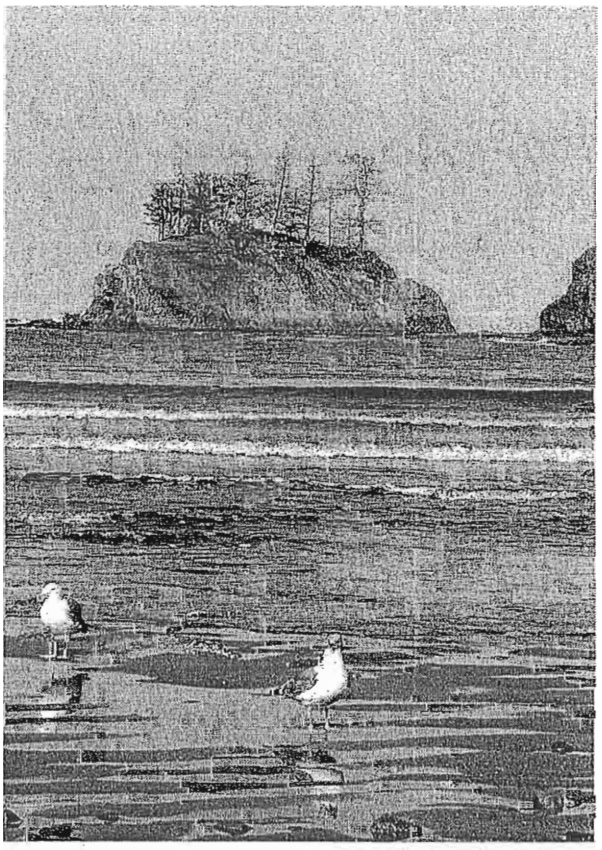
# DEEP-SEA NEWSLETTER

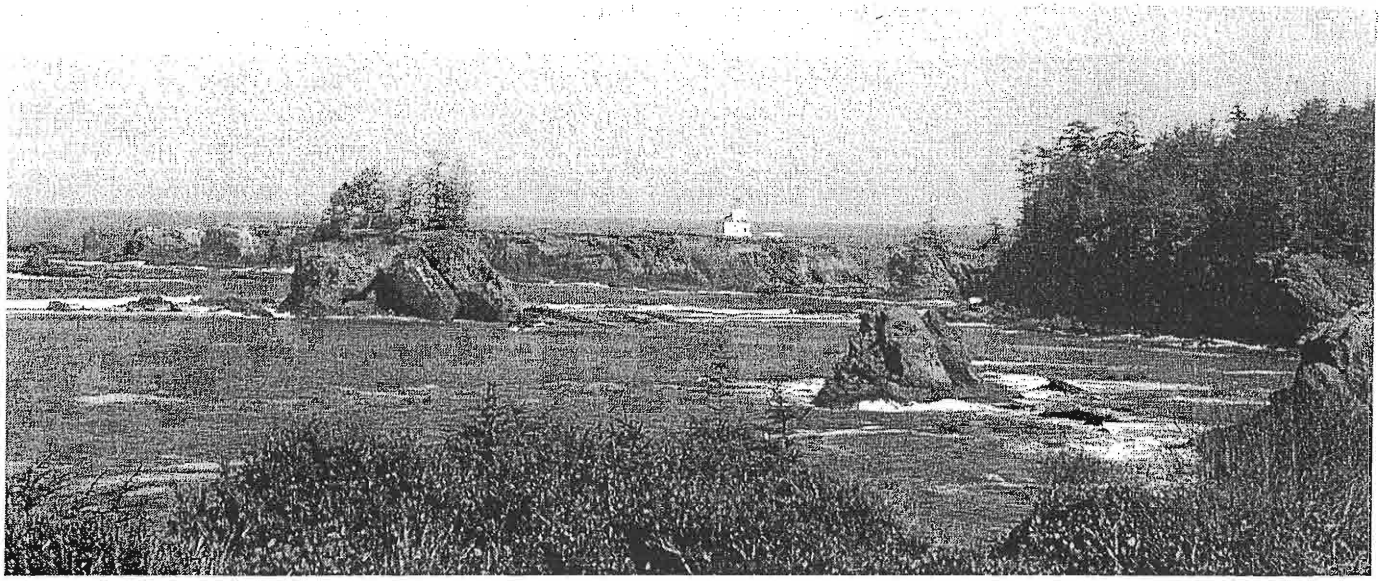
No. 31, April 2002

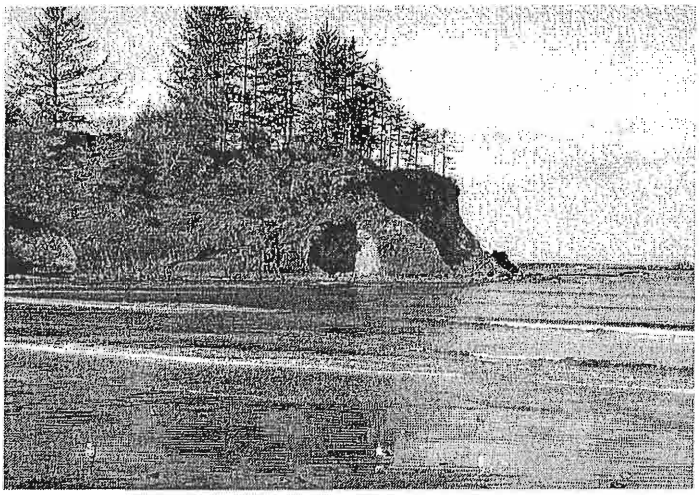

## TENTH DEEP-SEA BIOLOGY SYMPOSIUM
## COOS BAY, OREGON – AUGUST 25–30, 2003
## Second Announcement – Change of Venue

The tenth deep-sea biology meeting will not be held in Florida, as originally planned, but in the small coastal town of Coos Bay, Oregon on the southern Oregon coast. This change in venue has become necessary because the organizer, Craig Young, will soon leave his post at Harbor Branch Oceanographic Institution to assume the directorship of the University of Oregon's Institute of Marine Biology. The Florida venue was approved by participants in the Galway meeting, so this change was not made lightly; indeed, the national and regional correspondents of the Deep-sea Newsletter were given an opportunity to comment on the proposed change and other options before a decision was made. Those correspondents responding (a majority) all agreed that the shift to Oregon is a most suitable option. It eliminates some of the concerns about a Florida venue (heat and hurricanes) while presenting only a few minor challenges. As the meeting will be held at the end of August, the weather should be glorious, with little chance of the famous Pacific Northwest rain. The venue is near some of the most spectacular scenery on the rugged Oregon coast, including Sunset Bay (photo on right), Cape Arago, South Slough National Estuarine Reserve, and and the Oregon Dunes National Recreation Area. Opportunities for outdoor activities (hiking, dune riding, intertidal exploration, fishing, river rafting, kayaking, golf, etc.) abound in the immediate area.

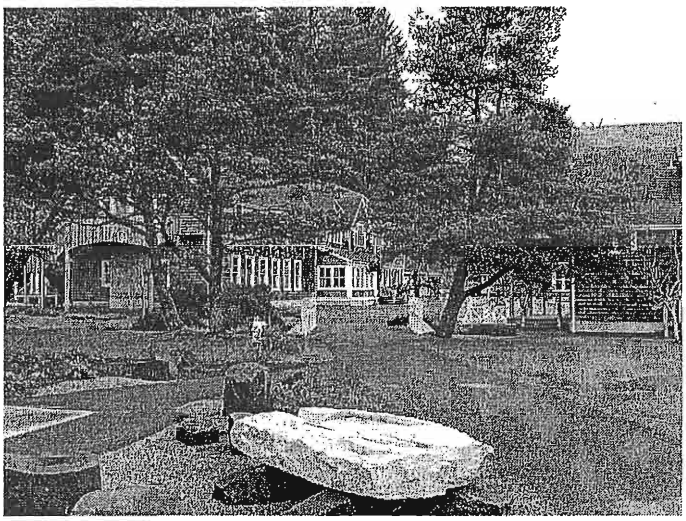


The Oregon Coast Deep-Sea Biology Meeting will take place from August 25 to 30, 2003 on the Campus of Southwestern Oregon Community College (SOCC) in Coos Bay. The campus is only 10 minutes away from the little fishing village of Charleston, where the Oregon Institute of Marine Biology is based. Located on the shore of Empire Lake, the



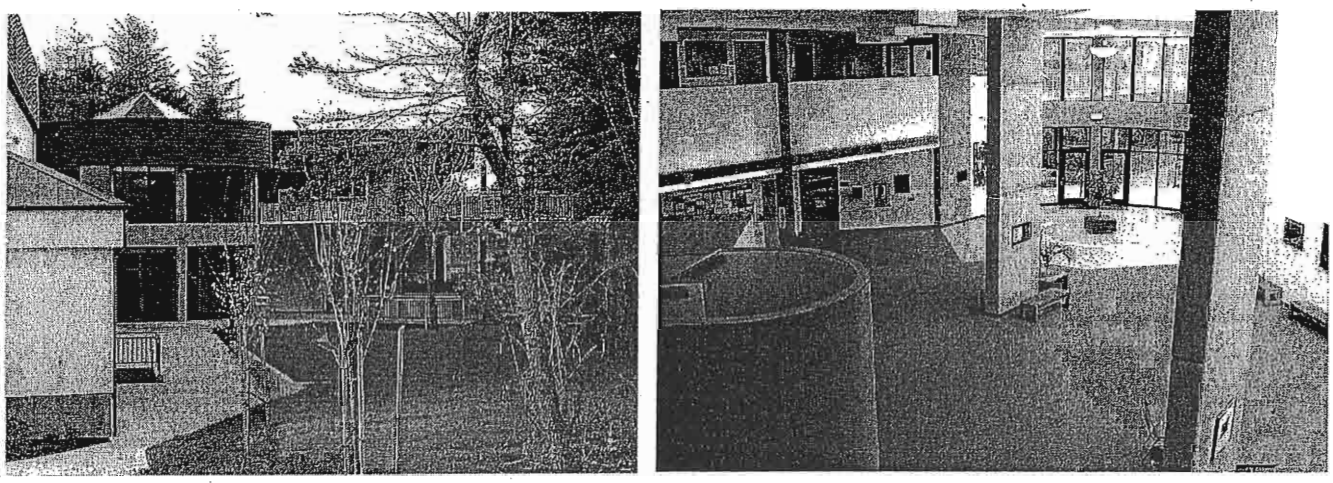


Views of the coastline within a few miles of the conference venue

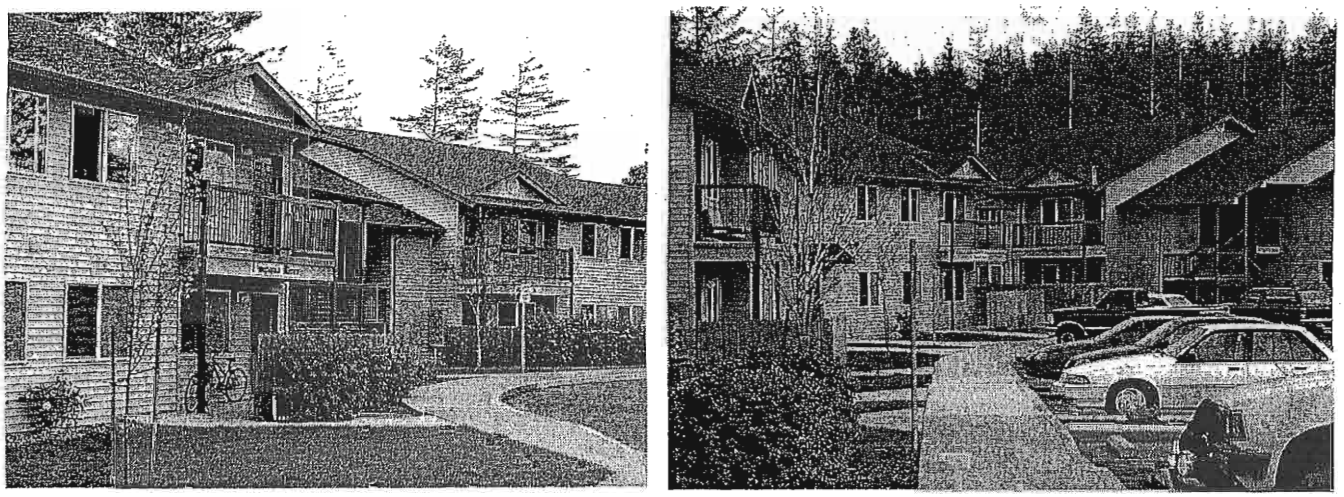


Oregon Institute of Marine Biology (left) and Bandon Dunes Resort (right)

modern campus of SOCC is peaceful and forested, yet within walking distance of shopping and fast food establishments and a few miles from downtown Coos Bay and North Bend. The North Bend airport, a 5 minute drive from the venue, is served by Horizon/Alaska Air, which currently makes 4 flights per day from Portland. Several carriers also fly into Eugene, a scenic two hour drive away by rental car. Talks and posters will be presented in a new performing arts center, which has a comfortable 500 seat auditorium and a cafeteria that will provide catered breakfasts and lunches for participants at a very reasonable price of about $5.00 per meal. Because the meeting will take place in the summer, there will be on-campus housing for up to 200 people at about $30.00 per night. The housing units resemble those we enjoyed in Galway; 4-bedroom apartments, mostly with single rooms, that share common bathroom, living and kitchen areas. For students and others traveling on a limited budget, there will be even cheaper housing in the OIMB dorms. Of course, those who require a higher level of comfort can make arrangements with many hotels and motels a short distance away.



