

DEEP-SEA NEWSLETTER



No. 19, February 1992

THE 6TH DEEP-SEA BIOLOGY SYMPOSIUM IN COPENHAGEN

First an apology, this is not a review of the proceedings, if that is what you want then please borrow a copy of the programme from a friend. Rather, this is a collection of thoughts on the meeting as a whole; perhaps useful to those who will organise the next meeting, or in starting a discussion on what we think our meetings should be like.

Be certain that this meeting was an undoubted success both scientifically and socially. The organisers deserve a great vote of thanks for their efforts. Torben Wolff of course merits special mention for his leadership, at all times leading from the front he made sure we missed nothing. We are also grateful to the three other organisers, Ole Tendal, Jørgen Kirkegaard and Reinhardt M. Kristensen, as well as to the very efficient secretaries and students for their assistance.

The success of the meeting owed much to its atmosphere. Informality and openness are admirable qualities, but they also bring with them other useful traits. Timeliness is important to a meeting of this type. By emphasising the novel the meeting becomes more accessible to the newcomer. The availability of the meeting to all, particularly students, was a question raised briefly in Copenhagen. It is perhaps mainly the responsibility of supervisors to ensure that students are recruited to these meetings [as larvae are entrained in the wake of seamounts, Mullineaux]. Judging by the size of some student parties at the meeting this is certainly being done with some success.

The general accessibility of the meeting can perhaps be gauged by the ratio of attending authors to total participants: 75% [a rather higher rate than spawners in an orange roughly aggregation, Newton]. The majority had single authorships, though many c.30% had two, often on both talk and poster [a non-random pairing? cf some echinoids, Young]. It should come as no surprise that the prize for the maximum authorships, at seven a piece, goes to the now immortal pairing of Gage & Tyler (available at all good bookshops).

Posters were given some prominence at the meeting, about 1/3 of all contributions. Presenting posters remains a problem; although on display throughout the



meeting and given their own specific hour, the instinct of participants to feed during the available 'free-time' was strong [a need not lost on some deep-sea echinoids, Campos]. One other potential problem relates to video and/or slide dominated presentations. With a number of very notable exceptions, the science behind some of these presentations got a little lost in the welter of visual images and species names [even more names are to be expected through the use of genetics, France, Vrijenhoek]. The timetabling and forum for all of these visually-based presentations should not over-tax their potential audience [stress, Hawkins].

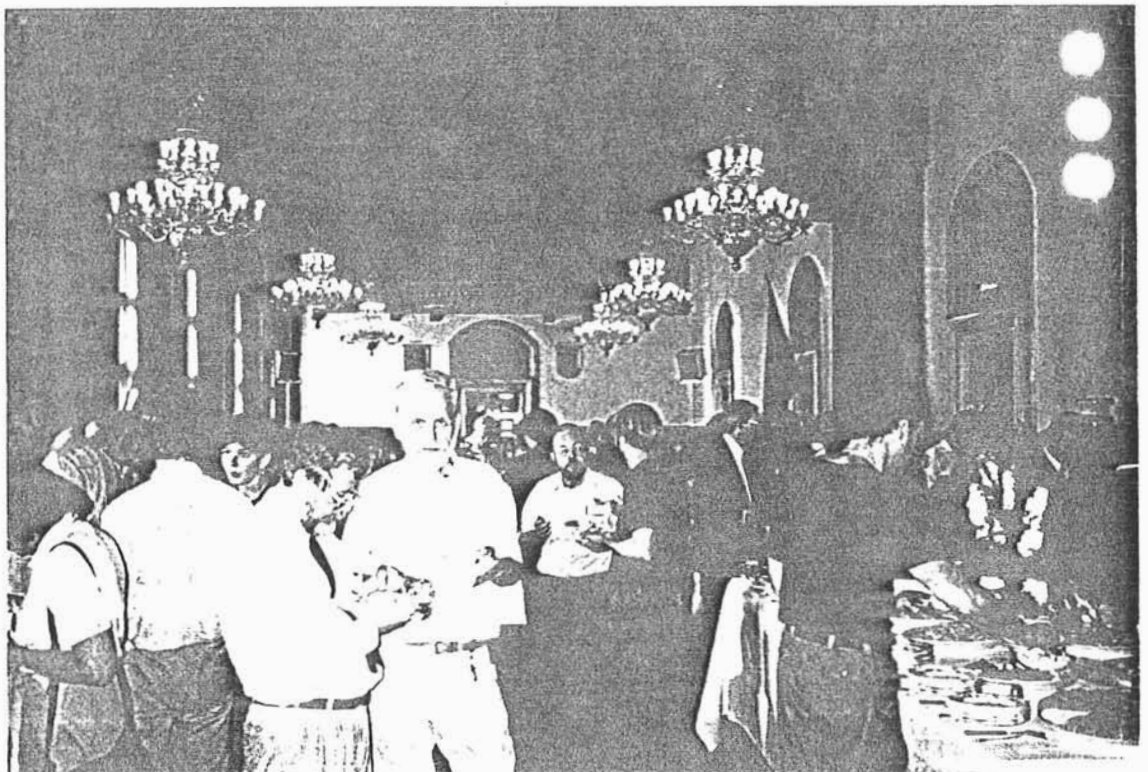
The key to the success of the Copenhagen meeting, apart from the efforts of the organisers and participants, was its diversity. Biodiversity may be an increasing concern for the future [Paterson], maintaining or enhancing the diversity achieved in Copenhagen should certainly concern us. Participants from 18 countries attended the meeting. The democratic selection of the next venue hopefully indicates that it will be similarly accessible. Topic richness was high, from taxonomy [Dahms] to technology [Bagley]. Size diversity [the importance of large rare organisms, Gerlach] in the presentations so helped; introductory talks to larger projects [DEEPSEAS and DISCOL, Rice and Thiel] and the more novel techniques [molecular biology, Felbeck] aided understanding and allowed subsequent speakers to proceed quickly to their results. Perhaps only one element was missing from the habitat mosaic [the 'grove'] of this meeting - the open patch - the chance for the opportunistic recruitment of minds and bodies.

Brian Bett
IOSDL

The Symposium was attended by a total of 141 participants from altogether 18 countries: Germany 31; UK 26; USA 22; Denmark 20; France and Russia 10; Japan 3; Australia, Belgium, Canada, Greece, Israel, Norway, Spain, and Sweden 2 each; Austria, Iceland, and Ireland 1 each.

Reception at
the Copenhagen
Town Hall

(Bob Hessler
phot.)



SCIENTIFIC PROGRAMME OF THE SYMPOSIUM

ORAL PRESENTATIONS

(In case of two or more authors the presenter is listed first)

T. Wolff Welcoming address

Deep-sea Biota/Community Structure:

J.D. Gage, P. Lamont & P.A. Tyler Disturbance ecology of deep-sea macrobenthos: community structure and dispersion at two contrasting transponder-mapped box-coring sites off Portugal

N.G. Vinogradova Abyssal and ultra-abyssal (hadal) bottom fauna of the Atlantic sector of the Antarctic

A. Eleftheriou, A. Tselepidis & C. Smith The deep-sea ecosystem of the Eastern Mediterranean

M.H. Thurston Abyssal size spectra - the megabenthos

B.J. Bett Temporal and spatial variation in the size spectra of larger macrobenthos from two NE Atlantic abyssal plains

A.L. Rice The face of a turbidite: Photographic evidence for sparse megafauna but active scavengers on the Madeira abyssal plain

P.V.R. Snelgrove, J.F. Grassle & R.F. Petrecca Patch mosaics in the deep sea: rapid response of a macrofaunal community to experimental enrichments

J.A. Blake Benthic infaunal communities on the continental slope off northern California

G.L.J. Paterson, P.J.D. Lamshead & J.D. Gage Down the slippery slope: a study of polychaete assemblages from bathymetric transects in the Rockall Trough

M. Koux, P. Bouchet, J.-P. Bourseau, C. Gaillard, R. Grandperrin, A. Guille, B. Laurin, C. Monniot, B. Richer de Forges, M. Rio, M. Segonzac, J. Vacelet & H. Zibrowius Bathyal environment with living fossils off New Caledonia (SW Pacific)

L. Thomsen, F. Blaume, G. Graf, P. Linke, W. Ritzrau, J. Rumohr, A. Schelz, & W. Ziebis Processes in the bottom nepheloid layer at the western Barents Sea shelf and the continental slope

N.B. Keller The regularities of geographical and bathymetrical variations of the morphological structure of the solitary corals

G.M. Newton Australia's deep-sea orange roughy fishery and the slope-fish community of the Great Australian Bight

Hydrothermal Vents and Cold Seeps:

J. Hashimoto, K. Fujikura & S. Ohta Vent communities around Japan

D. Desbruyères, A.-M. Alayse-Danet & S. Ohta Deep-sea hydrothermal communities in two southwestern back-arc basins (the North Fiji and Lau Basins): composition, microdistribution and food web

R.A. Lutz, R.G. Gustafson & R.C. Vrijenhoek Biology of a deep-sea hydrothermal vent field at 11°24.9'N along the East Pacific Rise

S.V. Galkin Spatial structure of vent communities

R.R. Hessler & D. Desbruyères Contrasting patterns of temporal change at hydrothermal vents between the East Pacific Rise at 13°N and Rose Garden on the Galapagos Rift

R.C. Vrijenhoek, C. Craddock, S. Schutz & R.A. Lutz Genetic studies at deep-sea hydrothermal vents

S. France Genetic distance between populations of the hydrothermal vent-endemic amphipod *Ventrella sulfuris*

C. Smith Biology/geology of deep-sea hydrothermal vents between 9° and 10°N along the East Pacific Rise (video)

R. Lutz Same title (video)

M. Sibuet, J.P. Foucher, J. Goncalvez, A. Fiala, N. Chamot Rooke, S. Lallemand, S. Ohta, X. le Pichon and the Kaiko Cold seep benthic communities at the toe of the Nankai accretionary prism: characteristics and spatial distribution of the clam colonies in relation to fluid flow rates

Meiofauna:

D. Thistle, R. Hilbiq, J.E. Eckman & J.F. Grassle Are polychaetes sources of habitat heterogeneity for harpacticoid copepods in the deep sea?

