiocten latens. The number of specimens of this species found is very few. However, one individual was found to be brooding a number of gastrulae in a sac-like structure between folds in the stomach.

Holothurians. Two small species, *Ypsilothuria talismani* and *Cherbonniera utriculus* have been found regularly in the time series samples from the Rockall Trough. Initial observations of the gonads suggest both species have a relatively low fecundity and egg size of about 400 μ m. This would suggest that both species have a lecithotrophic larva or have direct development. However, of the few specimens so far examined there appears to be no evidence of brooding. It is intended to examine the time series material of both species to determine their reproductive strategy including both larval type and reproductive periodicity.



Publications:

- Tyler, P.A. & J.D. Gage, 1979: The reproductive ecology of deep-sea ophiuroids. - 13th European Symposium on Marine Biology (in press).
- Tyler, P.A. & J.D. Gage, 1979: An abyssal time series II: Reproductive and population biology of the deep sea brittle star *Ophiura ljungmani*. - (In advanced prep.).
- Tyler, P.A. & J.D. Gage, 1979: An abyssal time series III: Reproductive biology of the deep sea ophiuroids *Ophiomusium lymani*, *Ophiacantha bidentata* and *Ophiocten latens*. - (In prep.).

Towards a better understanding of the Atlantic xenophyophore fauna

The xenophyophores are giant marine protozoans that, placed in a subclass of their own with the class Rhizopodea, seem to form a well-defined group, presumably related to the Foraminifera. Mainly abyssal in distribution, they have been recorded in many widely scattered areas.

One of us (Tendal) has earlier pointed to the strange fact that there were only few reliable records of xenophyophores from the Atlantic as compared to the Pacific and Indian Oceans. In recent years, however, expeditions from several countries have provided new samples, possibly as a result of efforts to make expedition participants aware of the existence of the group.

In addition to the earlier material from the "Challenger"- (1873-1876), "Triton"- (1882), "Scotia"- (1904), and "Goldseeker"- (1910) expeditions, samples from the "Akademik Kurchatov"- (cruise 11 1972, cruise 14 1973), "Jean Charcot"- (INCAL 1976, BIO-EMA 1977), and "R.R.S. Discovery"- (cruise 63 1974, cruise 79 1976, cruise 82 1977) expeditions are now available. The preliminary study of these collections, originating from different parts of the North Atlantic has allowed significant, although very general conclusions:

- 1) The number of xenophyophore species now known from the Atlantic Ocean is about the same as for the Indian Ocean and the Pacific Ocean.
- 2) The two orders of xenophyophores are both represented in the Atlantic area, as are all the five families. With respect to genera and species, it is too early to say anything definite, but there are indications of a rather strong "endemic" element, at least at the species level.
- 3) When compared to the other two large oceans there seems to be a predominance of species belonging to the order Psamminida in the Atlantic. These species generally have more weakly cemented agglutinated tests than their relatives in the other oceans, a fact that at least partly explains the heavy fragmentation characteristic of the Atlantic samples. The reason for the weak cementation is at present unknown.
- 4) Analysis of photographs from 3000 and 6000 m depths in the NE Atlantic has provided information on living positions, abundance and distribution of xenophyophores. The maximum densities seem to be somewhat higher than densities estimated earlier on photos from bathyal and hadal depths in the West Pacific. It seems safe to conclude that xenophyophores in some areas must play a considerable role also in the abyssal benthic community.

Ole S. Tendal, Copenhagen Andrew J. Gooday, Wormley

Recent literature on the Atlantic xenophyophore fauna:

- Gooday, A.J. & O.S. Tendal: New xenophyophores in samples and photographs from the Northeast Atlantic. - (Working title; in preparation).
- Tendal, O.S., 1972: A monograph of the Xenophyophoria (Rhizopodea, Protozoa). - Galathea Rep. 12: 1-99.
- 1975: A new xenophyophore (Rhizopodea, Protozoa), living on solid substratum, and its significance. - Deep-Sea Res. 22: 45-48.
 - Xenophyophores from the French expeditions "INCAL" and "BIOVEMA" in the Atlantic Ocean. - (In preparation).
 - Xenophyophores from the "Akademik Kurchatov" cruise 14 in the West Indian area. - (Working title; in preparation).

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