Outside and lobby of the performing arts center at Southwestern Oregon Community College



Views of the housing units, which are located within easy walking distance of the conference.

Although details are still being formulated, we anticipate mid-week activities that will take full advantage of the picturesque coastline, and a reception and salmon barbecue at the Oregon Institute of Marine Biology. The conference banquet is tentatively slated for a new pub and dining facility now under construction at the Bandon Dunes Resort. Two special sessions have already been proposed and other suggestions are welcome. Registration details will be available on the web this fall, and program details will be added to the web site as they become available. Between now and the middle of June 2002, questions or comments may be directed to Craig Young at youngc@hboi.edu. After this date, please use cyoung@oimb.uoregon.edu.

The students and faculty of the Oregon Institute of Marine Biology are excited to host friends and colleagues from the worldwide deep-sea community and look forward to showing off their beautiful corner of North America.

# RIDGE 2000: THE NEXT DECADE OF INNOVATIVE STUDIES AND DISCOVERIES AT THE MID-OCEAN RIDGE

**The RIDGE 2K Steering Committee**

RIDGE 2000 is a new, National Science Foundation (NSF) sponsored research initiative to understand the Earth's spreading ridge system as an integrated whole, from its inception in the mantle to its manifestations in the biosphere and water column. RIDGE 2000 is at the beginning of its anticipated 12-year duration. Although the general goals of the program have been defined, there are exciting opportunities for investigators to plan the detailed program and to carry out RIDGE 2000 projects.

Over the last 50 years, systematic observation and sampling of the world's oceans have led to significant discoveries that have influenced many scientific disciplines. This basic oceanographic research led to the identification of the mid-ocean ridge as a locus of seafloor volcanism where the oceanic crust of the earth is created, provided crucial evidence for the landmark theories of seafloor spreading and plate tectonics, and led to the discovery of ecosystems based on chemoautotrophy rather than photosynthesis. Since 1988, the NSF sponsored RIDGE Program has fostered major advances in our understanding of the global mid-ocean ridge system through focused interdisciplinary studies.

The RIDGE 2000 Program was conceived to promote an integrated approach towards the study of mid-ocean ridges. Outlined by community workshops over the past two years, RIDGE 2000 builds directly on the scientific and technological successes of the RIDGE Program. The scientific motivation for the RIDGE 2000 Program is encapsulated in the phrase "from mantle to microbes..." that expresses the inextricable linkages between processes of planetary renewal in the deep ocean and the origin, evolution and sustenance of life in the absence of sunlight.

The RIDGE 2000 Science Plan aims for a comprehensive understanding of the relationships among the geological processes of plate spreading at mid-ocean ridges and the seafloor and sub-surface ecosystems that they support. Research carried out under this new program will be structured within an integrated, whole-system approach that will encompass a wide range of disciplines. Specific geographic areas will be the focus of detailed studies to yield new insights into the linkages among the biological, chemical and geological processes that are involved in crustal accretion and subsequent ridge crest processes. The RIDGE 2000 Program will support two main research themes: Time-Critical Studies and Integrated Studies.

**Time-Critical Studies**

The goal of the Time-Critical Studies element is to understand the nature, frequency, distribution and geobiological impacts of magmatic and tectonic events along the global mid-ocean ridge system. To this end, the theme focuses on the immediate biological, chemical and geological consequences of active processes on the seafloor. Such processes generally occur as transient events and include volcanic eruptions and intrusions of magma at the ridge axis and faulting related to seafloor spreading.

Since 1993, event detection and response efforts on a single, short ridge system on the Juan de Fuca Ridge (northeast Pacific) have revolutionized our understanding of these active processes. The field response to events detected using the SOSUS array (the Navy's cabled hydrophone system in the northeastern Pacific Ocean) has provided fundamental new information about the linkages among volcanic events at the seafloor, the development of hydrothermal plumes in the ocean above the ridge crest, hydrothermal circulation and vent biota.

Under the RIDGE 2000 Program, Time-Critical Studies are dedicated to facilitating rapid-response missions that can observe, record and sample these critical transient phenomena in the ocean above the mid-ocean ridge as well as on the seafloor itself. In the initial phases of this element, the program will be restricted to the northeast Pacific where real time detection is possible through the SOSUS array and where the facilities are available for a rapid response.

**Integrated Studies**

The Integrated Studies theme of RIDGE 2000 is intended as a program of focused, whole system research of global mid-ocean ridge processes. This component addresses the complex, interlinked array of processes that support life at and beneath the seafloor as a consequence of the flow of energy and material from Earth's deep mantle, through the volcanic and hydrothermal systems of the oceanic crust to the overlying ocean. Moreover, this part of the program recognizes that the complex linkages between life and planetary processes at mid-ocean ridges can only be understood through coordinated studies that span a broad range of disciplines. Thus, Integrated Studies will consist of multidisciplinary research that is focused on a small number of pre-selected "type" areas that are designed to characterize segments of the mid-ocean ridge system. The objective of Integrated Studies is to develop quantitative, whole-system models through coordinated and interdisciplinary experiments. It will be necessary for RIDGE 2000 scientists to understand the interactions and linkages among the volcanic, tectonic, geochemical and biological systems to achieve this goal.

The Integrated Studies theme will initially focus on three sites that were chosen on the basis of a community vote and a special RIDGE 2000 Integrated Site Selection Panel. These are:

- 9–10°N segment of the East Pacific Rise;
- The Endeavour Segment of the Juan de Fuca Ridge;
- East or Central Lau Basin Spreading Center.

**RIDGE 2000 Program Status**

The RIDGE 2000 Program officially began October 15, 2001, when the office opened at the Pennsylvania State University. All biologists, chemists, earth scientists, engineers, and physicists who are interested in mid-ocean ridge science are encouraged to participate in RIDGE 2000. Two workshops have been scheduled for early 2002, one for scientific background and one for planning. The workshops are designed to provide opportunities for a broad cross-section of scientists and engineers to share information about the Integrated Study sites and to participate in planning the implementation of the research program.

The Community Education Workshop was held in Long Beach, CA at the Queen Mary Hotel, on Feb. 25–27. Approximately 110 people attended. The primary purpose of this workshop was to provide a forum for community education and the sharing of data among all investigators wishing to write proposals for work at one of the Integrated Study sites. Each day was devoted to one Integrated Study site and featured several invited speakers, an interdisciplinary panel led discussion after each talk, and general poster sessions. Speaker notes and figures, white papers, available data sets, maps, publications, and bibliographies from the workshop can be found at the RIDGE 2000 website.

A detailed implementation plan will be required for each Integrated Study site. These site plans will be developed at an open community workshop scheduled for April 7–8 in Albuquerque NM. All interested investigators are encouraged to attend. Each implementation plan will identify a geographic "focus", about which all the nested components of the Integrated Study will be centered, and provide the guidelines for the components that will comprise the set of Integrated Studies necessary at each site. The implementation planning will also consider time lines, site administration, and data sharing.

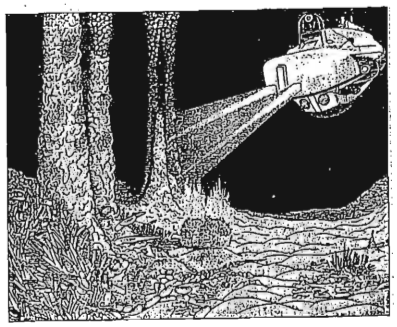
The NSF Program Announcement for RIDGE 2000 is available and proposals for funding work at the three Integrated Study sites will be considered beginning with the August 15, 2002 Ocean Sciences (OCE) target date. The results of the Community Education and Implementation Plan Workshops are available on the web site and should be used by proponents to guide in proposal preparation. RIDGE 2000 proposals are subject to the normal peer-review process and will be reviewed by the regular NSF Ocean Science Division Panels. Additionally, the RIDGE 2000 Steering Committee will perform a relevancy review of all RIDGE 2000 proposals.

Along with the program elements discussed above, RIDGE 2000 is sponsoring a postdoctoral fellowship program. The fellowship is intended to foster cross-disciplinary fertilization by providing opportunities for individuals to broaden their research expertise as well as to expand the breadth of ridge science.

**Contact Us**

To join the RIDGE 2000 mailing list, for timetables, data, upcoming meetings and workshops, contacts and other information about the RIDGE 2000 program, email us at ridge200@psu.edu, see the RIDGE 2000 website at http://www.ridge2000.bio.psu.edu or call +1 (814)-865-RIDG (7434).

The above contribution by the RIDGE 2K Steering Committee was sent to D-SN by committee member Craig Young.



# MAR-ECO - "PATTERNS AND PROCESSES OF THE ECOSYSTEMS OF THE NORTHERN MID-ATLANTIC", A PROJECT UNDER THE PROGRAMME "CENSUS OF MARINE LIFE"

**The Census of Marine Life (CoML) programme** established by the Alfred P. Sloan Foundation in 1997 stimulated new research efforts in poorly known ecosystems and communities. The mid-ocean ridges are vast global systems inhabited by communities that are insufficiently described and hence obvious candidates for CoML activity.

**The project MAR-ECO**, focussing on the communities associated with the Mid-Atlantic Ridge, has recently been established as an international ecosystem study under CoML. This project shall gather new knowledge on biodiversity, distribution patterns, and ecological processes, and the overriding aim is "to describe and understand the patterns of distribution, abundance and trophic relationships of the organisms inhabiting the mid-oceanic North Atlantic, and identify and model ecological processes that cause variability in these patterns". The project will focus on pelagic, benthopelagic and epibenthic macrofauna. Fish, crustaceans, cephalopods and gelatinous plankton and nekton have the highest priority in the study.

The project will be carried out as a multi-ship operation in 2003–2004. The project will work on the Mid-Atlantic Ridge and in adjacent waters from the Azores to Iceland (Figure 1), both by surveying large areas by acoustics and mid-water trawling, and by focussing on selected sub-areas for intensive sampling and observation by traditional and novel methods and technology.

**The Science Plan** now available (e.g., on the website http://www.efan.no/midatlcensus/) presents the three central tasks and a compilation of hypotheses and suggestions resulting from discussions during and after an initial workshop held in Bergen 12–13 February 2001:

***Task 1***: Mapping of species composition and distribution patterns.
- Theme 1: Identity and distribution patterns of macrofauna.
- Theme 2: Population genetics and dispersion studies.

***Task 2***: Identification of trophic interrelationships and modelling of food web patterns

***Task 3***: Analyses of life-history strategies

The three tasks are obviously inter-related. Also, all the tasks rely on understanding the abiotic environment.