H.-U. Dahms & M. Pottek *Metahuntemannia* Smirnov, 1946 and *Talpina* gen.nov. (Copepoda, Harpacticoida) - meiofauna representatives of the deep-sea

R.M. Kristensen Deep-sea loriciferans

P. Linke Response of deep-sea benthic Foraminifera to a simulated sedimentation event

Microbiology and Biochemistry:

J.W. Patching Biomass and activity of a deep ocean bacterial population - evidence of a barophilic community

I
W
I

- A. Godfroy, A.L. Tredan,
E. Antoine,
G. Raguenes
& G. Barbier Preliminary characterization of anaerobic sulfur dependent ultrathermophilic archaeobacteria isolated from hydrothermal vents in the North Fiji Basin
- C.M. Turley,
P. Mackie,
A.H. Taylor
& M. Carstens Effects of pressure on microorganisms associated with aggregates: implications on remineralization of organic matter and a preliminary model
- C.R. Smith, B.A. Bennett,
B. Glaser
& H.L. Maybaum Chemosynthetic communities on whale bones in the North-east Pacific: species structure, population sizes and persistence times
- U. Hentschel, S.C. Cary
& H. Felbeck Nitrogen metabolism in the symbiont-bearing bivalve *Lucinoma aequizonata*
- H. Felbeck Deep-sea biology on a molecular scale: nucleic acid sequence to protein function
- G. Liebezeit Amino acid fluxes in the world ocean - a review
- S.C. Cary Habitat characterization and nutritional strategies of the endosymbiont-bearing bivalve *Lucinoma aequizonata*
- F. Gaill Collagen from hydrothermal vent worms: an indicator of the temperature of the environment?
- S.K. Juniper, I.R. Jonasson,
V. Tunnicliffe
& A.J. Southward Modification of hydrothermal chimney mineralisation by a tube-building polychaete
- L.D. Guidi,
G. Cahet
& A. Dinet *In situ* measurements of biological activities at the deep-sea sediment-water interface: a new instrument operated by manned submersible
- Films introducing the visit the following day to the Viking Ship Museum at Roskilde

Seamount Biology:

- A. Genin Hard bottom habitats in the deep sea: communities structured by currents and topography
- F. Pasternak Species composition, distributional patterns and the ways of forming of the bottom fauna of isolated under-water rises
- K.F. Wishner, M.M. Gowing,
L. Levin &
L.S. Mullineaux Ecology of a seamount in the oxygen minimum zone in the eastern tropical Pacific
- M.M. Gowing
& K.F. Wishner Feeding ecology of benthopelagic zooplankton on an eastern tropical Pacific seamount

- J.G. Larwood Tertiary to recent evolution of Ostracoda on seamounts
- L.S. Mullineaux Retention of benthic invertebrate larvae in flows near Fieberling Guyot
- Distribution:
- M.N. Sokolova Comparative characteristics of the deep-sea macrobenthos on the floor of the Pacific, Indian and Atlantic Oceans (presented by O.N. Zezina)
- R.G. Gustafson,
R.C. Vrijenhoek
& R.A. Lutz Distribution of molluscan morphospecies at deep-sea hydrothermal vent and cold-water seep sites
- H.M. Krylova The bathymetrical and geographical distribution of Cuspidaroida
- K. Fujikura,
J. Hashimoto
& T. Okutani Preliminary account of gastropods associated with hydrothermal vents and cold seeps around Japan
- A.N. Mironov Distribution patterns of the deep-sea echinoderms, represented in the Antarctic fauna
- G.C.B. Poore
& J. Just The isopod fauna of the slope of southeastern Australia
- J.-O. Strömberg
& J. Svavarsson Some aspects on the distribution of deep-sea asellote families and genera, with special reference to Arctic basins
- O.E. Kamenskaya Komokiacea in the deep-sea benthic fauna of the World Ocean
- H. Zibrowius Photographic records of *Iridogorgia* from submersible dives in the Atlantic and Pacific Oceans (Cnidaria: Anthozoa: Gorgonaria)
- O.N. Zezina Deep-sea brachiopods, their morphology and evolution
- Research Projects: the DISCOL-Impact Experiment and East Atlantic research (Hamburg Group):
- H. Thiel Approaches to deep-sea ecology and the need for international collaboration: long-term and large-scale research projects
- G. Schriever First results from the DISCOL-Impact Experiment. Recolonization after disturbance of a manganese nodule field in the deep Southeast Pacific
- H. Bluhm Megafauna analysis of photographs from the DISCOL experimental area (tropical southeastern Pacific Ocean)

- H. Thiel, C. Borowski, C. Bussau
& G. Schriever Manganese nodule crevice fauna
- T. Soltwedel Meiofauna and sediment-biochemical compounds off the southwestern African coast (shelf to abyss) between 1° and 18°S
- O. Pfannkuche Sediment community oxygen consumption in the north-eastern Atlantic
- K. Lochte Bacterial carbon consumption in the benthic boundary layer
- B. Christiansen Comparison of three populations of the necrophagous amphipod *Eurythenes gryllus* in the Northeast Atlantic
- R. Koppelman & H. Weikert An improved model of vertical zooplankton distribution from a deep site in the NE Atlantic

Poster session

Evening discussion on Deep-Sea Mining Impact

Behaviour:

- P.A. Tyler, C.M. Young,
D.S.M. Billett & L.A. Giles Pairing behaviour, reproduction and diet in the deep-sea holothuroid genus *Paroriza* (Holothuriodea: Synallactidae)
- C.M. Young & P.A. Tyler Pairing behaviour and fertilization biology of the bathyal echinoid *Stylocidaris lineata*
- P. Jensen An enteropneust's nest: results of bioturbation and microbial gardening by the deep-sea acorn worm *Stereobalanus canadensis*
- V. Tilot Who builds the deep-sea pyramids?

Biology:

- S.A. Gerlach
M.B. Romero-Wetzel Abundance, biomass, size-distribution and bioturbation potential of deep-sea benthos on the Vøring Plateau (1200-1500 m, Norwegian Sea)
- N.R. Merrett & S.H. Barnes Further evidence on abyssal ichthyofauna zonation in the eastern North Atlantic
- P.M. Bagley,
I.G. Priede & J.D. Armstrong AUDOS (Aberdeen University Deep Ocean Submersible): a new autonomous system for photographing, tagging and precise acoustic tracking of deep-sea scavenging fish
- J.D. Armstrong
I.G. Priede & P.M. Bagley Population densities and foraging movements of the grenadier fish, *Coryphaenoides (Nematonurus) armatus*, in the North Atlantic Ocean

- J. Svavarsson, G. Gudmundsson
& T. Brattegard Asellote isopods (Crustacea) preying on foraminiforans (Protozoa) in the deep-sea?
- M.A. Rex
& R.J. Etter Ecological implications of body size in deep-sea gastropods
- E. Schein Adaptation of pectinids (*Bivalvia*) to the deep-sea: remarks on ontogeny, functional morphology and dispersal
- F. Sardá
& J.E. Cartes Relationship between size and depth in decapod crustacean populations on the slope between 900 and 2200 m in the western Mediterranean
- I.S. Roginskaya Possible influence of the Earth's rotation on some deep-sea biological phenomena
- D. Gaspard Growth stages in deep-sea articulate brachiopod shells
- L.S. Campos, P.A. Tyler, J.D. Gage, D.S.M. Billett,
A.W.G. John & D.S. Harbor Feeding biology and life history of deep-sea echinoids in relation to their food supply

Discussion on Biodiversity in the Deep Sea

- T. Wolff Next meeting
- O. Tendal Closing address

Post-Symposium Workshop on Benthos Methods

POSTER SESSIONS

Biota - General Ecology:

- M.N. Ben-Eliahu,
F.D. Por & B. Galil A preliminary report on the density and composition of small-size levantine bathyal benthos
- C. Borowski Benthic macrofauna and polychaetes from an experimental area in the deep Peru Basin (SE Pacific)
- J.D. Gage Secondary production by macrobenthos at the SMBA permanent station in the Rockall Trough
- Lisa A. Levin,
C.L. Thomas & K.F. Wishner Changes in the structure of infaunal communities across the lower boundary of the eastern Pacific oxygen minimum zone
- C.M. Turley Macroaggregates: Vehicles for the rapid transport of carbon to the deep sea in the N.E. Atlantic

Biota - Hydrothermal Vents:

- E.C. Southward, A.J. Southward, S.K. Juniper, V. Tunnicliffe,
K. Wilson Biological features of a sedimented hydrothermal site:
& M. Black Middle Valley, Juan de Fuca Ridge
- A.-M. Alayse-Danet, C. Ladrat
& M. Marchand Thermostable enzymes screened on bacterial strains
isolated from Lau and Fiji Basins
- J.A. Blake Polychaeta from hydrothermal vents in the eastern
Pacific
- S.V. Galkin Spatial structure of vent communities
- L.S. Mullineaux, P.H. Wiebe
& E.T. Baker Zooplankton and benthic larvae in a hydrothermal vent
plume
- M. Segonzac, P. Briand
& V. Marine Hydrothermal vent community on the "Snakepit" (mid-
Atlantic Ridge, 23°22'N - 44°56'S)

Protozoans and Meiofauna:

- C. Bussau Deep-sea Nematoda from a manganese nodule area of the
the eastern South Pacific
- H.-U. Dahms, Adaptations for burrowing in *Metahuntemannia* Smirnov,
M. Pottek & 1946 (Copepoda, Harpacticoida) from the deep-sea of the
H.K. Schminke High Antarctic
- A.J. Gooday, M. Carstens,
O. Pfannkuche & The importance of "Nanoforaminifera" in deep-sea sedi-
H. Thiel ments: some preliminary results
- J.C. Green, A.J. Gooday
& C.M. Turley Feeding by benthic Foraminifera under simulated deep-sea
conditions
- C. Maybury & Carboniferous analogues of Recent xenophyophores
K. Evans
- C. Maybury An enigmatic deep-sea foraminiferan from the South
Pacific
- S. Scheibe Distribution of meiofauna and biochemical sediment
compounds of the abyssal North East Atlantic
- G. Schriever Can benthic Copepoda Harpacticoida be used as indicator
organisms in the German deep-sea impact study DISCOL
- R. Shires, A.J. Gooday
A.R. Jones Komokiacean mudballs (Protozoa, Foraminiferida) from the
& T.R.S. Wilson bathyal and abyssal NE Atlantic
- A. Vanreusel & The meiobenthos of the transition zone to the deep sea
M. Vincx in the Gulf of Biscay

Biology of Macrofauna:

- S.K. Bronsdon, G. Lawson,
P.A. Tyler, A.L. Reproductive biology of anthozoans from the bathyal NE
Rice & J.D. Gage Atlantic Ocean
- L.A. Giles, Diet and reproduction in the deep-sea protobranchs
P.A. Tyler & *Ledella pustulosa* and *Malletia cuneata*
J.D. Gage
- J.B. Kirkegaard The bathyal and abyssal polychaetes from the Galathea
Expedition errant species
- J. Knudsen & An enigmatic, bathyal pectinacean bivalve: *Pseudo-*
H.H. Dijkstra *binnites* Levij Dijkstra, 1989
- G. Lawson, M. Sheader, P.A. Tyler
& M.H. Thurston Population and reproductive biology of amphipods from
the NE Atlantic Ocean
- M.H. Thurston Adaptions for swimming in propeamsiuid bivalves
- Distribution:
- D.S.M. Rillett The limit of studies on bathymetric distributions
- P. Bouchet, A. Crosnier
& B.R. de Forges The deep-sea fauna of the New Caledonian region (SW
Pacific): facts, fiction and perspectives
- H.M. Krylova The bathymetrical and geographical distribution of
Cuspidaroida
- B. Christiansen Megafauna abundance and biomass at 3 mid-oceanic
locations in the Northeast Atlantic
- W. Wakefield Patterns in the distribution and abundance of demersal
fishes on the upper continental slope off Central
California
- New Techniques:
- L.D. Guidi The CYANECO deep-sea cruises in the NW Mediterranean
- L.E. Hawkins, S. Batten, S. Hutchinson, G.L.J. Paterson &
P.J.D. Lamshead Application of stress assessment methods in the deep sea
- F. Sardá & "MAIRETA": an efficient semi-balloon trawl for deep-sea
J.E. Cartes samplings
- H. Thiel, Megafauna observations and experiments with a
E.J. Foell time lapse camera
& G. Schriever
- M.A. Ward & Extracting smaller macro- and larger meiofauna from
B.J. Bett abyssal box cores

BIODIVERSITY

A report on a discussion held at the Deep-Sea Biology Symposium in Copenhagen

The discussion was introduced by John Gage who began by stating that it was imperative to conserve (or at least slow the loss!) of species from pristine habitats. To maintain this diversity a clear response was required which provided a scientific rationale on what could be done, and what was achievable, in conserving species diversity. In the field of aquatic biology the main concern in different parts of the world was the effects of fish farming. The problem with presenting a case for the deep sea was that public perception of the deep sea was poor. It was difficult to explain to the layman that the deep sea was a vast pool of genetic diversity, especially when it was not as visual as a coral reef or a rain forest.