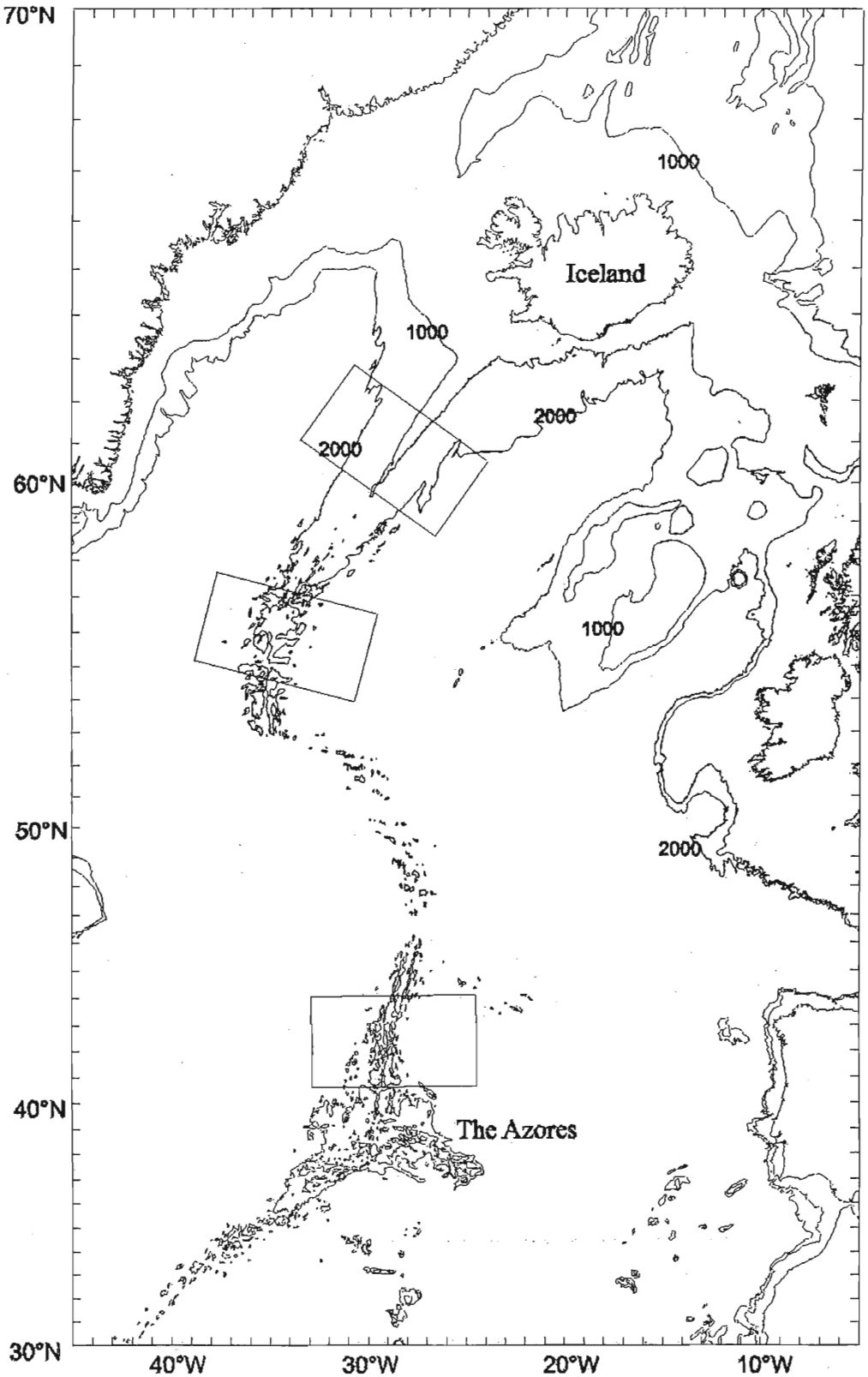



Figure 1. The Mar-Eco area with sub-areas selected for detailed studies. The exact locations are to be decided during the planning phase.

**Some basic overall hypotheses** or questions to be adressed are:

a) Is the MAR an extension of the North Atlantic basin continental slope regions?

b) Is the MAR a barrier between the pelagic fauna of the east and west North Atlantic basins? Is there a difference in species occurrence either side of the MAR?

c) Do circulation features, e.g., the Gulf Stream, act as barriers between the northern and southern fauna? In the region of the Gulf Stream, what is the effect of eastward drift and import of material from the west?

d) What is the significance of seamounts within the ridge system?

e) Is the trophic structure of the northern mid-Atlantic ecosystem similar to that on the slope regions of the eastern and western sides of the Atlantic?

**The International Steering Group** organises and oversees the planning, financing, and implementation of the project. Members of the group are:

Dr. Odd Aksel Bergstad, IMR, Norway (chairman)
Prof. Peter Boyle, Univ. Aberdeen, UK
Dr. Olafur S. Astthorsson, MRI, Iceland
Dr. Ricardo S. Santos, Univ. Azores, Portugal
Dr. Uwe Piatkowski, Univ. Kiel, Germany
Prof. Michael Vecchione, NOAA, NMFS, USA
Dr. E.M. Burreson, Virginia Institute of Marine Science (VIMS)
Prof. Ulf Båmstedt, University of Bergen, Norway
Dr. Pascal Lorance of IFREMER, France

Norway has offered to take on secretarial duties for the project, and the responsible institution will be the Institute of Marine Research (IMR) in collaboration with the University of Bergen. The new Norwegian research vessel R/V *G.O. Sars* will be at the disposal of the project activities in 2004, and may form a central focus of international multi-vessel operations.

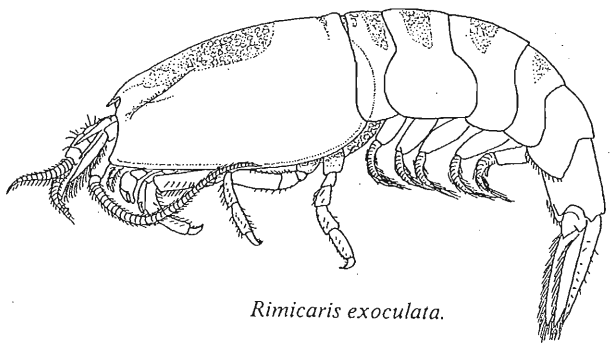
**The schedule and phases** of MAR-ECO are the following:

| | |
|---|---|
| Planning phase: | 2001–2003 |
| Field phase: | 2003–2005 |
| Analysis, synthesis: | 2004–2008 |
| Incorp. in OBIS: | 2005–2008 |

**The status of MAR-ECO** is that the planning phase has been initiated and action has been taken to set up a formal organisational structure. A planning grant recently awarded enables the International Steering group to stimulate the network of experts to formulate component projects.

**A planning workshop** was convened at Der Alfred Wegener Institut für Meeresforschung in Bremerhaven 5–6 January 2002. Some 45 experts from around the North Atlantic gathered to discuss ideas for component projects and develop strategy. A number of component projects are already emerging and updates on the full range of proposals will be posted on the website.

**The MAR-ECO vision** is that following the 2001–2008 project period, the identity, distribution patterns, food webs, and life-history patterns of the macrofaunal communities of the northern Mid-Atlantic Ridge and its flanks will be understood and well known both to the scientific community and the interested public.



*Rimicaris exoculata.*

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# MINI-SYMPOSIUM: "SCAVENGERS IN THE DEEP SEA"

On the 7th of June 2001 a group of biologists, geologists, chemists and geochemists from various German research institutes met at the Alfred Wegener Institute for Polar and Marine Research in Bremerhaven to discuss current activities and recent results on the ecology of deep-sea scavengers. This Mini-Symposium aimed at an introduction of individual research efforts, the presentation of recent findings and new technologies being applied as well as the identification of gaps in our understanding about the role of scavengers in the deep sea. Several short lectures were given, some of them either just submitted to or printed in international journals. Among them were a talk about the possible role of mechanoreception in the food-finding strategies of crustacean scavengers, reports on the spatio-temporal attraction of *Eurythenes gryllus* by bait in the northern North Atlantic, metabolism and decompression tolerance in lysianassoid amphipods, lipids in Antarctic and deep-sea amphipods and about scavengers of the eastern Mediterranean Sea. A variety of open questions were discussed during the afternoon session. Examples of future perspectives being identified are: what influence do food falls have on the activity and diversity of the sediment-inhabiting fauna over time; are there any "fingerprints" in the sediment reflecting past or even ancient food falls and, if so, how can we measure them; how can we estimate the total amount of organic carbon reaching the deep-sea floor (global/regional) by carcasses per time interval; and how do food falls influence the rhythms and energy-conservation strategies of scavengers?

Experience in the use of advanced technologies such as Remotely Operated Vehicles (ROV) allowing video-controlled bait experiments, autonomous-scanning sonar systems for detection of approaching scavengers at long distances and microprofilers measuring different parameters in the sediment-water boundary layer were presented and identified as helpful instruments for further improvements in some of the above-mentioned open questions.

Finally, the perspective of an international symposium covering different aspects like distribution, metabolism, physiology, behaviour, population dynamics and the role of scavengers in the deep sea and the potential of such a topic for a symposium were considered. The participants thought that this short report in the *Deep-Sea Newsletter* might be a tool to transfer this idea into the scientific community for suggestions. Any comments (interest, suggestions, proposed dates) may be sent to: mklages@awi-bremerhaven.de

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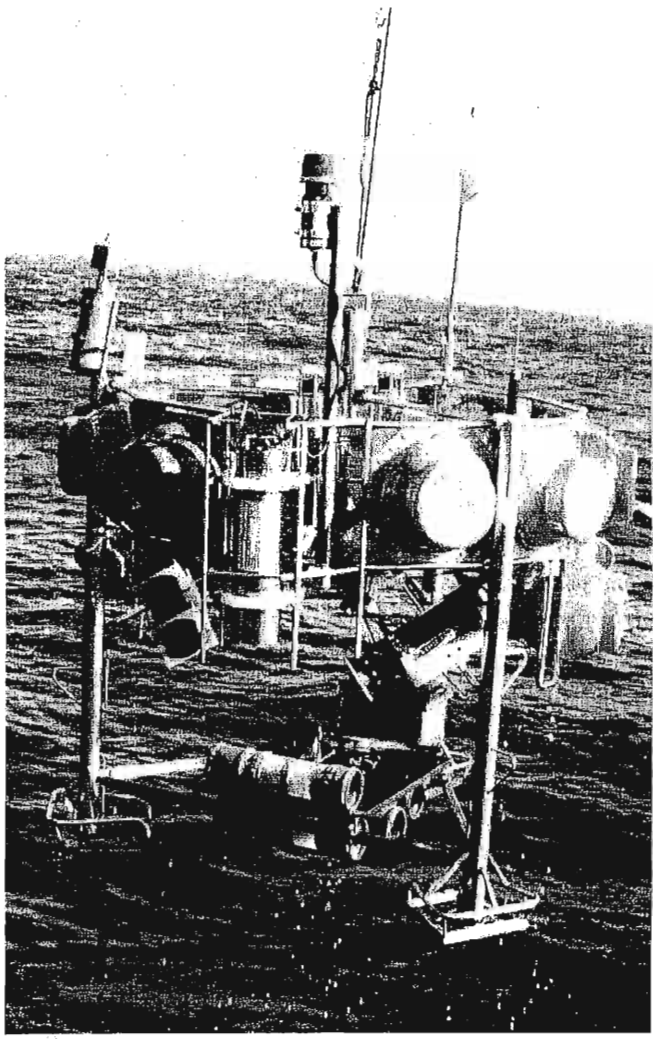

Photograph showing one of the free-falling landers being used by the interdisciplinary deep-sea research group at AWI. This one is equipped with two time-lapse cameras, acoustic doppler current profiler, autonomous scanning sonar head (on top of the lander frame), several small traps, Argos and a radio transmitter.

# ON THE THAI-DANISH SCIENTIFIC COOPERATION PROGRAMME AND THE DEEP-WATER FAUNA OF THE ANDAMAN SEA CONTINENTAL MARGIN

The five-year (1996–2000) "Scientific Cooperation Programme (SCP) in connection with supply of a marine research vessel for Phuket Marine Biological Center (PMBC)" comprised numerous subprojects with different Danish marine scientific institutions involved. Among the contracts signed between the Zoological Museum, University of Copenhagen (ZMUC) and PMBC were BIOSHELF (Biodiversity and biomass of demersal invertebrates on the shelf of the Andaman Sea off Phuket) and BIODEEP (Biodiversity and biomass of demersal invertebrates in deep water beyond the shelf of the Andaman Sea off Phuket). Although the samples are not yet all worked up, we find it appropriate to present some information on the background and a few preliminary experiences and considerations here.

The Andaman Sea is a closed basin with depths down to about 4000 m and the deepest connection to the Indian Ocean at 1300–1400 m, between the Nicobar Islands and Sumatra. Covering roughly 800,000 $km^2$ and being at maximum about 600 km wide, the sea is completely covered by the Exclusive Economic Zones of India, Burma, Thailand, Malaysia and Indonesia, and represents an obvious goal for future regional cooperation in oceanographic sciences. The deepest part is within the Indian EEZ. The Thai EEZ, which has a maximum depth of about 2400 m, covers roughly 110,000 $km^2$, with 94,000 $km^2$ lying between 100 and 600 m depth (Nishida & Sivasubramaniam 1986).

Some of the renowned expeditions, viz. the Austrian "Novara" (1857–1859), the German "Valdivia" (1898–99) and the Danish "Dana" (1928–30) and "Galathea" (1950–52) took a few samples, adding somewhat to the knowledge of the fauna of peripheral areas. More comprehensive sampling, mainly in Indian waters (around the Andaman Islands) and Burmese waters, was carried out between 1874 and 1925 by the two Royal Indian Navy ships both named "Investigator", under the leadership of "the surgeon-naturalist" (Alcock 1902, Rice 1986), but still the accounts of the bottom fauna were scarce and no proper regional picture emerged. A general view of the origin and distribution of the fauna was presented by the "surgeon-naturalist" R.B.S. Sewell, who filled this post from 1910 to 1925, when he after a review of the supposed Tertiary-Quarternary development of the Andaman Sea concluded (1925, p. 22): "These various channels have permitted the entry into the basin of the rich shallow-water fauna of both Indian and Pacific Oceans, whereas the deep fauna must have been derived from ancestors capable of living in moderate depths of less than 800–900 fathoms, who had already succeeded in establishing themselves in the Bay of Bengal, or else by recent migration of shallow-water forms downwards into the deep waters of the basin."

The first comprehensive biodiversity study on invertebrates along the Thai coast of the Andaman Sea was initiated through Thai-Danish cooperation after the World War II, when the 5$^{th}$ Thai-Danish Expedition in 1966 included marine sampling from the Burmese border in the north to the Malaysian border in the south. The expedition worked onboard the research vessel "Dhanarajata", and close to 600 samples were taken from the shoreline to 80 m depth. The main gear for macrofauna was the 0.1 $m^2$ Smith-McIntyre grab, but triangle dredge samples and trawl catches were taken as well (Thorson *in* Seidenfaden *et al.* 1968). Although it was a shallow-water expedition, one of their main conclusions is pertinent for deep-water investigations: the number of animals decreases with increasing depth, a tendency appreciable from about 10 m depth (Thorson *op. cit.*).

With the erection of the Phuket Marine Biological Center in 1971, the Department of Fisheries and the Thai community got first-hand access to information on the biocomplexity of local benthic ecosystems, as well as on hydrography, productivity and other subjects. From the onset, most biological projects investigated species and communities in shallow-water bottoms (<100 m depth), where most of the commercial fishery activity takes place. Comprehensive facilities became available with the inauguration of a new building for the Reference Collection at PMBC in 1983. Biodiversity studies were continued, especially during the 1980s (literature list in Aungtonya *et al.* 2000, Hylleberg 2001), including a quantitative programme (Chatanathawej & Bussarawit 1987). In deeper waters, a few investigations have been made down to about 400 m, aiming at potential natural resources, which among the invertebrates are species of prawns and deep-sea lobsters in the Bay of Bengal Programme (Nishida & Sivasubramaniam 1986), and at oceanographic conditions on fishing grounds in the Thai-Japanese Joint Oceanograpic and Fisheries Survey in 1981, and the Southeast Asian Fisheries Development Center (SEAFDEC) studies in 1987 and 1989 (Takahashi & Ruangsivakul 1983).

Further interest in deep-water benthos was prompted by the extension of the EEZ and the search for exploitable demersal populations. With the delivery in November 1995 of the Danish-built "Chakratong Tongyai", a modern research vessel of suitable size and capacity for work all over the Andaman EEZ was put at the disposal of the PMBC, potentially adding new dimensions in regional scientific and educational efforts.

In connection with the supply of the vessel, the above-mentioned cooperation project was launched, and the Reference Collection Subdivision got responsibility for the two individual biodiversity projects. During the first deep-water cruise in 1999 it became evident that due to technical difficulties it was not possible to work in the deepest parts of the EEZ. The cooperation partners then agreed to concentrate the open sea efforts to the areas down to the 1000 m depth contour. Because of the special topography of the shelf-edge region, it was decided to consider investigation of this and the upper part of the slope an extension of the BIOSHELF project. When future economic circumstances allow for it, a BIODEEP project in the part of the EEZ that is deeper than 1000 m should be formulated and carried out by the Reference Collection.

During 3 deep-water cruises in 1999 and 2000, samples were taken all over the outer shelf and upper slope of the Thailand EEZ. The gear types employed were triangular dredge, rectangular dredge, Agassiz trawl, otter trawl, detritus sledge (Ockelmann sledge), epibenthic sledge (Rothlisberg-Pearcy sledge), Smith-McIntyre grab, and Olsen box corer. Samples were roughly sorted on deck and fixed in formaldehyde. Fine sorting and transfer to alcohol were done at the Reference Collection. The material is worked up partly by the staff of the Reference Collection, partly by foreign specialists, some of whom pay shorter visits to the PMBC, while others have the material sent to their home institutions. Publication can be done in any scientific journal, but space is offered in a planned special volume of PMBC research Bulletin with the working title "The Deep-water Fauna of the Andaman Sea continental Margin" (eds. S. Bussarawit & O. Tendal). Deep-water fishes are planned to be published in another special volume (eds. K. Matsura & J. Nielsen).

We still need to work out a lot of details, but at present the general picture that has emerged of the deeper part of the Thai EEZ is the following: The upper slope of the eastern side of the Andaman Sea has a somewhat special topographic configuration, with two "steps" separated by a 100–150 km wide "shelf plain" at 300–600 m depth. The first part of the slope, from 100 to 300 m, generally has a very hard and rugged bottom, with the fauna comprising mostly small forms. The fauna of the "shelf plain" is poor, the sediment consisting of very clean pelagic remains of foraminifers and pteropods. From 500 to 700 m depth is found a bathyal fauna comprising such forms as several species of glass sponges (hexatinellids), the scyphozoan *Stephanoscyphus*, the sea pen *Umbellula*, scleractinian corals resembling *Flabellum* and *Fungiacyathus*, the giant isopod *Bathynomus*, several echinoids including a *Phormosoma*-like species, and the large crinoid *Saracrinus*. The slope is steep further down to at least 1000 m, but probably down to about 2000 m, and in certain areas there seems to exist a relatively rich fauna. Below 2000 m the bottom flattens into a deep-sea plain stretching far north in the Andaman Sea, but without connection to the Indian Ocean deep-sea bottom.

**References**

Alcock, A., 1902: A naturalist in Indian Seas or, four years with the Royal Indian Marine survey ship "Investigator". – J. Murray, London, 328 pp.

Aungtonya, C., S. Thaipal & O. Tendal, 2000: A preliminary report on the Thai-Danish BIOSHELF surveys (1996–2000) of the west coast of Thailand, Andaman Sea. – Phuket Mar. Biol. Cent. Res. Bull. 63: 53–76.

Chatanathawej, B. & S. Bussarawit, 1987: Quantitative survey of the macrobenthic fauna along the west coast of Thailand in the Andaman Sea. – Phuket Mar. Biol. Cent. Res. Bull. 47: 1–23.

Hylleberg, J., 2001: Biodiversity studies at Phuket Marine Biological Center (PMBC): Polychaetes, sipunculans, amphipods, echinoderms and molluscs. – Pp. 48–49 *in* Centenary Celebration of Thai-Danish Co-operation in Biodiversity, 10–11 February 2001. Abstract Book, 71 pp.

Rice, A.L., 1986. British oceanographic vessels 1800–1950. – The Ray Society, London 157: 1–193.

Nishida, T. & K. Sivasubramaniam, 1986: Atlas of deep water demersal fishery resources in the Bay of Bengal. – Bay of Bengal Programme. Marine Fishery Resources Management, Colombo, 49 pp.

Sewell, R.B.S., 1925: Geographic and oceanographic research in Indian waters. Part I. The geography of the Andaman Sea basin. – Mem. Asiatic Soc. Bengal 9: 1–26.

Takahashi, K. & N. Ruangsivakul, 1983: A comprehensive study on the oceanographic conditions of trawl fishing grounds in the Andaman Sea off the southwest coast of Thailand. – Training Department, Southeast Asian Fisheries Development Center. Current Technical Paper 23: 148–182.

Thorson, G., 1968: The marine biology work. Pp. 255–260 *in* G. Seidenfaden, T. Smitinand & G. Thorson: Report on the Fifth Thai-Danish Expedition 1966. – Nat. Hist. Bull. Siam Soc. 22: 245–261.

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## GEAR COME, SERVE AND GO - THE SWAB OR HEMPEN TANGLE

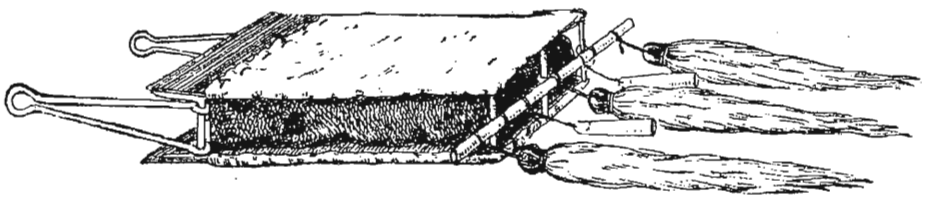
In the history of deep-sea research innumerable types of gear have been developed, used for a shorter or longer period, then further developed or forgotten. The remarkable cataloque of the large collection of gear in Musée océanographique de Monaco by C. Carpine (1987-1999) bears testimony to this, as do many expedition reports and older marine biology textbooks.

The concept of a new kind of gear is the possible solution to a specific scientific problem, and the development and further use is subject to the technical demands and possibilities of the given time. An example is the hempen tangle or swab. It was developed as a means of heightening the efficiency of the dredge, which could not be made larger because of the limited strength of a very long hempen rope, and it was abandoned a few decennia later in the wake of the steel wire, the more powerful machines and the trawl.

We owe the invention of the swab in deep-sea biology to captain E.K. Calver of the "Porcupine". In the preliminary report of the cruises of the "Porcupine" during the summer of 1869, Carpenter, Jeffreys and Thomson gave a vivid description of how it was used for the first time on a mid-August day on the *Holtenia*-ground west of the Orkney Islands (1870, p. 436): "It was here that we employed for the first time an addition to our Dredging apparatus devised by Capt. Calver, who ... justly reasoned that if the Sea-bottom were swept with hempen brushes, they would probably bring up many creatures that might escape the *scraping* of the dredge. These brushes were made of bundles of rope-yarn teazed out into their separate threads, and tied together at the top, so as closely to resemble the ordinary "swabs" used on board the ship. An iron rod was attached to the bottom of the dredge, and carried out about two feet on either side of it; and it was to these projecting portions that the "hempen tangles" were attached by Capt. Calver, who rightly judged that if they were attached to the bottom of the dredge itself, they would only bring up what the dredge had passed over and crushed." The situation is referred to also by Thomson (1873, p. 256), Davis (1982, p. 145) and Rice (1986, p. 121).

The enthusiasm of Carpenter, Jeffreys and Thomson, and most likely also of Calver, onboard the "Porcupine" that summer was large when the tangles by first use "...added much to our 'hauls'..." (1870, p. 437). It rose appreciably when "we may say that our exploration of this Cold area, which we had been led by the results of our last year's dredging to regard as comparatively poor in Animal life (as, indeed we should still have believed it to be, had our knowledge of its fauna been restricted to the contents of the dredge, instead of being chiefly obtained by the instrumentality of our 'hempen tangles'), greatly extended our ideas of the condition of animal existence; ... " (1870, p. 442). But it became almost euphoric when, on the way home to Britain, on 7 September, "We ... put down our dredge with its 'hempen tangles' upon what we were assured by Capt. Calver was the spot ... upon which we had made the *first* deep-sea dredging in this cruise; and the result of this *last* visit to our favorite ground was such as to surpass our most sanguine expectations. For the dredge and the tangles alike came up laden with such a collection of the 'treasures of the deep', as we feel quite safe in asserting had never before been brought to the surface on any one occasion - almost every specimen being such as would be accounted an important acquisition to Museums already most complete" (1870, p. 449).

Although the enthusiasm was kept, some second thoughts had turned up when Thomson in 1873 published "The Depths of the Sea": "Captain Calver's invention initiated a new era in deep-sea dredging. ... We now regard the 'hempen



The dredge and hempen tangles used onboard the U.S. "Blake" (after Agassiz 1888).

tangles' as an essential adjunct to the dredge nearly as important as the dredge itself, and usually much more conspicuous in its results" (p. 256). But: "The tangles certainly make a sad mess of the specimens; and the first feeling is one of woe, as we undertake the almost hopeless task of clipping out with a pair of short nail-scissors the mangled remains of sea-pens, the legs of rare crabs, and the dismembered disks and separated arms of delicate crinoids and ophiurids. We must console ourselves with the comparatively few things which come up entire, sticking to the outer fibers; and with the reflection that had we not used this somewhat ruthless means of capture the mutilated specimens would have remained unknown to us at the bottom of the sea" (p. 258).

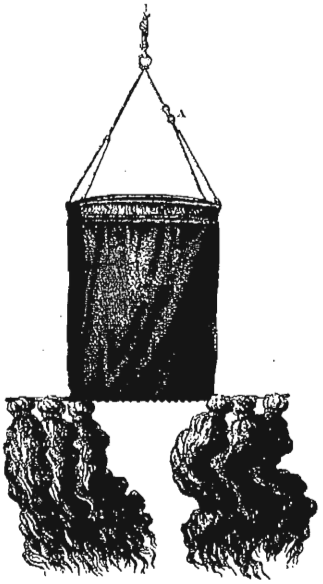
It seems that the swab largely went out of use in deep-sea investigations shortly after 1900. At that time dredges were generally replaced by trawls, first by the beamtrawl and the Sigsbee- (Blake- or Agassiz-) trawl, later by the ottertrawl. The new kinds of gear covered a larger bottom area and were not filled so fast, so they brought a bigger catch to the surface. Behind this was the replacement of the hemp rope with metal wire which could stand a larger strain, was not so voluminous and was easier to handle. The first trawling at abyssal depths with a beamtrawl was admittedly made onboard the "Challenger" with hemp rope, but during the expedition the loss of rope was enormous: according to Wandel (1881) about 55 km during the first 6 months.