John Gage suggested the discussion should be composed of four components:

- a. Patterns of biodiversity
- b. Where are we now in relation to biodiversity?
- c. What do we need to do?
- d. Funding.

a. Patterns of biodiversity

Mike Rex introduced the issue by talking about scales of biodiversity. Biodiversity in a box core was calculable, on a regional scale possible, but on a global scale very difficult. Mike outlined the main issues in ecology in general and proposed that deep-sea workers would have to document the species present in order to understand other deep-sea processes. A discussion followed in which the main questions raised were:

1. How many species are there? Is the deep sea the most speciose environment?
2. What is the effect of microtopography, of depth, and of the input of organic matter on local and regional scales?
3. What index should we use to measure diversity? There are a number available but no accepted standard.

It was felt that addressing these questions was fundamental to understanding deep-sea biodiversity.

b. Where are we now?

The greatest concentration of data was in the North Atlantic. There were some big US programmes in the 1970's, but the National Academy of Sciences did not like them, and interest (?funding) fell rapidly. At present the Smithsonian is trying to retrieve and archive this material but, inevitably, some has been lost. Field codes had proved a great problem, but the Smithsonian now had a formal procedure in place for logging of samples. NODC collates all the written data but will not handle unnamed species. It was apparent that these represented a vast pool of data. In Germany all material had to be deposited with one of two museums, but in other countries the collation of material was more haphazard.

Arising from the discussion it became apparent that it was necessary to:

1. Maintain and stress the importance of voucher collections which had a firm taxonomic basis.
2. Try to work independently of the Government which often was very restrictive.
3. Encourage the teaching of taxonomy at University level. Restoring its importance in biology was imperative.
4. Initiate a discussion as to what is a species. Is it possible to rely on morphological characteristics when genetic studies were suggesting that boundaries between individual species were becoming blurred?

c. What do we do?

There was a general feeling that a series of questions should be posed to answer this topic. These included:

1. What are the rules of assembly and persistence in communities? Bob Hessler felt we need go back to the beginning and start collecting again. This concept was supported but who pays?
2. Taxonomists must learn to sell themselves and their science. Many museums were producing booklets and getting good response from the public, but had yet to convince the funding bodies.
3. Philippe Bouchet suggested we should be going for a catalogue of all species on earth. Though there were murmurs of approval from the audience, Tony Rice found that this may prove a scientific black hole, whilst Ole Tandal suggested there should be concentration on the species that are of most ecological importance.
4. Should we be attempting to collate biodiversity in the deep sea? Mike Rex felt it was imperative to find what material exists and what is the state of the database. Mike generously agreed to contact all those with large sampling programmes and suggested we use the Deep-Sea Newsletter to establish this database.

d. Funding

Dave Billett outlined a meeting he had attended in London concerning the funding of biodiversity which was inconclusive. The National Science Foundation (USA) has a special programme in Conservation and Restoration Biology administered by the Division of Biotic Systems and Resources that is considering proposals on Biodiversity. It may be possible to sponsor international work on problems of deep-sea biodiversity through the Agency for International Development. A useful resource is 'Research Priorities in Conservation Biology' (1989), M.E. Soule and K.A. Kohm (eds), Island Press. Those interested in deep-sea biodiversity should also see 'Marine Biodiversity and Ecosystem Function: A proposal for an International Programme of Research' (1991) by J.F. Grassle et al., Biology International, Special Issue 23. An entire issue of *BioScience* (1991) vol. 41, no. 7 is devoted to the problems of marine biological diversity (with an interesting article by Fred Grassle). *Science* (1991) vol. 253 has just featured a perspective of four articles on biodiversity, and the special report 'The sustainable biosphere initiative: An ecological research agenda' in *Ecology* (1991) vol. 72, no. 2 is very commendable.

P.A. Tyler, M.A. Rex, J.D. Gage

P.S. Although this deadline is now overdue it may be useful to quote the following announcement which gives details regarding grants:

Biodiversity Research Grants

The Biodiversity Support Programme (BSP) - a joint venture of World Wildlife Fund [World Wildlife Fund for Nature], The Nature Conservancy and World Resources Institute - funded by the U.S. Agency for International Development (USAID), is soliciting proposals for biodiversity research in USAID assisted countries. Research may be ecological, economic, anthropological or socio-political in focus or may utilize an interdisciplinary methodology. Deadline is 15 November 1991. Contact Biodiversity Support Program, c/o World Wildlife Fund, 1250 24th St., N.W., Washington, D.C. 20037. (202) 778-9795.

PRE-REPORT ON THE BENTHOS METHOD WORKSHOP
held in Copenhagen on July 6, 1991, in conjunction with the
6th Deep-Sea Biology Symposium

The two days following the symposium were reserved for this workshop. At the end of the first day the discussions had already made such good progress that the workshop was closed.

Partly due to other commitments but mainly to the difficult subject matter the report of the four subgroups

- bacteria
- meiofauna
- macrofauna
- megafauna

have not been finished and will be printed in a later issue of the Deep-Sea Newsletter.

It was most encouraging to have such a large number of colleagues attending the workshop and demonstrating their interest in the topic, although it was difficult to convince at least some of the participants that standardization is important for future deep-sea research.

What struck me most forcefully during these discussions was the difficulty in reaching agreement between participants on the need for both taxonomic and size-related approaches to benthic community studies.

Both of these approaches have their advantages and attractions and both ask important and valuable questions. The qualitative approach may ask "who is there?" and "who is doing what?". "Who" may be a species, a guild of functional types, a restricted or a wider taxon. All animals in such a category share specific structural or functional characters. Generally, however, size is not one of these associating features.

The quantitative approach asks "how many are there?", "what is their total (bio-)mass?". At the total community level these questions may also be independent of size. Why then is size important? Much of the discussions during the workshop in Copenhagen focussed around size classification of the benthos! Why do we need size groups?

Size has two different aspects in benthos research: a methodological and a theoretical one. Because of the size/abundance relation, quantitative information on small organisms can be worked out from small samples. Conversely, for the quantitative assessment of large organisms, large samples are necessary. A nested sample design is therefore essential for total benthic studies. There is another method-based reason for size fractionation - that different authors have used different mesh sizes. To reach maximum comparability, fractioning into size classes applied earlier should optimize comparison. A third argument for working with size groups is that samples with narrow grain size ranges are much easier to sort than those with a broad spectrum. The magnification of the stereolens, focus and eye adaptation are kept to a minimum when working with a limited grain size.

It is a general rule in ecology that a relationship exists between metabolic rate and size. Smaller and less structured organisms exhibit a higher metabolic rate per weight unit than larger and more complex ones. This is certainly only applicable to community averages, but it does permit the intercomparison of communities. Although we are not able to establish such community structure species by species, the size structure of a community can tell us something about energy transfer through the system.

These are the aspects of size in ecology, and these are the arguments for breaking down the community into size groups. It is important for the quantitative, but not for the qualitative approach. A taxon may have members in different size categories termed meiofauna, macrofauna, megafauna (example: Xenophyophorea). For taxonomic reasons we have no argument to separate a tax-

on into several size classes.

In the quantitative approach size structure seems to be ecologically significant, but inevitably cuts across well-defined taxonomic lines. On the other hand, an expression such as "macrofauna of meiofaunal size" does not respect the quantitative approach and the ecological idea behind size groups; instead, it mixes the qualitative and quantitative approaches to community structure.

I hope that these first comments on the workshop in Copenhagen will give a clearer science structure to the community of deep-sea benthologists, help to define the different approaches to community studies and support further discussions on these matters via the Deep-Sea Newsletter.

Dinner at
Danmarks
Akvarium:

H. Bluhm,
Eric and
Mary Ann
Foell,
Christian
Borowski,
Virginie
Tilot,
Christine
and
Sebastian
Gerlach



Hjalmar Thiel
Hamburg

PARTICIPANTS IN THE 6TH DEEP-SEA BIOLOGY SYMPOSIUM

Numbers refer to the photos on the next pages (brackets = staff or guests)

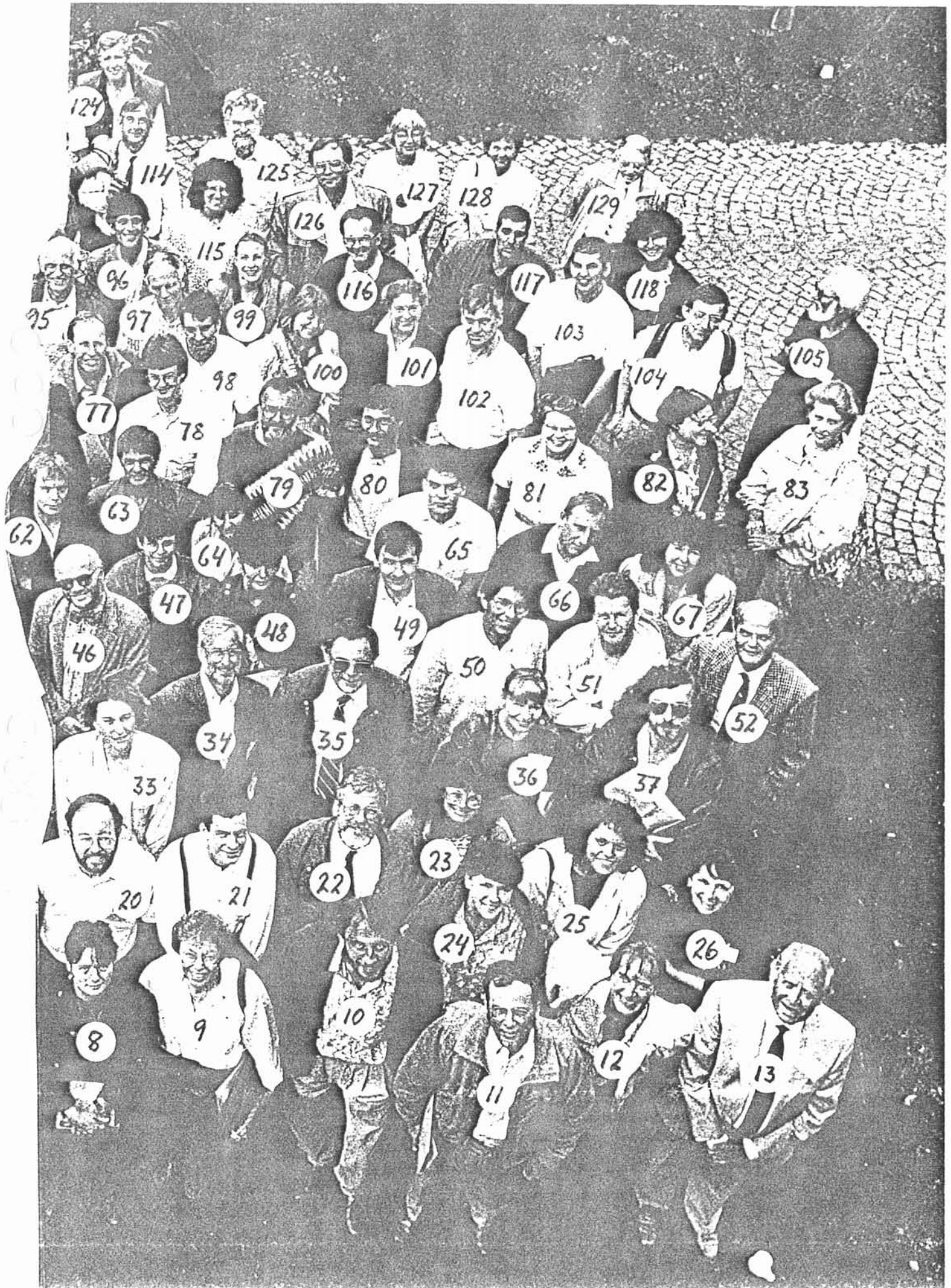
- | | |
|-----------------------------------|-----------------------------------|
| 1. Jun Hashimoto, Japan | 21. Jonathan Larwood, UK |
| 2. Claudia Thomsen, Germany | 22. John Patching, Ireland |
| 3. Tomomi Sato, Japan | 23. Marcia Gowing, USA |
| 4. Yoshihisa Shirayama, Japan | 24. Lucy Giles, UK |
| 5. Laurence D. Guidi, France | 25. Sonia Batten, UK |
| 6. Kim Juniper, Canada | 26. Rizpah Shires, UK |
| 7. Peter Funch Andersen, Denmark | 27. (M. Jensen, Denmark) |
| 8. Antje Dolle, Germany | 28. (C. Nielsen, Denmark) |
| 9. Mary E. Petersen, Denmark | 29. Ursula Witte, Germany |
| 10. Peter Linke, Germany | 30. Christian Borowski, Germany |
| 11. David Thistle, USA | 31. Richard Lutz, USA |
| 12. Sarah Bronsdon, UK | 32. Gordon Paterson, UK |
| 13. Jørgen B. Kirkegaard, Denmark | 33. Anne Godfroy, France |
| 14. Laurenz Thomsen, Germany | 34. Andrew Carey, USA |
| 15. Hans-Uwe Dahms, Germany | 35. Jim Blake, USA |
| 16. Reinh. M. Kristensen, Denmark | 36. Caroline Maybury, UK |
| 17. Onno Grosz, Germany | 37. Roger Bamber, UK |
| 18. Helga Kapp, Germany | 38. Danièle Gaspard, France |
| 19. Paul Tyler, U.K. | 39. M. Nechama Ben-Eliahu, Israel |
| 20. Craig Young, USA | 40. Anette Grøngaard, Denmark |

41. A.-M. Alayse-Danet, France
42. Christian Bussau, Germany
43. Antje Boëtius, Germany
44. Scott France, USA
45. Robert Vrijenhoek, USA
46. Daniel Desbruyères, France
47. Marina Carstens, Germany
48. Ann Vanreusel, Belgium
49. Stephen Hutchinson, UK
50. Amatzia Genin, Israel
51. Philip Mackie, UK
52. Torben Wolff, Denmark
53. Elisabeth Schein, France
54. Paul Snelgrove, USA
55. Ute Hentschel, USA
56. Ute Wilhelmsen, Germany
57. Michael Rex, USA
58. Ingeborg Bussmann, Germany
59. Bob Hessler, USA
60. Angelika Brandt, Germany
61. Erdogan Ozturgut, USA
62. Andrew Gooday, UK
63. Knut Poremba, Germany
64. Monika Nebelsieck, Austria
65. Grant Lawson, UK
66. Lawrence Hawkins, UK
67. Gina Newton, Australia
68. Anastasios Tselepidis, Greece
69. Nina Vinogradova, Russia
70. Tony Rice, UK
71. Jarl-Ove Strömberg, Sweden
72. Karin von Juterzenka, Germany
73. Eve Southward, UK
74. Alan Southward, UK
75. Robert Kunzig, USA
76. Jörundur Svavarsson, Iceland
77. John Armstrong, UK
78. Brian Bett, UK
79. Horst Felbeck, USA
80. Gerd Liebezeit, Germany
81. Olga Zezina, Russia
82. Irina Roginskaya, Russia
83. Natalia Keller, Russia
84. John Gage, UK
85. Myriam Sibuet, France
86. (Claudia Luth, Germany)
87. Anastas. Eleftheriou, Greece
88. (M. Smith-Zoninovich, USA)
89. Hjalmar Thiel, Germany
90. Rolf Koppelman, Germany
91. Karen Bille Hansen, Denmark
92. Stephan Scheibe, Germany
93. Jon-Arne Sneli, Norway
94. Richard Gustafson, USA
95. Torleiv Brattegard, Norway
96. Craig Cary, USA
97. Gary Poore, Australia
98. Philip Bagley, UK
99. (Mary Ann Foell, USA)
100. Carol Turley, UK
101. Dagmar Barthel, Germany
102. Ole Tendal, Denmark
103. Joan Cartes, Spain
104. Helmut Zibrowius, France
105. Feodor Pasternak, Russia
106. Ulf Luth, Germany
107. Bernd Christiansen, Germany
108. Craig R. Smith, USA
109. Sergei Galkin, Russia
110. Helen Krylova, Russia
111. Olga Kamenskaya, Russia
112. Thomas Soltwedel, Germany
113. Jorgen Nielsen, Denmark
114. Nigel Merrett, UK
115. Karen Wishner, USA
116. David Billett, UK
117. Francesc Sardà, Spain
118. Lúcia S. Campos, (Brazil) UK
119. (Christine Gerlach, Germany)
120. Sebastian Gerlach, Germany
121. Hartmut Bluhm, Germany
122. Alexander Mironov, Russia
123. Gerd Schriever, Germany
124. Richard L. Haedrich, Canada
125. Michael H. Thurston, UK
126. Eric J. Foell, USA
127. (Else Højgaard, Denmark)
128. (Lisbeth Wolff, Denmark)
129. (Poul Jeppesen, Denmark)

Not in photo:

Danny Eibye-Jacobsen, Denmark
Michael Hartmann, Danmark
Jens Høeg, Denmark
Peter G. Jensen, Denmark
Preben Jensen, Denmark
Anne Klitgaard, Denmark
Jørgen Knudsen, Denmark
Karin Lochte, Germany
Fritz J. Madsen, Denmark
Kirsten Michalek, Germany
Lauren Mullineaux, USA
Arne Nørrevang, The Faroes
Olaf Pfannkuche, Germany
Michel Roux, France
M.N. Sokolova, Russia
Marianne Thorsen, Denmark
Virginie Tilot, France
Magda Vincx, Belgium
Bent Vismann, Denmark
Waldo Wakefield, USA
Håkan Westerberg, Sweden





INVITATION TO ATTEND
THE SEVENTH DEEP-SEA BIOLOGY SYMPOSIUM IN 1994

After a most successful suite of symposia (Scripps 1981, Hamburg 1985, Brest 1988, Copenhagen 1991) the baton has been passed on to Iraklion and the Institute of Marine Biology of Crete for the 7th Deep-Sea Biology Symposium.

We would therefore like to convey a warm invitation to everybody in the deep-sea community to come to Crete during the summer of 1994. Crete, surrounded by abyssal depths, was once upon a time the center of Greek mythology where the first glimmerings of marine science were observed. Now it is an active center of modern marine research.

The island is easily accessible by air and sea, characterised by warm weather, beautiful landscape, full-bodied wine and a hospitable local population. The symposium will be held during the last week of September, when both accommodation costs and weather conditions are favourable.

Anastasios Eleftheriou

REQUEST FOR COMMENTS AND SUGGESTIONS

The location of the next deep-sea symposium was decided on the last day of the Copenhagen meeting. There were invitations to host the forthcoming 7th symposium from Ireland (Galway), USA (Fort Pierce, Florida) and Greece (Iraklion). A vote was taken, resulting in a slight majority for the latter.

Towards the end of the symposium several participants addressed me regarding a re-evaluation of the way these meetings might be conducted in future (e.g. more emphasis on poster presentations and thus more time for individual talks, etc.).

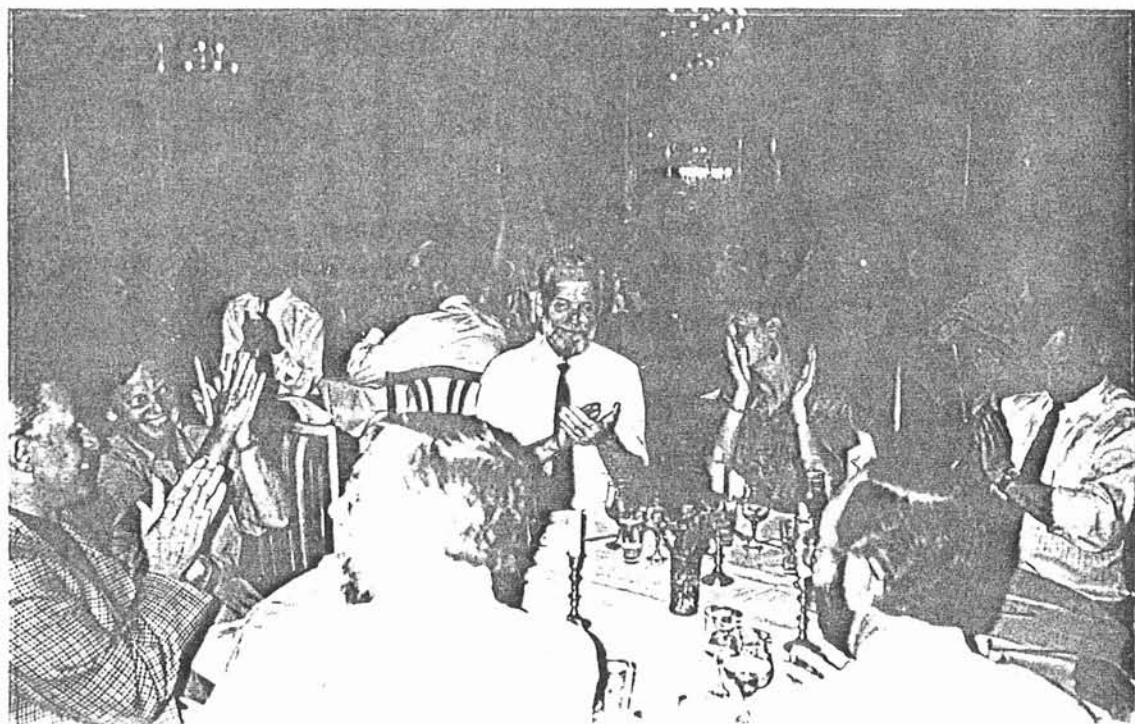
Naturally, Anastasios Eleftheriou and his co-organisers are very interested in any advice and new ideas. Organisers of previous symposia have agreed to help our Greek colleagues in preparing the Crete meeting.

The next issue of Deep-Sea Newsletter will give further details about the forthcoming symposium. In addition, we suggest that participants of the former symposia (hopefully quite a lot!) should write to the Editor commenting on the way they would like to see the symposia conducted in future, giving suggestions to particular items to be included in the program, etc.