As appears from the table below, the swab came into wide use onboard British ships involved in deep-sea investigations, and the experience soon became known and used in other countries. There must be more examples than those shown here; it is just not all expedition reports that describe the gear, or the list of gear may be included in an easily overlooked account.

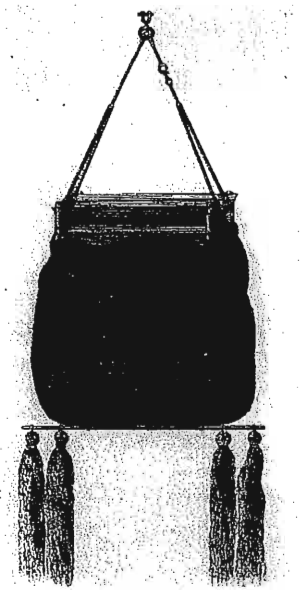
| Expedition | Year | Geographical area | References |
|---|---|---|---|
| "Porcupine" | 1869, 1870 | NE Atlantic | Carpenter et al. 1870; Carpenter & Jeffreys 1870 |
| "Challenger" | 1873-1876 | Around the world | Tizard et al. 1885 |
| "Valorous" | 1875 | Davis Strait | Jeffreys & Carpenter 1876 |
| "Vöringen" | 1876, 1877, 1878 | Norwegian Sea | Wille 1882 |
| "Blake" | 1877-1880 | Caribbean Sea and US Atlantic coast | Agassiz 1888 |
| "Dijmphna" | 1882-1883 | Kara Sea | Holm 1887 |
| "l'Hirondelle" and "Princesse Alice" | Many cruises 1885-1909 | North Atlantic and the Mediterranean | Richard 1910 |
| "Investigator" | 1885-1901? | Indian waters | Alcock 1902 |
| "Hekla" | 1891-1892 | East Greenland | Ryder 1895 |
| "Ingolf" | 1895, 1896 | Northern Atlantic, Greenland | Wandel 1899 |
| "Belgica" | 1897-1899 | Antarctica | Decleir 1998 |
| "Valdivia" | 1899-1900 | Around Africa | Chun 1900 |
| "Arcturus" | 1925 | North Atlantic | Beebe 1926 |

As a curiosity I may like to mention that during one of the BIOFAR cruises in 1990 around the Faroe Islands in the

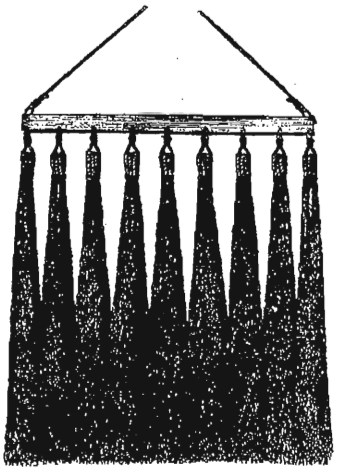
North Atlantic on board the Faroese "Magnus Heinason", we got the idea to try 'hempen tangles'. We only had nylon rope to tease out and so we did, and put them on the back corners of the dredge. They did not work!



"Porcupine" dredge with the swab-bar (after Thomson 1873).



Dredge used onboard the "Vøringen" (after Ville 1882).



Swab-bar from the "Blake" (after Agassiz 1888).

**References**


Agassiz, A., 1888: Three cruises of the United States Coast and Geodetic Survey steamer "Blake" in the Gulf of Mexico, in the Caribbean Sea, and along the Atlantic coast of the United States. Vols. 1 and 2. - Bull. Mus. Comp. Zool. 14: 1-314, 15: 1-220.

Alcock, A., 1902: A naturalist in Indian seas or four years with the Royal Indian Marine survey ship "Investigator". John Murray, London, 328 pp.

Beebe, W., 1926: The "Arcturus" adventure. G.P. Putnam's Sons. London, 439 pp.

Carpenter, W.B., J.G. Jeffreys & C. Wyville Thomson, 1870: Preliminary report of the scientific exploration of the deep sea in H.M. surveying-vessel "Porcupine" during the summer of 1869. - Proc. Roy. Soc. London 121: 395-492.

Carpenter, W.B. & J.G. Jeffreys, 1870: Report on deep-sea researches carried on during the months of July, August, and September 1870 in H.M. surveying-ship "Porcupine" - Proc. Roy. Soc. London 125: 145-220.

Carpine, C., 1987-1999: Catalogue des appareils d'océanographie en collection au Musée océanographique de Monaco. - Bull. Inst. océanogr. Monaco 73-76, numbers 1437 through 1444, 1287 pp.

Chun, C., 1900: Aus den Tiefen des Weltmeeres. Schilderungen von der Deutschen Tiefsee-Expedition. Gustav Fisher, Jena, 592 pp.

Davis, P., 1982: The captain of the "Porcupine": Edward Killwick Calver, R.N., F.R.S.. - Porcupine Newsletter 2: 143-147.

Decleir, H. (ed.), 1998: Roald Amundsen's "Belgica" diary. - Halewijeh, 224 pp.

Holm, T., 1887: Indledning [Introduction]. Pp. i-xii. *in* C.F. Lütken (ed.): "Dijmphna"-togtets zoologisk-botaniske udbytte. - København, 515 pp.

Rice, A.L., 1986: British oceanographic vessels 1800-1950. - The Ray Society. London, 193 pp.

Richard, J., 1910: Les campagnes scientifique de S.A.S. le prince Albert I$^{er}$ de Monaco. - Monaco, 159 pp.

Ryder, C., 1895: Beretning om den østgrønlandske Expedition 1891–92. - Meddr. Grønland 7: 1-159.

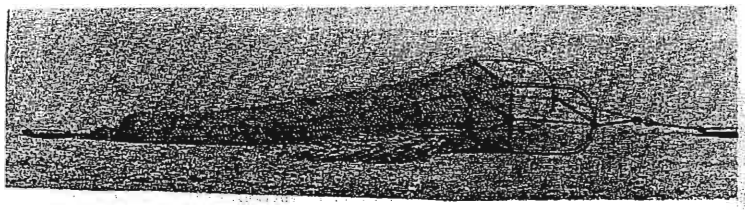
Thomson, C.W., 1873: The Depths of the Sea. - Macmillan & Co. London, 527 pp.

Tizard, T.H., H.N. Moseley, J.V. Buchanan & J. Murray, 1885: Narrative of the cruise of H.M.S. Challenger with a general account of the scientific results of the expedition. - Rep. Sci. Res. Challenger Narrative I, first part. 509 pp.

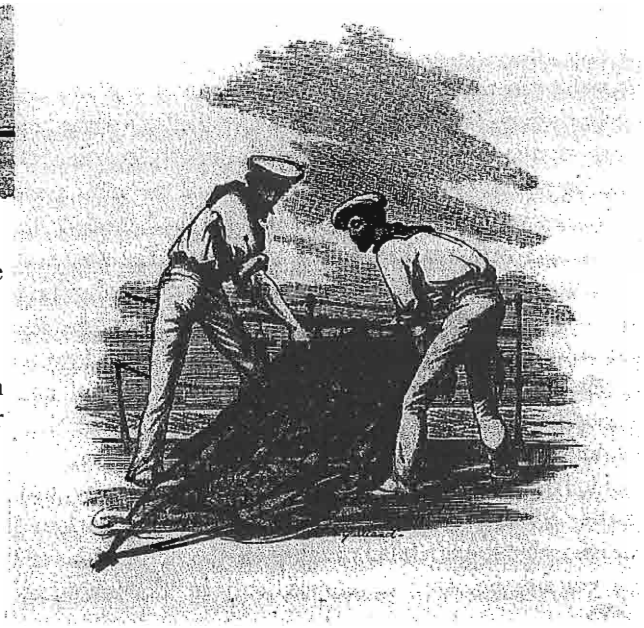
Wandel, C.F., 1881: Apparater og fremgangsmåder ved de nyere amerikanske dybhavsundersøgelser [Apparatus and procedures in recent American deep-sea investigations]. - Tidsskrift for Søvæsen, N.R. 16: 1-38.

Wandel, C. F., 1899: Report on the voyage. - The Danish Ingolf-Expedition I: 1-21.

Wille, C., 1882: The apparatus, and how used. - The Norwegian North-Atlantic Expedition 1876-1878. 54 pp.



The trawl with hempen tangles along the sides used on board the "Hirondelle" and the "Princesse Alice" (after Richard 1910).



Seamen on board the "Challenger" emptying the dredge. 'Hempen tangles' are seen behind their legs. The men do not seem to bother about removing them first (after Tizard et al. 1885).

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# MEIOFAUNA-MACROFAUNA RELATIONSHIP IN THE SOUTHWEST GULF OF MEXICO

The area of study includes the continental margin, slope and rise, and part of the upper abyssal plain from the SW Gulf of Mexico and is known as Campeche Sound (Fig. 1). This geographic region is influenced by complex hydrodynamics and is characterised by a semi-permanent frontal zone mainly determined by wind, river outflow and the regional topography (Vidal et al. 1990). Processes in the region are upwellings that lead to the high values of phytoplankton biomass that is exported to deeper areas and is the major source available to benthic forms in the sediment of the slope. The food supply diminishes with increasing water depth and distance from the coast and will affect the density and biomass of the infaunal components.

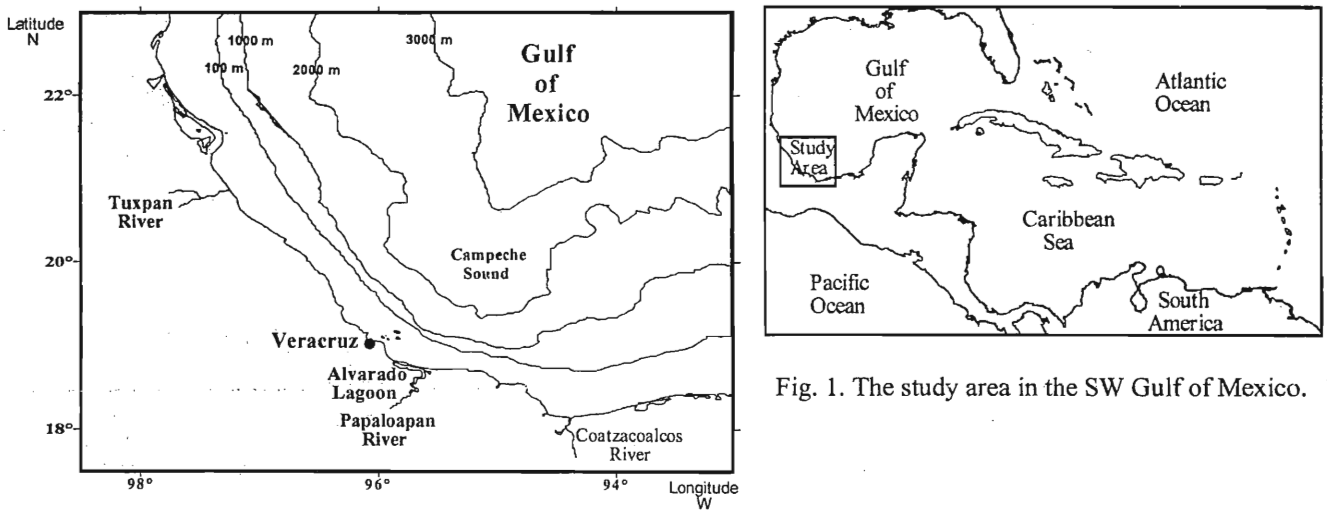


Fig. 1. The study area in the SW Gulf of Mexico.

The current study analysed the effect of the frontal zone on the meio- and macrofaunal distribution in the region. The changes observed included both benthic components and their trophic associations. The relevance of studing both size fractions in the benthic infauna is, on one hand, their major role in the transfer of energy to higher trophic levels (demersal fish and megafauna). On the other hand, these two smaller fractions facilitate the recycling of allocthonous materials in the region (Soto & Escobar 1995).

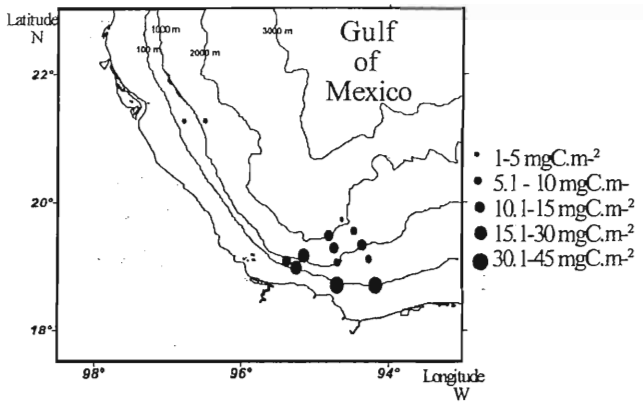


Fig. 2. Spatial variability of the meiofaunal biomass in the SW Gulf of Mexico.