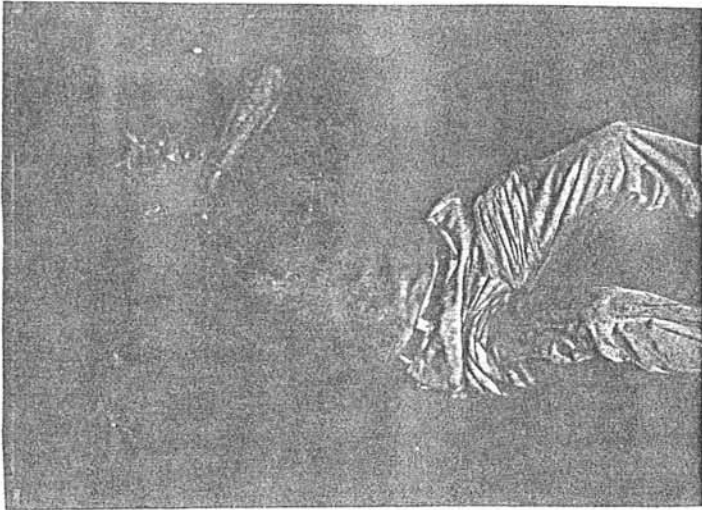
Please let us have your letter well in advance of the deadline for the D.-S.N.: 1 November 1992.

Thank you very much!

Torben Wolff



Farewell dinner in Tivoli Gardens.
Round the table: Anastasios Eleftheriou, Lisbeth Wolff, Hjalm. Thiel, Dagmar Barthel, Ole Tendal, Craig Young & John Patching.
(Bob Hessler, phot.)



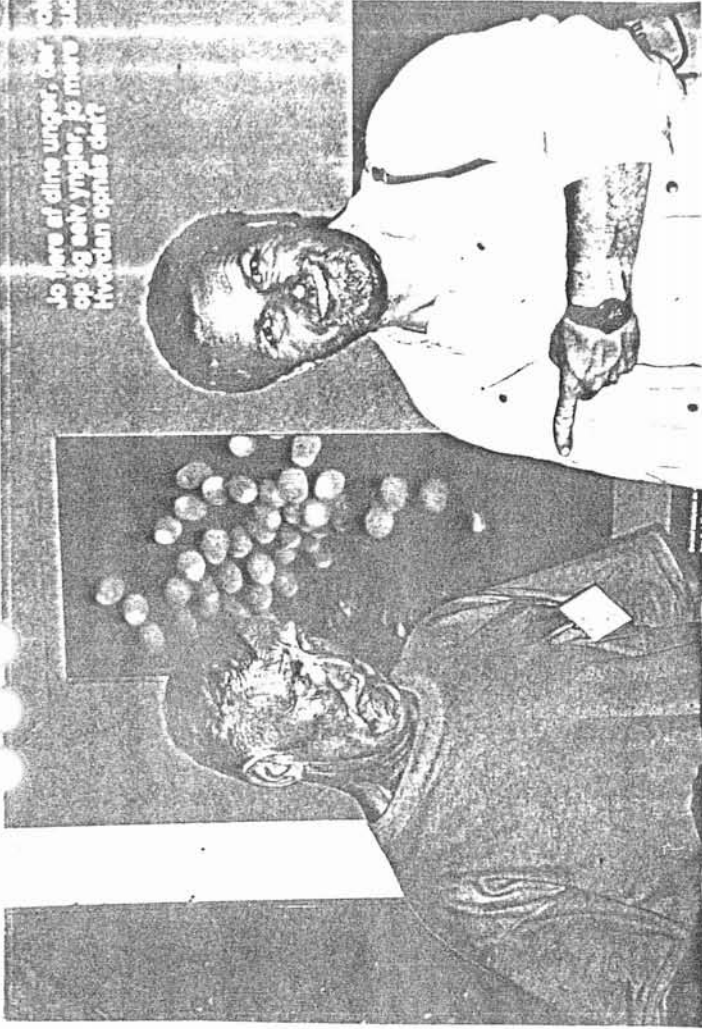
Your editor presenting his terrible war cry, the haka, at the farewell dinner

Paul Tyler: "What do you think of my co-author?" (John Gage)

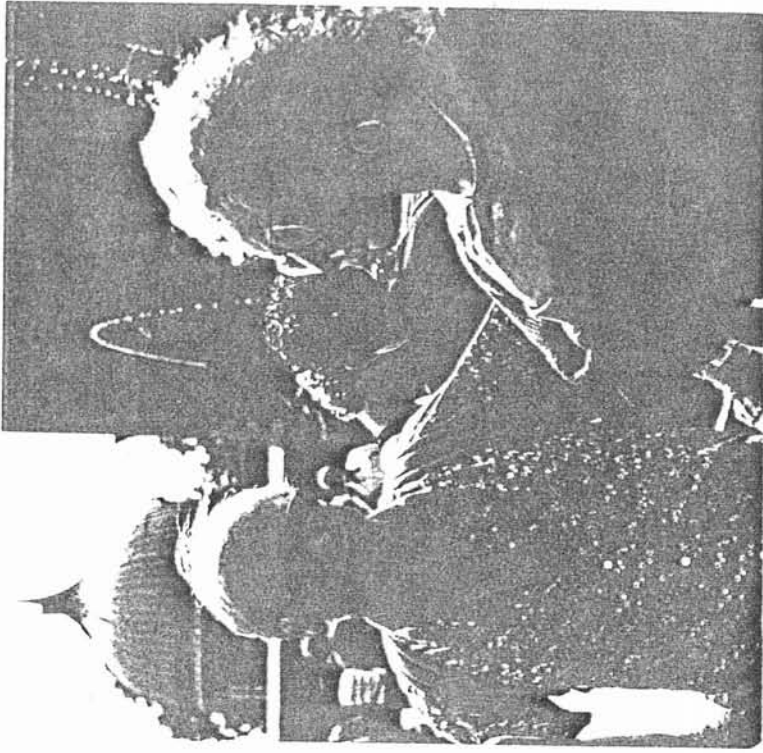
Feodor Pasternak and Myriam Sibuet making friends

Nina Vinogradova having a jolly good time

(Bob Hessler, phot.)



Lo here at dine unger, der op og each yngler, lo more sic the dan opnis det?



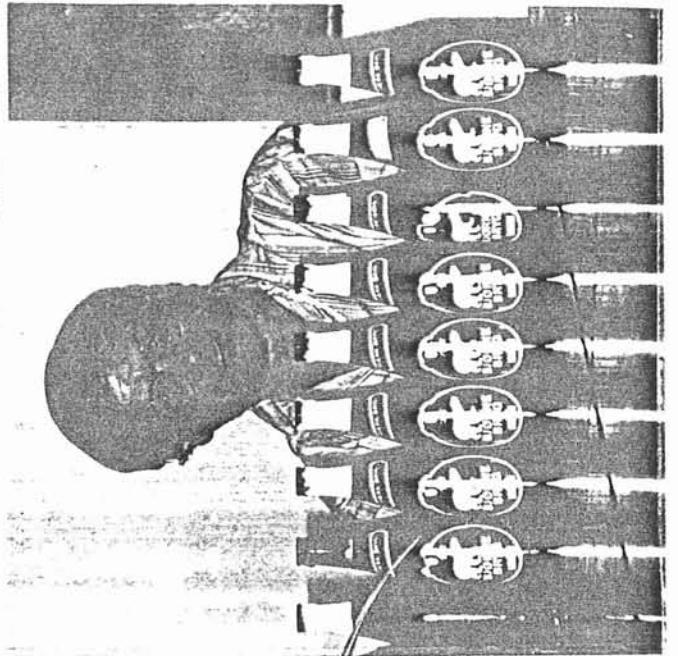
Craig Smith, M. Smith-Zoninovich and David Thistle at Nyhavn

Daniel Desbruyères and Anne-Marie Alayse-Danet at Frederiksberg Castle

Daniel having his share

Craig Young and John Patching - future hosts after Crete?

(Bob-Hessler, phot.)



A TWISTED TALE

The effects of the Coriolis force on moving benthic animals were discussed by Irina Roginskaya at the Deep-Sea Biology Symposium in Copenhagen (see abstract below).

My impression listening to this paper was that there are numerous observations of circular or spiral lebensspuhren that have a common sense of rotation within each hemisphere, but that turn in opposite directions to the north and south of the equator. If this indeed is so, then it is an intriguing phenomenon which, however, hardly can be attributed to the direct effect of the earth's rotation. I will present a "back of the envelope" calculation to show why and propose an alternative explanation for the observations.

All objects that move relative to the earth are subject to a fictitious force - the Coriolis force - that acts perpendicularly to the direction of the movement, to the right on the northern hemisphere and to the left on the southern. This is true for all movements, regardless of their speed or duration. The force is, however, small (and proportional to the speed), so in general it has to be applied for a fairly long time to manifest itself. As is derived in any textbook on mechanics or oceanography, the Coriolis acceleration is equal to $V 2 \Omega \sin \phi$, where V is the speed of the object, Ω is the angular speed of rotation of the earth and ϕ is the latitude. The factor $2 \Omega \sin \phi$ is called the Coriolis parameter, f , and has the numerical value 1.5×10^{-4} per sec. at the poles, decreasing to 1×10^{-4} around 45° and 0.5×10^{-4} at 20° .

The force due to the Coriolis acceleration on an animal with the mass m , which crawls along on the bottom with a speed V , becomes Vfm . If the animal has a characteristic length scale L , we can approximate the mass with $L^3 \rho$, where ρ is the density of the animal, which we for simplicity equate with that of the water. Unless the creature moves exactly with the same speed and direction as the prevailing current, U , there will be a water movement around the animal which causes a drag force. We can estimate the water velocity relative to the animal as $V + U$. Applying the common formula for fluid drag we get the drag force $C \rho A (V+U)^2$, where C is the drag coefficient and A is the area of the animal projected towards the flow. The latter can be estimated as L^2 .

The ratio of the Coriolis force to the drag force forms a dimensionless number which we, in the absence of an established name, call the Pirouette number, Pi . We find that

$$Pi = \frac{L V f}{C (V+U)^2}$$

A large value of Pi means that the Coriolis force dominates over the drag force, whereas a small value shows that the Coriolis force is negligible. We can now look at the simple case where the fluid is at rest ($U = 0$) and the drag on the animal is due solely to its own motion. Pi is then reduced to Lf/CV . For most speeds C is of the order of magnitude 1 (increasing for very slow, creeping motion). For a 1 cm size animal moving at the speed 0.1 cm per sec. we find that Pi becomes roughly 10^{-3} . This means that even in an extreme case as this, from the very slow movement through the water the drag becomes 1000 times as large as the Coriolis force! Any slight asymmetry on the animal will certainly give a perpendicular component of the drag which exceeds and offsets the Coriolis effect completely. It is easy to see that a reasonable value for U makes Pi even smaller and the Coriolis force more insignificant.

What then is the explanation for circular tracks showing a constant sense

of rotation? A simple and reasonable cause would be a rheotactic behaviour in combination with a rotating current. The tide provides just such a steadily rotating current, with a period of about 12 hours. An animal that for example burrows at 1 cm per min. at the same time as it keeps a fixed orientation to the current direction will produce a circular track with approximately 1 m radius. In the deep ocean, well away from the coast, the tidal current ellipse rotates clockwise in the northern hemisphere and anticlockwise in the southern hemisphere. The direction varies, however, on the continental shelf and close to bathymetric barriers, so there is ample room for exceptions. It should be pointed out that the direction of the tidal current changes at a constant rate, so a constant speed of the animal will lead to a circular track even if the current ellipse is highly excentric.

I should be very interested to hear if there are observations that really show a common sense of rotation of animal tracks in a large area. A time-lapse sequence that shows a circular track being formed is something that could test the mechanism by comparing the rotation and tidal periods. Conversely, a known period would make it possible to read the speed of animals from bottom photographs simply by measuring the curvature of their tracks.

H. Westerberg
National Board of Fisheries, Göteborg, Sweden

Abstract: I.S. Roginskaya,

P.P. Shirshov Institute of Oceanology, Academy of Sciences of the USSR, 23 Krasikova Street, Moscow 117218, USSR

POSSIBLE INFLUENCE OF THE EARTH'S ROTATION ON SOME DEEP-SEA BIOLOGICAL PHENOMENA

A model is proposed to explain the formation of the spiral patterns observed in many biological structures, e.g. egg masses of gastropods, faecal tracks of hemichordates and some trace fossils. The possible influence of the Coriolis effect on the formation of these "living" spirals is discussed.

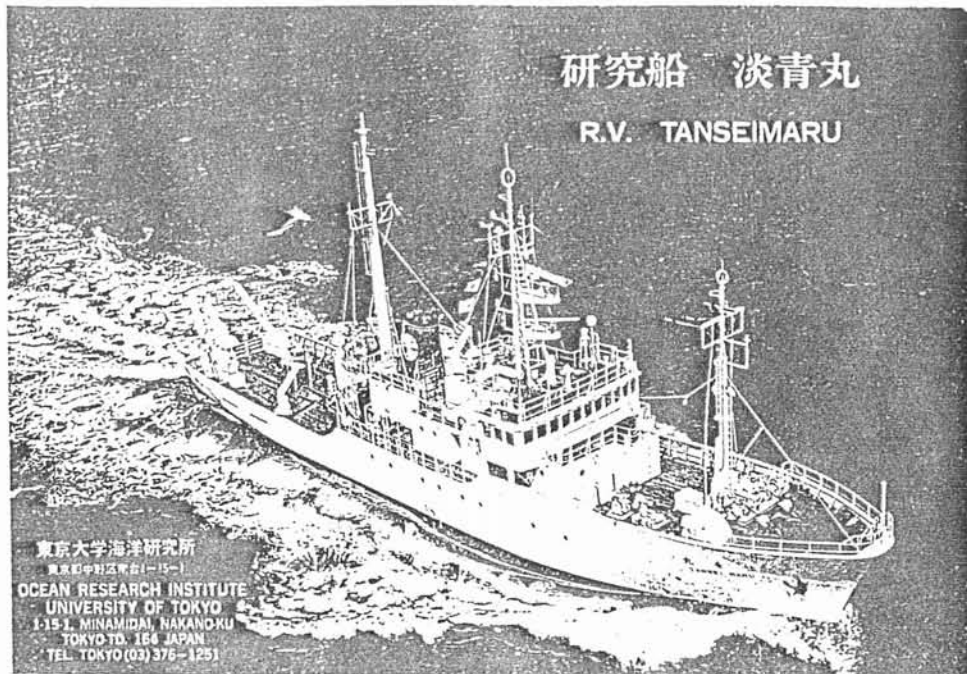
- o - 0 - o -

SHELF AND BATHYAL DEEP-SEA BENTHIC STUDIES USING R.V. TANSEI MARU OF THE OCEAN RESEARCH INSTITUTE, UNIVERSITY OF TOKYO

The Ocean Research Institute, University of Tokyo, has two research vessels, R.V. Tansei Maru and R.V. Hakuho Maru. Our larger vessel, Hakuho Maru, was renewed in 1989, being 3,987 in tonnage and 100 m long. It is a very powerful ship, equipped with 8 winches, seabeam, radio isotope lab., etc. It served for a 130-days around-the-world cruise from November 1989 to March 1990, calling at San Diego, Miami, Lisbon, Monaco, Goa, and Singapore, and passing both the Panama and Suez canals.

It is probably one of the best research vessels in the world. The competition for its ship time is thus very severe, and we tend to select abyssal and hadal areas as its working site, because in studying shallower depths we can use the other vessel.

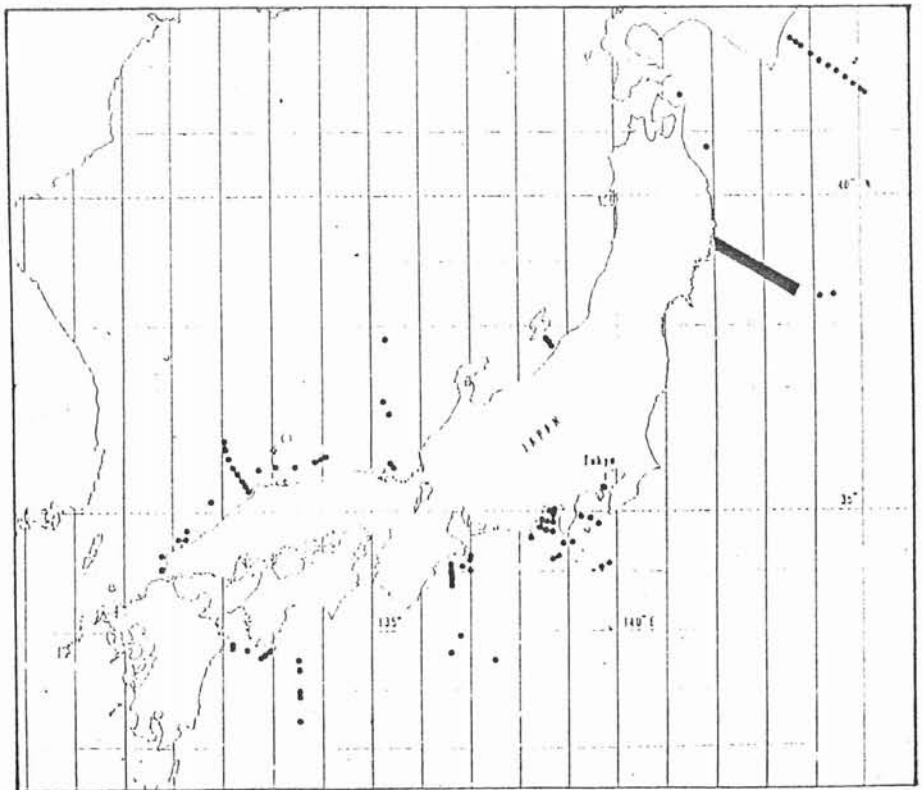
The Tansei Maru covers works on the shelf and in bathyal areas around Japan (Tansei means pale blue which is the symbol colour of our university).



It was remodeled in 1982 to a size of 470 in tonnage and 51 m in length. There are 4 winches, and the biggest one has a 7000 m cable of 9 mm. Eleven scientists can be on board the ship. Around 20 cruises are accounted for each year (7-10 days each). In addition to Japanese, Asian scientists have recently also joined the cruises as part of the WESTPAC program. Applicants need not prepare grants for the ship time.

Our division (Marine ecology) constantly has succeeded in running 1-2 benthic biology cruises on Tansei Maru each year. In 1985 we made a down-scaled model (1/10 m²) of USNEL-type box corer to fit the A-shaped frame. For 6 years we have used it intensively with as many as 340 sampled cores. We also carried out trawlings, dredgings, CTD observations, sediment trap experiments, etc. After the extensive study of megabenthos in Suruga Bay, central Japan using underwater cameras (Ohta, 1983 in Bull. Ocean Res. Inst. Univ. Tokyo, 5: 1-244), we have concentrated in studying the area off Sanriku, Japan. The results have mainly been published in the Journal of the Oceanographical Society of Japan.

Recently we expanded our study area toward north (off Kushiro, Hokkaido), south (Kumano Basin, Tosa Basin etc.) and the Japan Sea. In the near future our division is planning to describe the zoogeography of the bathyal, benthic fauna around Japan, based on our huge collections.



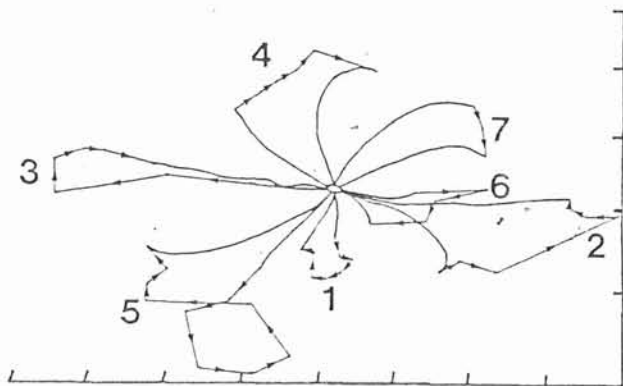
Suguro Ohta and Yoshihisa Shirayama
Ocean Research Institute, Univ. Tokyo

Investigations of the Tansei Maru

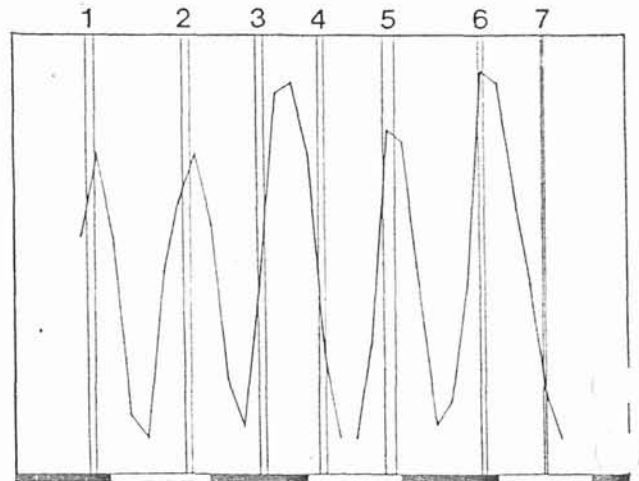
ECHIURAN ENIGMA

A recent deployment of an IOSDL free-fall time-lapse camera system, Bathysnap, recorded the feeding behaviour of an echiuran worm. The film, taken at 4838m on the Porcupine Abyssal Plain (48°50'N 16°30'W), showed the periodic excursions of an echiuran proboscis over the sediment surface. Those who attended the Copenhagen meeting may remember that this film sequence was shown as a short video during Tony Rice's presentation on the DEEPSEAS project. We have now been able to make a more detailed analysis of the worm's activity and examine the simultaneous current meter record; the results are interesting but pose more questions than they answer.

During the 12 day deployment the proboscis appeared seven times over a 58hr period in the first four days and then was not seen again. Four hours after the camera landed a definite hole appears, the first proboscis excursion began half an hour after the appearance of this hole. The duration of proboscis excursions varied from 18 to 90 mins (mean 60 mins). The interval between excursions (mid-point to mid-point) varied from 455 to 702 mins (mean c. 9 hrs). Five of the proboscis sweeps were clockwise, one anticlockwise, the sixth included both directions. Only one excursion overlapped a previously swept sector. Proboscis activity does not appear to correlate with current speed and/or direction; tidal movements are predominantly diurnal.



Echiuran proboscis movements during the seven recorded excursions. (Each axis division represents 10 cm, note the axes are not orthogonal.)