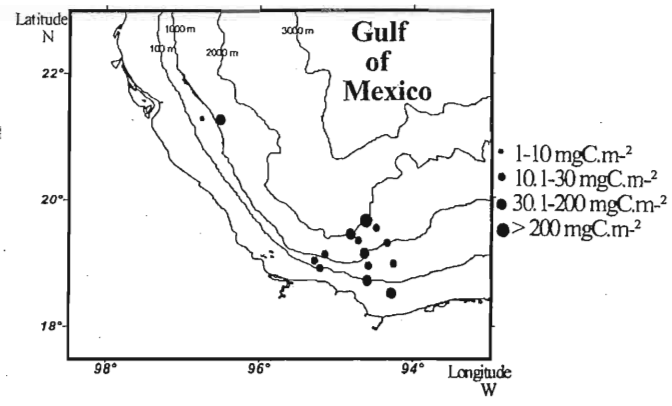


Fig. 3. Spatial variability of the macrofaunal biomass in the SW Gulf of Mexico.

Samples were collected along transects in the SW Gulf of Mexico (Figs. 2 and 3) on board the R/V Justo Sierra, UNAM. Processing, sorting and other statistical analysis followed common infaunal protocols. The infauna is characterised by low values, typical of tropical environments. The density and biomass values decrease with depth (Figs. 2 and 3); the change can be attributed to the nature and availability of the exported biogenic carbon, which can be used by bacteria, rather than meiofauna or macrofauna (Escobar et al. 1999).

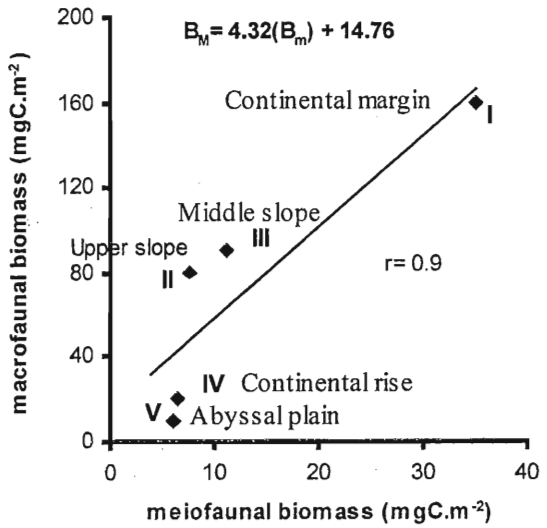


Fig. 4. Regression of the biomass of meio- and macrofauna in the SW Gulf of Mexico.

A positive correlation exists with the meio- and macrofauna; the lowest values were recorded on the continental rise and upper abyssal plain, the largest on the continental margin (Fig. 4). However, it is interesting to see that the upper slope values were lower than those recorded on the middle slope. The former were tightly coupled with the largest content of organic matter in the sediment. The strong interaction between both infaunal components is of a trophic nature with biological controls that act in both directions, bottom up (availability of organic matter or bacteria) and top down (predation exerted on the meiofauna by the macrofauna and megafauna and upon the macrofauna by the megafauna and fish). This tight trophic coupling has been recognized previously.

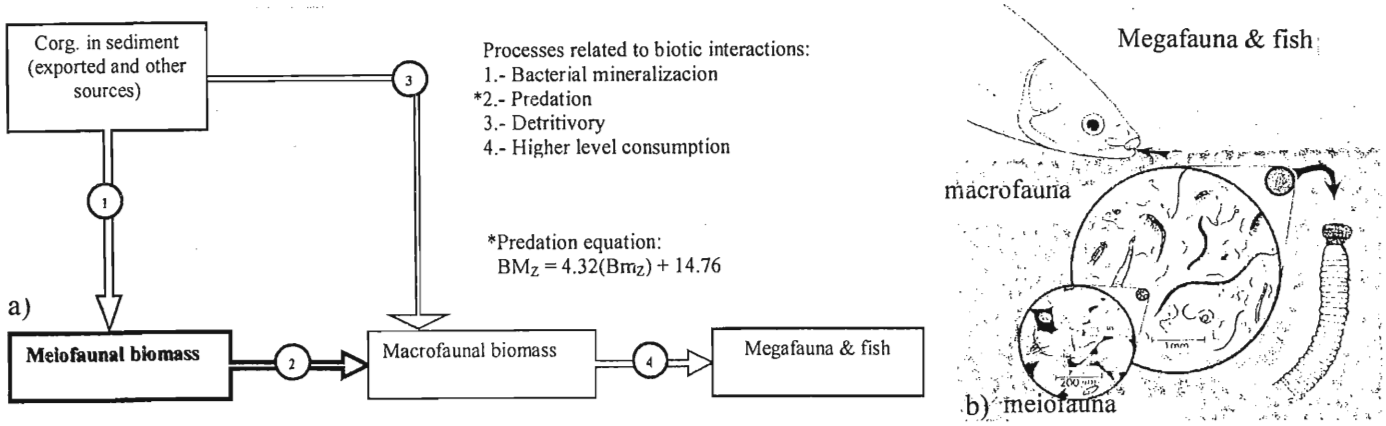


Fig. 5. a) Boxes representing the standing stocks used in the model [model modified from Salas (2001)] belong to the continental rise-upper abyssal plain. b) Hypothetical benthic food web, illustrating possible connection between meiofauna and macrofauna and potential top-predators. Abbreviations used: Corg = Biogenic carbon; BMz = Biomass of macrofauna at depth (z); Bmz = Biomass of meiofauna at depth (z).

Among several trophic efficiencies that the fauna can have between trophic levels, Salas (2001) tested the classical 10% efficiency for transfer in the abyssal plain. In this 10% scenario and based on the model depicted in Fig. 5, the macrofauna feeding on the meiofauna (6 $mgC.m^{-2}$) would attain 0.6 $mgC.m^{-2}$ and not the standing stock of 10 $mgC.m^{-2}$ reported by Rodriguez (1999). This discrepancy is explained by trophic efficiencies within the macrofaunal community components. In addition, carbon sources different from the biogenic carbon export from the euphotic zone could be available at these depths, namely, carbon from methane or hydrocarbon seeps, which may contribute to the carbon pool available to bacteria and some meiofaunal components. This will need to be evaluated in future studies.

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**Literature cited**

Escobar, E., M. Signoret. & D. Hernández-Robles, 1999: Variación de la densidad de la infauna macrobéntica en un gradiente batimétrico: Oeste del Golfo de México. – Ciencias Marinas 25 (2): 193–212.

Rodríguez, P., 1999: Variación de la densidad y biomasa de la infauna macrobéntica a lo largo del gradiente batimétrico en el suroeste del Golfo de México. Tesis de licenciatura. FES Iztacala. Universidad Nacional Autónoma de México, México, 49 pp.

Salas, J.A., 2001: Variación espacial y batimétrica de la biomasa de meiofauna en el suroeste del Golfo de México. Tesis de licenciatura. FES Iztacala. Universidad Nacional Autónoma de México, México, 50 pp.

Soto, L.A. & E. Escobar, 1995: Coupling mechanisms related to benthic production in the SW Gulf of Mexico. *In* A. Eleftheriou, A.D. Ansell & J. Smith (eds.): *Biology and Ecology of Shallow Coastal Waters*. Proc. 28th. European Marine Biology Symposium Series. Olsen & Olsen, Denmark, pp. 233–242.

Vidal, V.M., F.V. Vidal & A.F. Hernández, 1990: Atlas Oceanográfico del Golfo de México. Vol. 2. Instituto de Investigaciones Eléctricas, Cuernavaca, Morelos, México. 707 pp.

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# CHANGE IN RATIOS OF OCCURRENCE OF DOMINANT COMPONENTS OF THE INFAUNA IN THE WESTERN DEEP GULF OF MEXICO

In a previous number of Deep-Sea Newsletter (No. 29, 2000), Escobar presented a preliminary study of the macroinfauna from the Sigsbee Deep in the central Gulf of Mexico. In this occasion the taxonomic composition and distribution of biomass of meio- and macroinfauna are described. Studies that analyze the coupling between the two groups are scarce for the tropical deep-sea. Many organisms of the meiofauna are juvenile forms of the macrofauna, making it hard to establish the correct separation between both groups and, in consequence, to relate them. It is well known that meiofauna is numerically larger than macrofauna, by a factor of five (Reise 1979).

The Sigsbee Deep is well known as one of the most oligotrophic locations in the world ocean. Located in the tropics, its primary productivity is low, and export may relate to seasonality of wind patterns or mesoscale hydrodynamic features. The deep-sea communities depending on export will respond with a delay in time towards the input of organic matter (Rowe et al. 2001).

The objective of this study is focused to describe the patterns of distribution of the infauna (meio- and macrofauna) along a depth gradient.

The samples were collected with an US-NEL box corer along a transect in the western Gulf of Mexico, in June 1997, on board the R/V "Justo Sierra". Samples were sieved on board and processing of environmental factors, sorting of infauna and statistical analyses were done in the lab. Values presented here in were used in the bachelor theses of the two first authors. Depth zonation used here is the same as that used in Escobar (2000).

Polychaetes, together with nematodes and some crustaceans, were the dominant components, which contributed with >90% of total biomass of the infauna in all depth zones (Fig. 1).

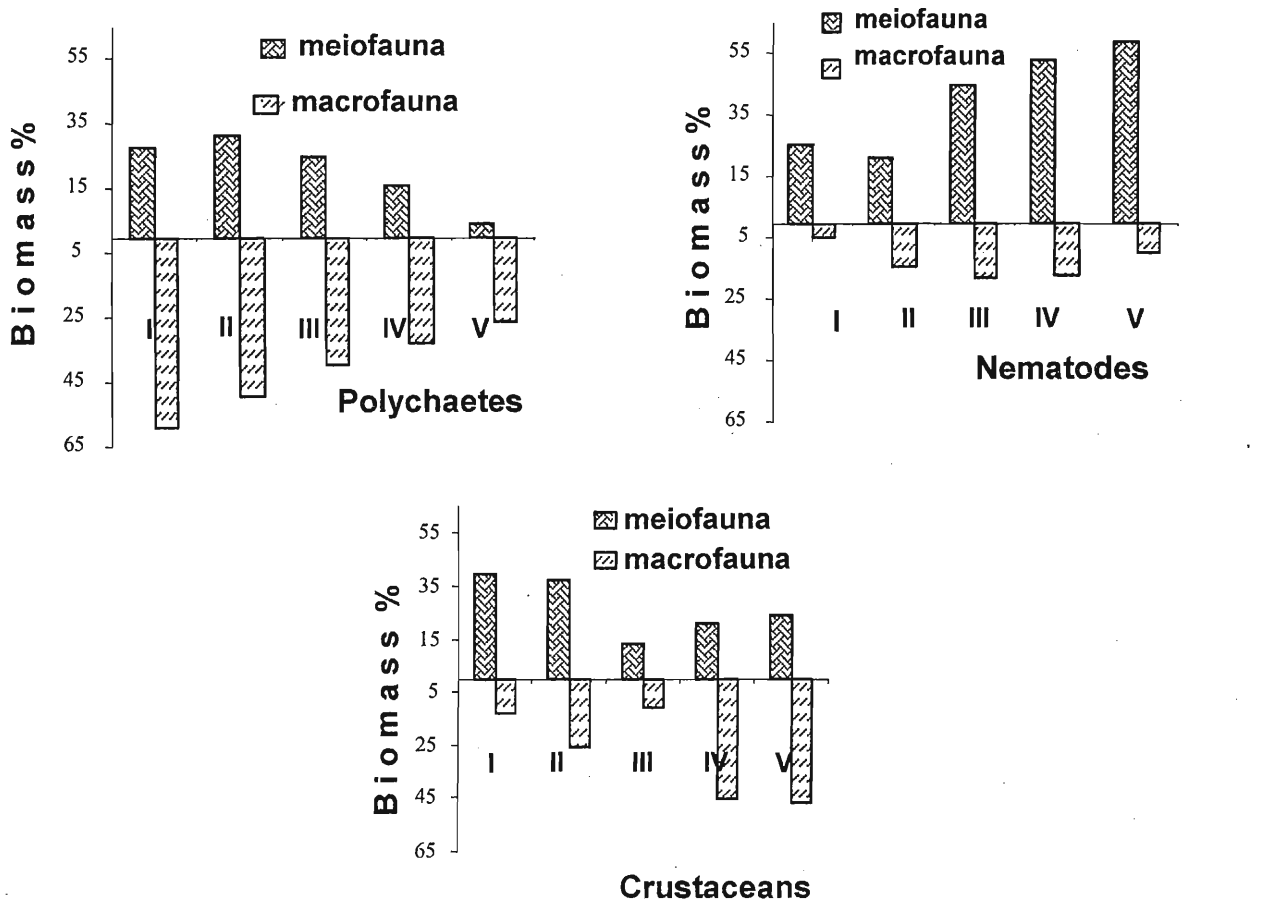


Fig. 1. Percent of biomass of dominant groups of meio and macrofauna. Zones are as follows: I = shelf-slope transition, II = lower continental slope, III = continental rise, IV = northern abyssal plain, V = southern abyssal plain.