Near bottom current velocities and periods of echiuran proboscis activity (Horizontal axis shown in 12 hr divisions)

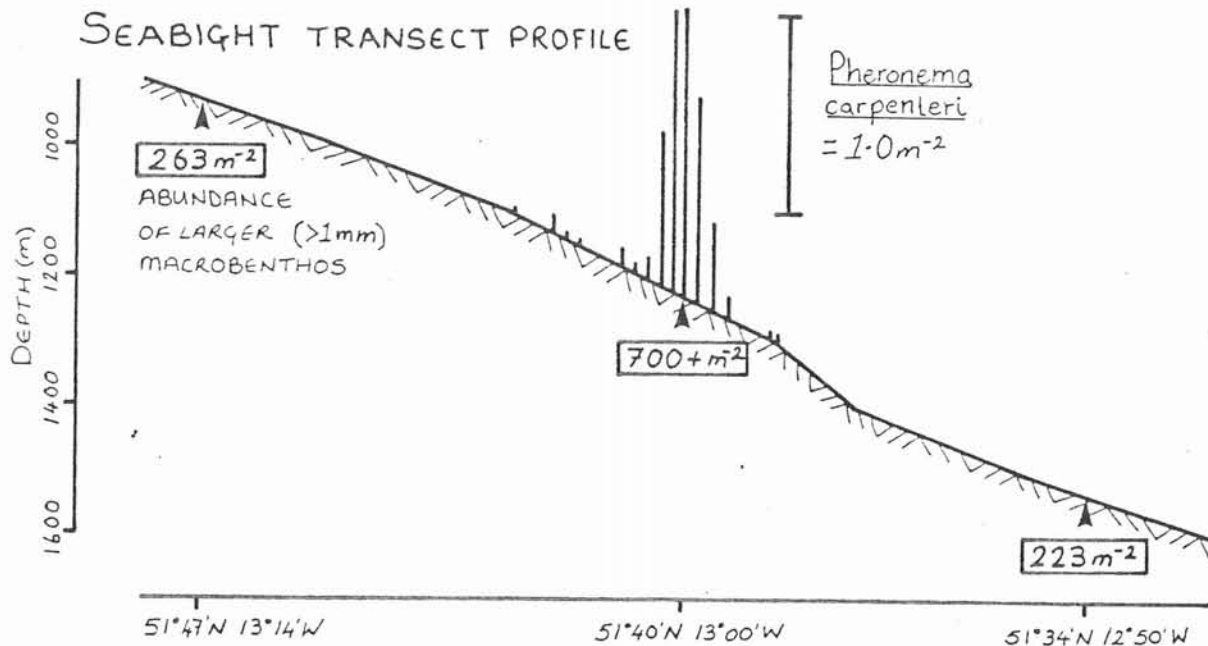
If feeding is rhythmic what controls the period?, is it a gut filling and emptying cycle. Is there a mechanism to prevent the proboscis re-entering a previously swept sector?, could mucus secretions mark the swept sectors. Why did feeding stop?, did the worm die, or did it move on to a new location.

With the help of Lawrence Hawkins (Department of Oceanography, University of Southampton) we have examined the behaviour of *Thalassema thalasseum*, an intertidal rock crevice dwelling echiuran. Initial results on the possible role of mucus were inconclusive. However, we may continue and extend this study if a suitable population of sediment dwelling sublittoral echiurans can be located and live specimens retrieved.

SPONGE SURPRISE

Returning from the latest cruise of the DEEPSEAS project, *Challenger* May 1991, to the Porcupine Abyssal Plain, we were able to spend a few days in the Porcupine Seabight (49-52°N, 11-14°W). Like our illustrious predecessors on the *Porcupine* we planned to re-visit an "Holtenia ground", now known rather more prosaically as 'dense aggregations of a hexactinellid sponge, *Pheronema carpenteri*' (Rice *et al*, 1990, *Prog. Oceanog.*, 24, 179-196.). The sponge is abundant in a narrow strip (1000-1300m depth) around the Seabight, in places attaining densities of over 1.5m^{-2} .

Our aim was to study the influence of dense sponge aggregations on the ecology of the macrobenthos. We established a three station transect: one in a suspected dense sponge zone, one above this zone and one below. The stations were sampled with a box corer: three replicates at the upper and lower stations and four within the sponge zone. The range of 'sponge influence' recorded in these four samples indicates the heterogeneity of this habitat: (1) diffuse spicules, having a 'loose-packed' volume of 250ml, (2) minor spicule mats, 500ml, (3) extensive dense spicule mats, 1250ml, and to our delight (4) a complete intact sponge.



Average densities of the larger (>1mm) macrobenthos from the upper and lower stations are broadly similar (c. 240m^{-2}). The analysis of sponge zone samples is incomplete, but present data suggest abundances at least 2-3 times higher than at the other two stations. Reasons for the enhancement of sponge densities in a narrow bathymetric range, and the potentially corresponding enhancement of macrobenthos, are not clear; proximity to regions of increased near-bottom tidal flows has been suggested (Rice *et al*, 1990).

Our immediate interest is in the extension of our present investigation of the use of size spectra in the description of deep-sea benthic communities. Can these three stations be differentiated in terms of their size spectra?, does the presence of dense megabenthos influence the shape of the size spectra? The sponges and their spicule mats do provide a substrate for a number of large macro-/small megafaunal species: sipunculids, terebellid polychaetes, solitary ascideans and very numerous ($600+ \text{m}^{-2}$) ophiuroids. Is this for some reason a 'large animal habitat' - only size spectra will tell. One hundred and twenty years on, "Holtenia grounds" still hold rich pickings for the benthic ecologist.

A PLEA FOR BENTHIC CHAETOGNATHS

Most chaetognaths are pelagic animals living at all depths of the oceans. But there are also some benthic arrow-worms, e.g. the species of the genus *Spadella*, which are well known from coastal waters. Once I got a specimen caught in a box-corer in the deep sea by Lisa Levin and no doubt belonging to the genus *Spadella*. A single specimen of a new species can be described if it is in excellent condition; unfortunately this is not so with the present specimen. In general, I wish to attract your attention to benthic deep-sea chaetognaths present in samples in box-corers or other bottom gear. They are transparent, up to 2-3 mm long. Please send me any deep-sea chaetognaths you may find!



Helga Kapp
Univ. Hamburg, Zoolog.Inst.
Martin-Luther-King-Platz
D-W-2000 Hamburg, Germany

THE ANTARCTIC DEEP-SEA HEXACTINELLID FAUNA

An often mentioned characteristic of the Antarctic benthos is the exorbitant occurrence of hexactinellid sponges all around the continent (Topsent 1912, Koltun 1970). To be precise, this dominance is found only on the shelf, and it is due to a high abundance of large-sized specimens of between 2 and 6 species - the number accepted depending on each author's ideas on synonymy (Burton 1929, Koltun 1976, Barthel & Tendal in prep.).

There are only two records of hexactinellids from the slope, and it can be questioned if there is a special bathyal sponge fauna at all in the Antarctic (Barthel & Tendal 1989).

At present, the Antarctic abyssal hexactinellid fauna comprises 23 recognized species (Table 1) taken at few localities, which are unevenly spread around only half of the continent (Fig. 1). These species all belong to families and - with the exception of two - to genera widely distributed at abyssal depths in the three large oceans (Lévi 1964).

Of the 23 species, 18 have only been found in the Antarctic region; this high "endemism" is, however, misleading, as 16 species (about 70 %) have only been found once, and another 5 only two or three times. The situation is typical for the deep-sea hexactinellid fauna worldwide, as 115 (76%) of the about 150 species known from depths greater than 2000 m have been found only once (Lévi 1964, Tendal unpublished).

Five species have been recorded in other oceans as well, i.e. one worldwide but not abyssally, two in the Atlantic, one in the Atlantic and the Pacific, and one in the Pacific and Indian Oceans; thus, the basis for conclusions on faunal relationships is too small.

The poor knowledge of the Antarctic deep-sea hexactinellids is further thrown into relief by the fact that 12 species are known only as fragments, a situation impeding even the simplest conclusions on biological features. For some species it is known, and for others it can be deduced from the (most often scantily) known congeners that 13 species probably are soft-bottom inhabitants, 5 may live on hard substrates, and for 5 nothing can be said. So the pack ice area that influences the distribution pattern of species of many other classes by delivering dropstones that can serve as substrates (Picken 1985), does not seem to be a decisive factor in hexactinellid distribution (Picken 1985).

The picture of the taxonomic composition of the Antarctic deep-sea hexactinellid fauna is very incomplete, and nothing is known about distribution

patterns, fauna relationships and general biology. We would therefore like ourselves to work up pertinent existing collections, as well as to take part in the planning of programs, projects and cruises that might provide relevant material. Being both the only topographic link between the large deep-sea regions of the world oceans and also the region where most of the globe's deep-water is produced, the ocean around the Antarctic continent houses a fauna that can provide the answers to a number of questions concerning present and past evolutionary, biological and biogeographical events.

Dagmar Barthel
Institut für Meereskunde, Kiel

Ole S. Tendal
Zoological Museum, Copenhagen

References

- Barthel, D. & O.S. Tendal, 1989: The sponge fauna of the deep Weddell Sea: status and the need for further biological and faunistic investigations. - *Deep-Sea Newsletter* 16: 8-9.
- - in prep.: Antarctic Hexactinellida. - In: J.W. Wägele & J. Sieg (eds.): *Synopses of the Antarctic Benthos*.
- Burton, M., 1929: Porifera. Part II. Antarctic Sponges. - *British Antarctic Expedition 1910, Zoology VI*: 393-458.
- Koltun, V.M., 1970: Sponges of the Arctic and Antarctic; a faunistic review, - *Symposia of the Zoological Society of London* 25: 285-297.
- 1976: Porifera, part I: Antarctic sponges. - *B.A.N.Z. Antarctic Research Expedition Reports, Series B (Zoology and Botany) IX*: 147-198.
- Lévi, C., 1964: Spongiaires des zones bathyale, abyssale et hadale. - *Gala-thea Report* 7: 63-112.
- Picken, G.B., 1985: Marine habitats - Benthos. - In: W.N. Bonner & D.W.H. Walton (eds.): *Antarctica*, Pergamon Press, Chapter 4: 154-172.
- Topsent, E., 1912: Sur la contribution apportée par les explorations scientifiques dans l'Antarctique à la connaissance des "Euplectellinæ". - *C.R. Assoc. Franc. Sc.* 40: 518-520.

Fig.1. Localities in Antarctica at depths larger than 2000 m from where hexactinellids have been reported.

▲ = localities within the pack ice limit. ▼ = localities outside the pack ice limit, but close to the Antarctic convergence.