A change in the ratios of occurrence of the dominant groups occurred in both macro and meiofauna (Fig. 1). Within macrofauna, polychaetes contributed with more than 50% of total biomass at the shelf-slope transition, but they were replaced by the crustaceans at the deepest zones (continental rise and abyssal plain), which contributed with more than 35% of biomass. Within the meiofauna, crustaceans contributed with more than 35% of biomass at the continental shelf and slope, but they were replaced by the nematodes, which contributed with more than 45% of total biomass at the continental rise, and with 50 to 60% at the abyssal plain (Fig. 1).

In both cases (meio- and macrofauna) there is a significant reduction with depth for the polychaetes. The nematodes recorded in meiofauna, in contrast, increased their biomass with depth. The crustaceans showed a mirror image of both macro- and meiofauna.

The meiofauna showed a parabolic pattern along the depth gradient (Fig. 1). Macrofauna contributed with largest values of biomass on the shelf-slope transition, 0.078 g C per $m^{-2}$, and decreased to 0.034 g C per $m^{-2}$ with the increase in depth. Meiofauna showed their largest biomass values, 0.119 and 0.124 g C per $m^{-2}$ on the shelf-

slope transition and the abyssal plain, respectively. Their lowest values (0.008 g C per $m^{-2}$) were recorded on the lower continental slope, which was consistent to the values of the macrofaunal biomass (Fig. 2).

The distribution patterns of both infaunal groups respond to the content of organic matter in the sediment. The concentration of dissolved oxygen in the bottom water mass also helped to explain the pattern observed in the macrofauna.

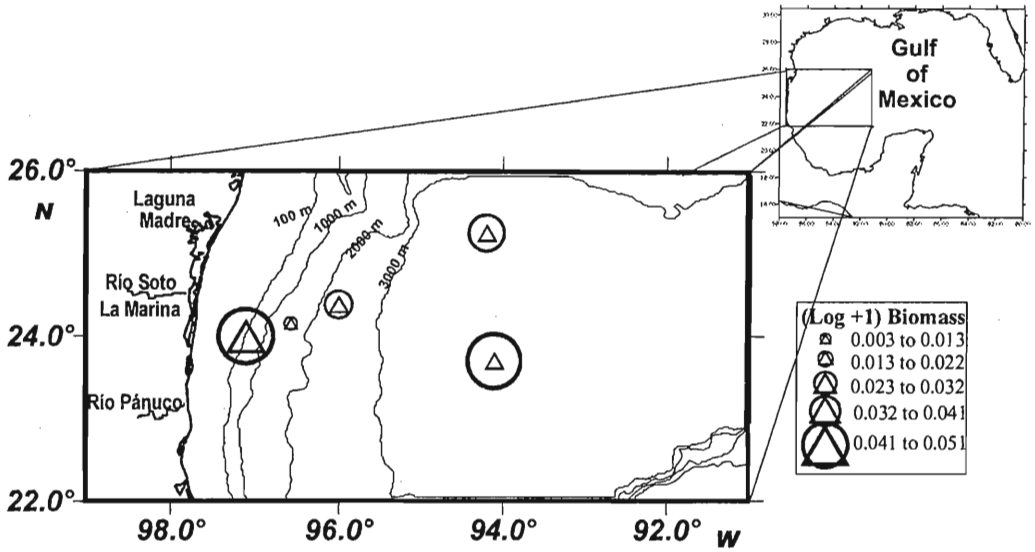


Fig. 2. Bathymetric distribution of meiofauna (○) and macrofauna (△) biomass. Values are transformed by Log+1.

The greatest values of meiofauna at the abyssal plain suggest that these communities are more resistant than macrofauna to the adverse conditions that characterize the deep sea, such as low input of food. Additionally, larger biomass values recorded for meiofauna from the abyssal plain lead us to suggest that smaller sizes may subsist under the strains of low food input.

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**References**

Díaz, C. 2001: Patrón de distribución de la riqueza taxonómica, densidad y biomasa de la meiofauna en un gradiente batimétrico del sector occidental del Golfo de México. – Tesis de Licenciatura. Facultad de Ciencias, UNAM. México. 61 pp.

Escobar, E. 2000: The deep Gulf of México. – Deep-Sea Newsletter 29: 19–22.

Hernández, D. 1999: Riqueza taxonómica, densidad y biomasa de la infauna macrobéntica a lo largo de un gradiente batimétrico en el sector occidental del Golfo de México. – Tesis de Licenciatura. Facultad de Estudios Superiores Zaragoza, UNAM. México. 43 pp.

Reise, K. 1979: Moderate predation on meiofauna by the macrobenthos of the Wadden Sea. – Helgolander wiss. Meeresunters. 32: 453–465.

Rowe, G. T., A. Loske, G. S. Boland, E. Escobar, F. Hubbard & J. Deming. 2001: Benthic community structure and function in the Sigsbee Deep, northern Gulf of Mexico. – Bull. Fish. (submitted).

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# COLD SEEPS, WHALE CARCASSES AND MEIOFAUNA

Our knowledge of deep-sea meiofauna is limited for the Mexican Exclusive Economic Zone. The lower slope and the abyssal plain located off the Baja California region are mostly unexplored. The current study provides a preliminary insight on the taxonomic composition and abundance of the meiofauna and the spatial changes recorded along distance gradients from a massive organic matter input (whale carcasses and methane seeps) in the deep sea. The samples were obtained off San Diego and Ensenada on board the research vessel "Atlantis II" in October 1999 in a cruise lead by Dr. Craig Smith. Additional samples were obtained from seeps in the San Clemente Basin (Fig. 1) on a similar cruise led by Dr. Martha Torres in March 2000.

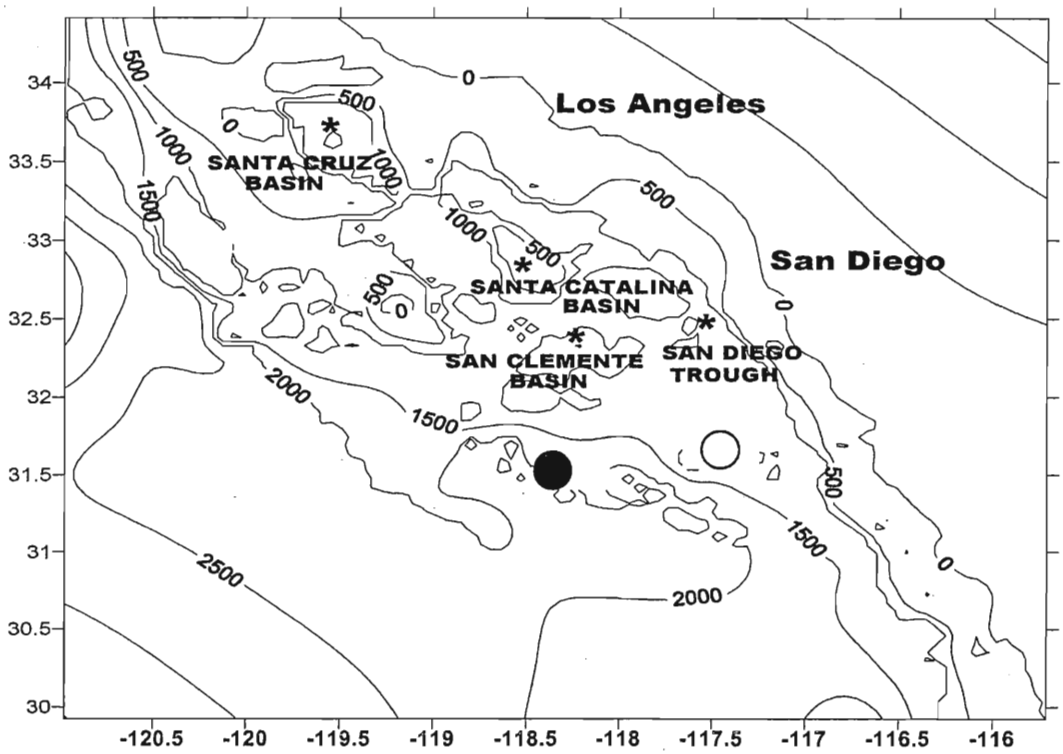


Fig 1. Area of study. The round markers show the two sites in Mexican EEZ where meiofaunal samples were collected from sediments at a whale carcass (solid) and a methane seep (open).

The main goal of this study was to evaluate the changes in taxonomic composition, density and biomass of the meiofaunal community along gradients in distance from major sources of organic matter, considered here as two types of habitats: a whale carcass and a methane seep (Fig. 1). Both deep-sea sites are subject to unusually high concentrations of organic matter in the sediment, as compared with the concentration found in the abyssal plain. The samples were collected with help of the submersible "Alvin". Due to the limited availability of acrylic pushcores and boxcores retrieved by the "Alvin", subsamples were obtained with a smaller hand corer (0.0003 $m^2$ in diameter, herein named minicores) that allowed us to have four replicates of each sampling event. Samples were always obtained at the carcass or seep (0 m) and with distances to the abyssal plain (distances 0, 1, 3, 9, 10 and 100 m) that allowed us to evaluate the spatial variability of the community (see Table 1 for sampling strategy). On deck the minicores were sectioned into 3 depth levels in the sediment, namely: Level 1 from 0 to 2 cm, level 2 from 3 to

Table 1. Sampling strategy.

| Dive | Habitat | Latitude N | Longitude W | Site | Depth (m) | Distances (m) |
|---|---|---|---|---|---|---|
| AD 3481 | Whale carcass | 32° 35.61 | 117° 29.98 | San Diego Trough | 1205 | 0, 1, 3 |
| AD 3485 | Whale carcass | 32° 25.59 | 119° 21.54 | San Diego Trough | 1675 | 3, 9, 30 |
| AD 3487 | Methane seep | 32° 13.55 | 117° 42.62 | San Clemente Basin | 1806 | 0, 1, 10, 200 |

5 cm and level 3 from 5 to 10 cm. Every sediment section was sieved through 42 µm mesh and fixed with 95% ethanol and Rose Bengal stain to facilitate the sorting process on board.

The organic C, N and S contents in the sediment were obtained from the elemental analysis with a Fisson Elemental Analyzer using acidified samples that included every depth section at every distance from the major carbon source at each site. The current note presents the results obtained on the taxonomic composition and the total abundance for each replicate from whale carcasses and the methane-seep samples.The taxonomic composition A.

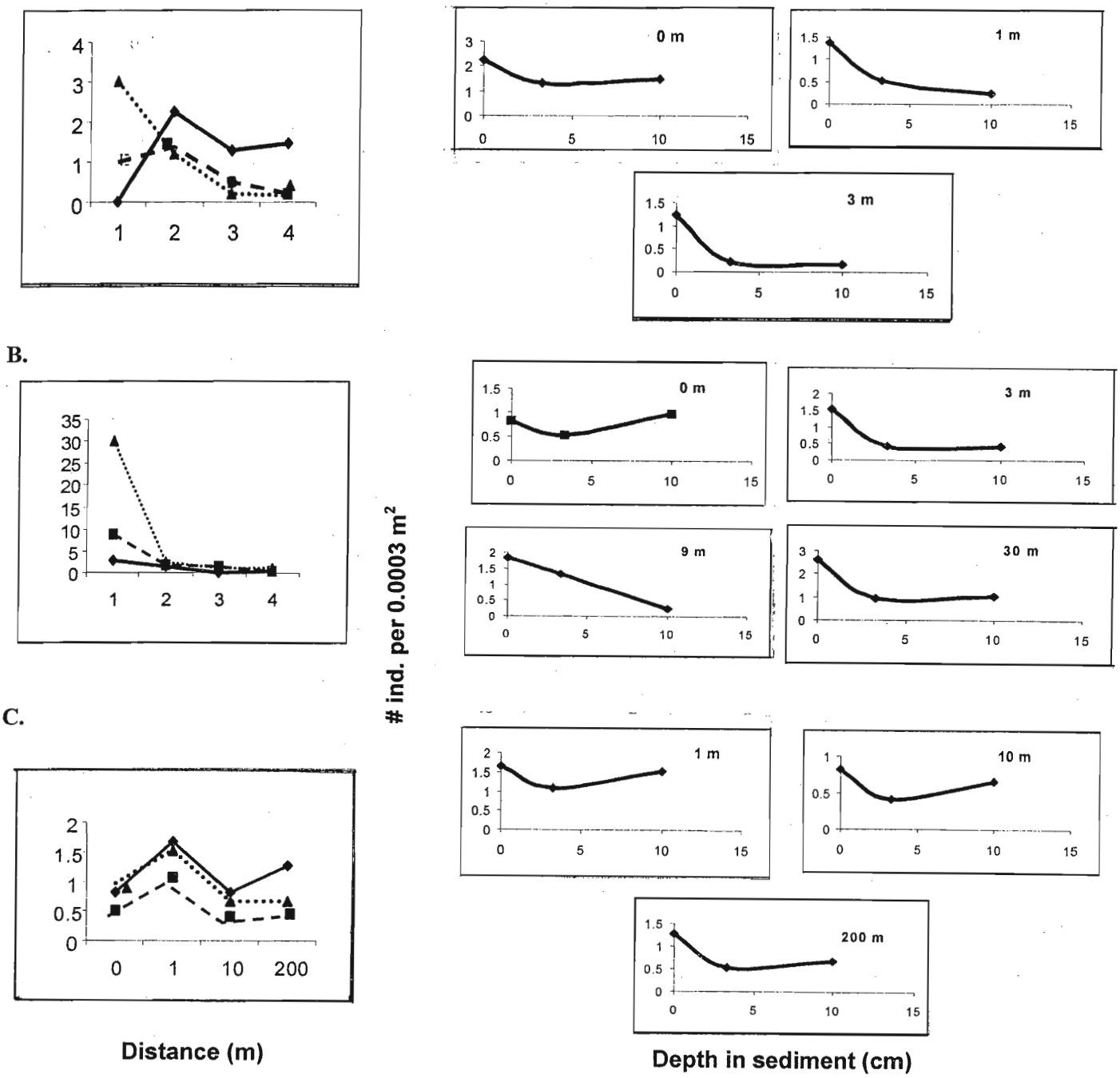


Fig. 2. Variability of mean meiofaunal total abundance with distance from main organic matter source. A and B, whale carcass; C, methane seep for samples taken from sediment sections at depth layers 1 (0–2 cm, solid line), 2 (3–5 cm, dashed line) and 3 (5–10 cm, dotted line).