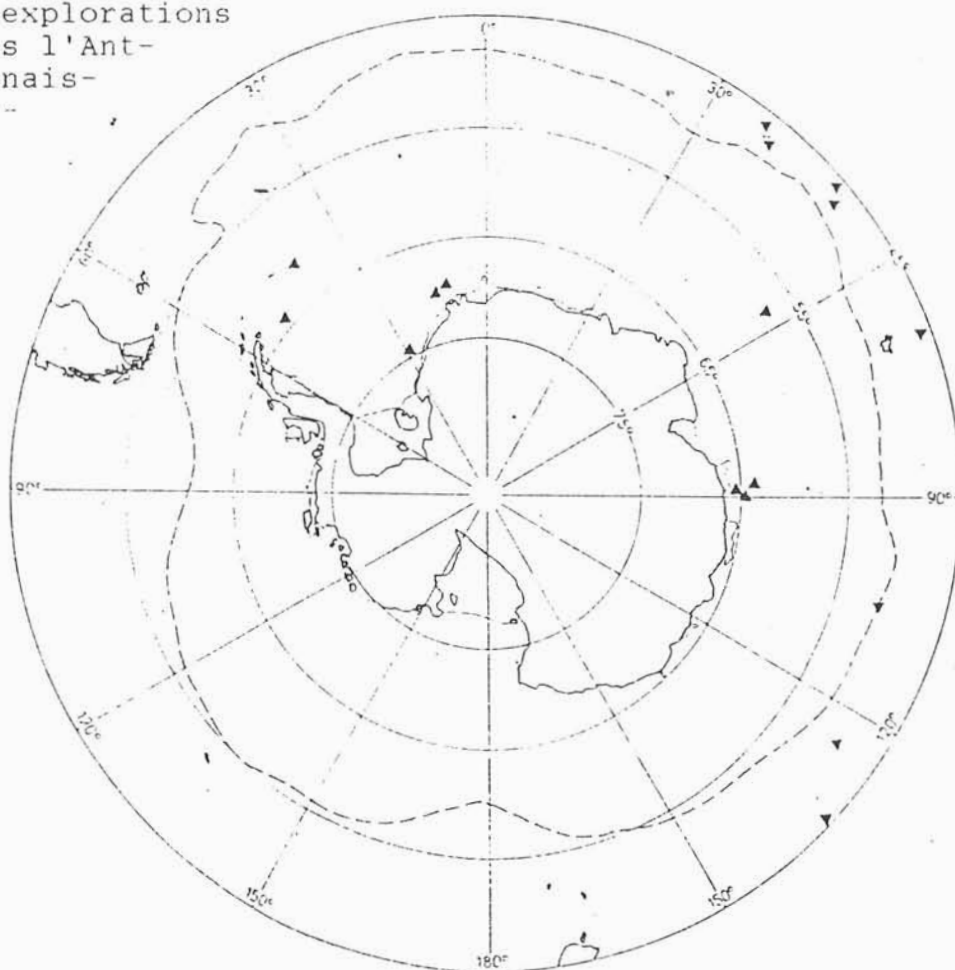


Table 1. The species of hexactinellid sponges known from the Antarctic deep-sea region and adjacent areas, and the corresponding bathymetric range.

*: occurs largely within the Antarctic convergence zone.
 +: occurs only in ("endemic" to) the Antarctic deep sea.
 (): number of records outside the Antarctic deep sea and adjacent areas;
 #: taken many times.

SPECIES	RECORDS		
	Geographical area	No	Range (m)
<i>Hyalonema clavigera</i> Schulze, 1886	Crozet Isls	1	2928
<i>H. conus</i> Schulze, 1886	S. of Australia	1	3300
<i>H. drygalskii</i> Schulze & Kirkpatrick, 1910*+	Wilhelm II Land	1	2795
<i>Farrea occa</i> Bowerbank, 1862*	Bellingshausen Sea, E. Weddell Sea	2(#)	450-2000
<i>Chonelasma lamella</i> Schulze, 1886*	E. Weddell Sea, Wilhelm II Land, Crozet Isls	7(2)	430-3397
<i>Bathyxiphus</i> sp. Schulze & Kirkpatrick 1910*	Wilhelm II Land	2(1)	2450-3397
<i>Aulocalyx irregularis</i> Schulze, 1886*	Wilhelm II Land, Marion-Crozet Isls, Pr. Edwards Isl.	3	567-3397
<i>Holascus fibulatus</i> Schulze, 1886	S of Australia, N of Kerguelen Isl.	2	2516-4758
<i>H. obesus</i> Schulze, 1904**	Enderby Land	1	4636
<i>H. polajevii</i> Schulze, 1886	S of Australia	1	2928
<i>H. tenuis</i> Schulze, 1904 *-	Enderby Land	1	4636
<i>Malacosaccus coatsi</i> Topsent, 1910*+	E Weddell Sea	1	2580
<i>M. pedunculatus</i> Topsent, 1910*+	E Weddell Sea	1	2580
<i>M. vastus</i> Schulze, 1886	N of Kerguelen Isl.	1	2543
<i>Acoelocalyx brucei</i> Topsent, 1910*+	C Weddell Sea	1	4547
<i>Docosaccus ancoratus</i> Topsent, 1910*+	C Weddell Sea	1	4547
<i>Caulophacus antarcticus</i> Schulze & Kirkpatrick, 1910*+	Wilhelm II Land	1	2450-3397
<i>C. instabilis</i> Topsent, 1910*+	S. Orkney Isls	1	3248
<i>C. pipetta</i> (Schulze, 1886)	SW of Australia	1	3566
<i>C. scotiae</i> Topsent, 1910*+	E Weddell Sea	1	2580
<i>C. valdiviae</i> Schulze, 1904**	? Bellingshausen Sea, Enderby Land	2	450-4636
<i>Bathydorus spinosus</i> Schulze, 1886*	Bellingshausen Sea, E Weddell Sea, Crozet Isls	5(3)	569-4847
<i>Calycosoma validum</i> Schulze, 1899*	Near South Orkney	1(1)	3266

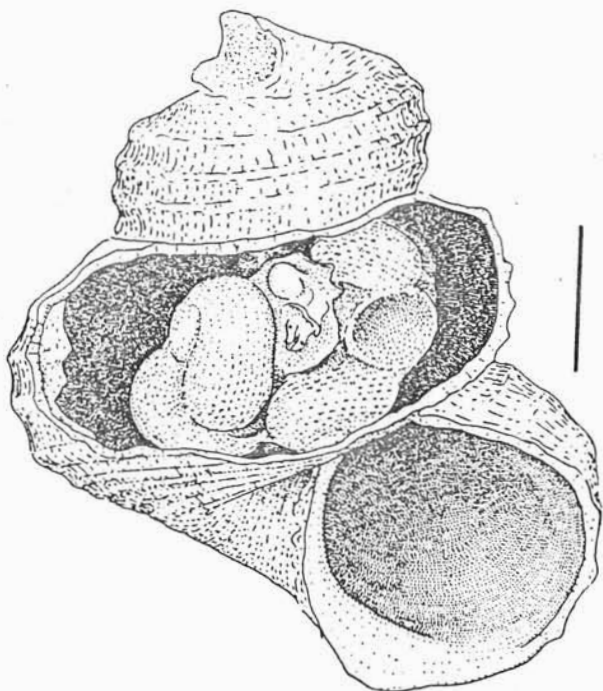
RESULTATS DES CAMPAGNES MUSORSTOM, VOL. 7

This volume is part of the series that deals with the results of the French MUSORSTOM expeditions (initiated in 1884) in the West Pacific. Most of the efforts of the project are devoted to the deep-sea bottom fauna down to a depth of 3700 m. The present volume (Mémoires du Muséum national d'Histoire naturelle, Sér. A, Zoologie, t. 150, 259 pp. 1991. Ed. Ph. Bouchet) is devoted exclusively to mollusks, comprising 10 papers (8 of which are in English) of a very high standard and providing important contributions to the knowledge of the bathyal and abyssal mollusks. At the same time the number of new species described in the volume (no less than 90) is evidence of the extreme diversity of the deep-sea bottom fauna - and also of how much we still have to learn about the deep sea.

The first paper, by P. Kaas, deals with the Polyplacophora, well known primarily as tidal zone mollusks. Ten bathyal species are recorded by Kaas, 8 of which are new. Perhaps the most remarkable report of the volume is on the gastropod family Seguenziidae, by B.A. Marshall. Representatives of the family are mostly living in the deep sea, and hitherto 89 taxa have been described. Marshall's paper deals with 55 species of which 50 are new to science. All species are carefully described and profusely illustrated by excellent micrographs. Two papers, by Dolin and Lozouet, respectively, deal with *Cypraeopsis* and *Eumitra*, two genera of gastropods, previously known only as Tertiary fossils, but now discovered to be represented by Recent species in the area.

Space precludes mention of the remaining papers of the volume, but they are all of the same high standard. Students of deep-sea fauna will certainly appreciate the efforts of the French National Museum and particularly the editor for producing this excellent series which brings France into the foreground as to deep-sea taxonomy.

Jorgen Knudsen
Zoological Museum, Copenhagen



Haloceras japonica Okutani, 1964.
A bathyal gastropod known only from 2 records from the N. Pacific. Part of the shell is broken, exposing 9 brooded embryos.
(From a paper by A. Warén and Ph. Bouchet on the genus *Haloceras* Dall, 1889, published in: Résultats des Campagnes MUSORSTOM vol. 7: 111-161.)



OCEAN CHALLENGE - A NEW MAGAZINE

We have all heard of the great Challenger Expedition. Many are also aware of the Challenger Society whose objectives are the advancement of marine science through research and education, dissemination of knowledge, and contributions to public debate.

The Society's dissemination of knowledge has lately been conspicuously strengthened by the launching of a new magazine which is of interest not only to the public but decidedly also to marine scientists, including the deep-water ones.

Ocean Challenge started in the spring of 1990 and is published quarterly (some are double issues). Items such as News and Views, Meeting Reports and Forthcoming Meetings (naturally including events of the Society), and Book Reviews are standing ingredients of each issue. One issue also brought an exciting nautical crossword! All the clues had a watery theme and really challenged the reader's knowledge of the Poseidon Kingdom.

The articles have so far covered a wide range of topics. Of particular interest to deep-sea biologists and apropos the discussion at the Copenhagen Symposium is Martin Angel's clear and appropriate "Biodiversity of the Deep-seas". Another article with deep-sea aspects is Peter Herring's "Biological Light in the Sea" with new and fascinating information and remarkable illustrations. A third, by Colin Summerhayes, "Investigating the Deep-Sea Floor in the 1990's" presents e.g. tools for mapping the sea-bed by means of side-scan sonar such as TOBI with a capacity of resolving features as small as 2-5 m across in water 5000 m deep.

As is well known, Tony Rice has a special flair for the history of marine science and has contributed several articles in his usual vivid style. One (with Arthur Fisher) is on "Oceanography on Stamps" and all present at the Brest Symposium will remember Tony's humorous causerie on the subject. The present article covers Russian, French and particularly British stamps, thus leaving out probably equally appropriate stamps from e.g. Monaco and others. In another article Tony compares the pay of scientists and sailors onboard the *Challenger* with what their modern counterparts are fobbed off with. The construction of the new British research vessel, the icebreaker RRS *James Clark Ross* (presented in another article by D. Drewry) has caused Tony to tell about "The Man behind the Name behind the Ship". Similarly, the establishment of the James Rennell Centre for Ocean Circulation at Southampton has called for an account of Rennell (1742-1830), "The Father of Oceanography", by R. Pollard and G. Griffiths.

Other articles deal with a broad variety of subjects, ranging from modelling of tides and ocean modelling, radioactivity in the Irish Sea, and long-term sea-level changes to the use for ocean sciences, international affairs in marine science and the YAPSO Standard Seawater Service, estuaries, artificial reefs, the North Sea seal epidemic, etc.

The subscription rate (incl. postage) is £30.00 (\$ 60) per year for individuals. Members of the Challenger Society receive *Ocean Challenge* automatically. Membership costs only £20.00 per year, so why not join the Society (Membership Secretary, IOS Deacon Laboratory, Wormley, Godalming, Surrey GU8 5UB, UK)?

Torben Wolff

THE DEADLINE FOR THE NEXT ISSUE OF D.-S.N. IS 1st NOVEMBER, 1992

Editor: Torben Wolff, Zoological Museum of the University
Universitetsparken 15, DK-2100 Copenhagen Ø, Denmark

ISSN 0903-2533