of the meiofaunal community includes nematodes, polychaete larvae, harpacticoid copepods, foraminifera, ostracods and oligochaetes. The nematodes (Fig. 3) are the dominant faunal components in samples of both habitats,

representing from 60 to 90% of the total abundance. The greatest nematode abundance occurs in the two samples nearest to each major source of organic matter. A replacement of the nematodes by harpacticoid copepods and other taxa occurs with increasing distance to the abyssal plain.

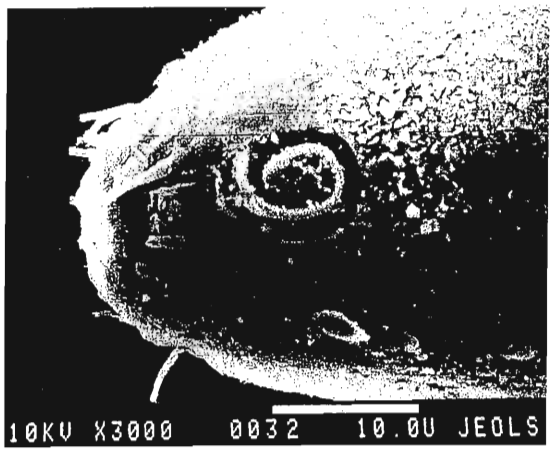


Fig. 3. Detail from a scanning electron micrograph of the head of a nematode. From E. Escobar files.

The greatest total abundances decrease with distance from the whale carcass (Fig. 2A, B) and show a slight increase in the abyssal plain at the methane-seep site (Fig. 2C). A decrease in the total abundance is observed with increasing depth in the sediment (figures to the right of Fig. 2A, B, C).

The factors that describe the current patterns observed in taxonomic composition and abundance are being analysed by means of multiple correlation with the environmental factors in the sediment that characterise each type of habitat (whale carcass vs methane seep). Preliminary results allow us to recognize that both the carcass and seep provide the meiofauna with larger sources of organics that may act as potential food sources. The large variability observed within replicates of samples is being analysed. Other variables, such as dissolved oxygen content, bacterial biomass, etc. can be related to the changes observed in composition and abundance. Suzzette is expecting to finish this study at the end of November 2002, after she spends a semester (January through June 2002) in Montreal taking core courses of the Biology curriculum. She is looking forward to applying to graduate school and continuing to work on deep-sea benthos and related processes. Partial results were presented at the Astro-biology Meeting at the Institute of Nuclear Research at UNAM (Tamez, S. & E. Escobar. Effect of enrichment by organix material on deep-sea benthic communities) on 28 August 2001.

**Acknowledgements**

We would like to thank Drs. Craig Smith, University of Hawaii, and Martha Torres, Oregon State University, and their enthusiastic research team for their invitation and kind support and for sharing materials from the whale and seep sites, and the DSV "Alvin" and R/V "Atlantis" crews for their support in the field. Thanks are also due to the current ICML UNAM CU administration for their support and infrastructure. S. Tamez's fellowship and elemental analyses have been supported by grants IN211200 DGAPA, CONACyT G-27777B, G35442-T.

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## NEW CORRESPONDENT FROM TAIWAN

We welcome a new correspondent, Dr. Hsin-Min YEH, from Taiwan, who completed a Ph.D. under Prof. Suguru Ohta, at Ocean Research Institute, University of Tokyo this February. Dr. Yeh has offered to be our correspondent from Taiwan. His Ph.D. under Prof. Ohta dealt with community structure of deep-sea demersal fish around Japan.

Hsin-Min now has a postdoctoral fellowship at the Academia Sinica in Taiwan. Together with Dr. Shao, the leader of the laboratory, he is studying the deep-sea fishes in the deep trench (an extension of the Ryukyu Trench) on the east side of Taiwan. The study has run for about 2 years, but the results are still preliminary. We look forward to hearing more about this in the next issue.

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# NEW XENOPHYOPHORE: COMPLETE TRANSLATION OF:

**O.E. Kamenskaya, 2000: *Xenophyophores* (Protista, Xenophyophorea) from the 16th cruise of R/V "Dmitry Mendeleev". 2. *Lobammina rigida* gen. et sp. nov. – new genus and species from the Coral Sea.**

Pp. 102–106, 110–111 *in* A.P. Kuznetsov & O.N. Zezina (eds.): *Benthos of the Russian seas and the Northern Atlantic.* Collected Proceedings. VNIRO Publishing House, Moscow. 113 pp. (In Russian, with Russian and English summaries.)

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During the 16th cruise of the R/V "Dmitry Mendeleev", the bottom fauna of the Australian, New Zealand and adjacent subantarctic areas were studied. A unique collection of giant protozoans of the class Xenophyophorea from the orders Psamminida and Stannomida were collected during the expedition. The species of the genus *Psammeta* recorded at depths of 1800–5400 m in the New Caledonian and South Australian abyssal plains and in the shallow waters near Tasmanian and Maquarie Trench along with the species of the genus *Homogammina* collected in the South Australian Basin and Hjort Trench at depths of 5470–6200 m are represented in the material. The genera above and two new genera belong to the family Psammetidae. The family Psamminidae is represented by the genera *Reticulammina* and *Galatheammina*. The species of the former genus live on the continental slope of Tasmania and the Coral Sea at depths of 755–3080 m, the species of the second genus are found at depths of 1016–4460 m in the South Fiji and South Australian Basins, on the slopes of New Zealand and Tasmania, in the family Syringamminidae were found representatives of the genera *Syringammina* from the depth 755 m at the slope of Tasmania, the genus *Aschemonella* from the depth 4800 m from the Tasmanian Basin, and a new species and genus from the New Caledonian Basin. The only family of the order Stannomida, Stannomidae, is represented by the genus *Stannophyllyum* collected in the South Fiji Basin at a depth of 2010 m.

A total of 22 species of xenophyophores were found during the 16th cruise of the R/V "Dmitry Mendeleev". The material contains many new taxa [Kamenskaya, 1998]. In this paper the description of the new genus and species *Lobominna rigida* gen. et sp. nov. from the Coral Sea is presented.

## Materials and methods

The xenophyophores were collected by the Galathea trawl at station 1235 in the northern part of the Coral Sea Basin at depths of 3070–3080 m. The substrate was dense carbonate foraminiferous sands and clays with pieces of volcanic material and abundant plant remnants. The protozoans were fixed by and stored in 70% ethyl alcohol. The details of the shell structure, stercomares and granulares were studied with use of CamScan scanning electron microscope and spectrographic analyzer SB S-50. The material was coated with gold.

We are grateful to I.A. Zhegallo and L.T. Protasevich, researchers at the Paleontological Institute, for their help during the use of SEM.

## Systematic part

### Order Psamminida Poch [Poche], 1913
### Family Psammettidae Tendal, 1972
### Genus *Lobammina* gen. nov.

**Diagnosis.** The test is of irregular shape, with sharp, flattened lobes pointing in all directions. The test is strong and hard. It reaches 15 mm in diameter. Silicious sponge spicules are the only type of xenophyae. They lie flat and cemented on the surface of the test, so that the surface is rather smooth. A thin film of cementing matter is stretched between the xenophyae. In the inner part of the body xenophyae are distributed without order. Strings of stercomare and granellare run between them.

**Etymology.** From the Latin "lobus" – blade, paddle.

**Type species.** *Lobammina rigida* sp. nov.

**Remarks.** *Lobammina* occupies an intermediate position between the families Psammettidae and Psamminidae. The test is primitive and irregular, with a single type of xenophyae, as in *Homogammina* Gooday //**page 103** [Fig. 1]; **page 104**]// & Tendal, 1988 and *Maudammina* Tendal, 1972; therefore we attribute this genus to the family Psammettidae. But there is a tendency for cementing matter to concentrate on the test surface although this surface layer is not so well developed as is typical for the family Psamminidae. It consists only of a thin film of cement without xenophyae.

[Figs. 2, 3]

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[Fig. 4]

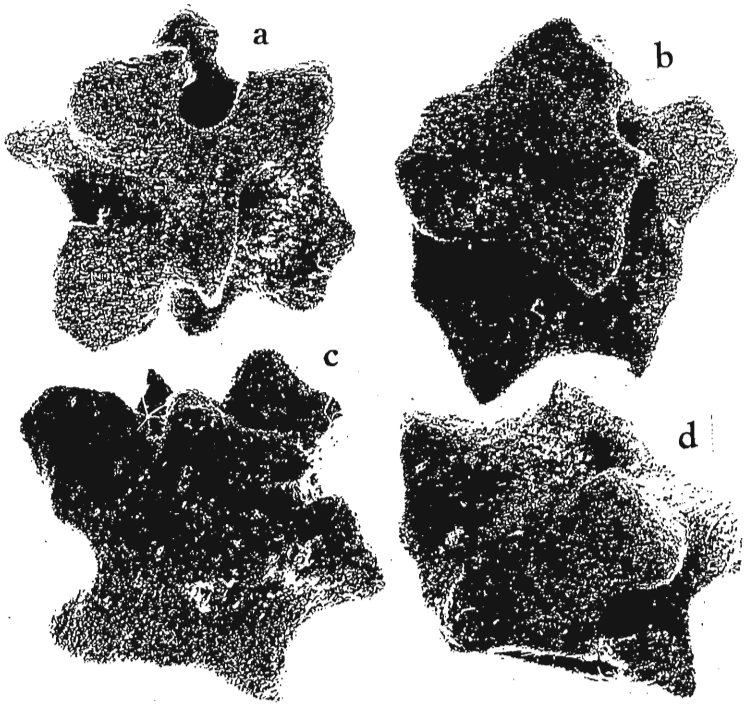


Fig. 1. *Lobammina rigida* Holotype: a – view from the top; b – view from the bottom; c, d – lateral view. Scale 10 mm [not shown].

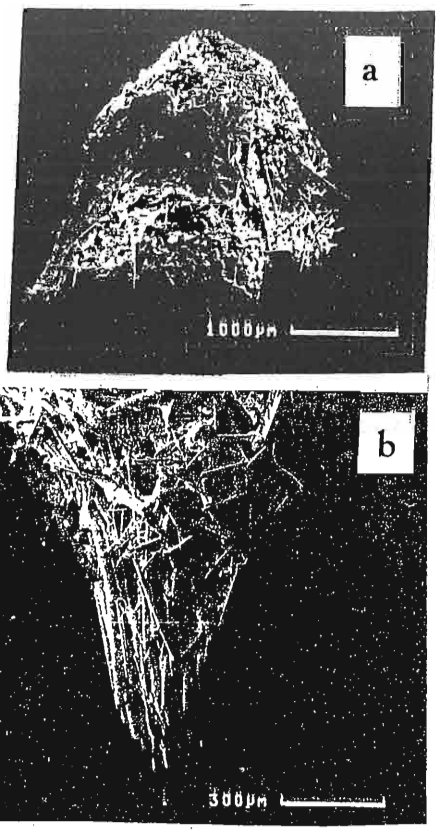


Fig. 2. *Lobammina rigida*, fragments of paratype No. 1: a – rounded lobe; b – sharp lobe with a bunch of spicules at the end. Scales: a = 1000 µm, b = 300 µm.

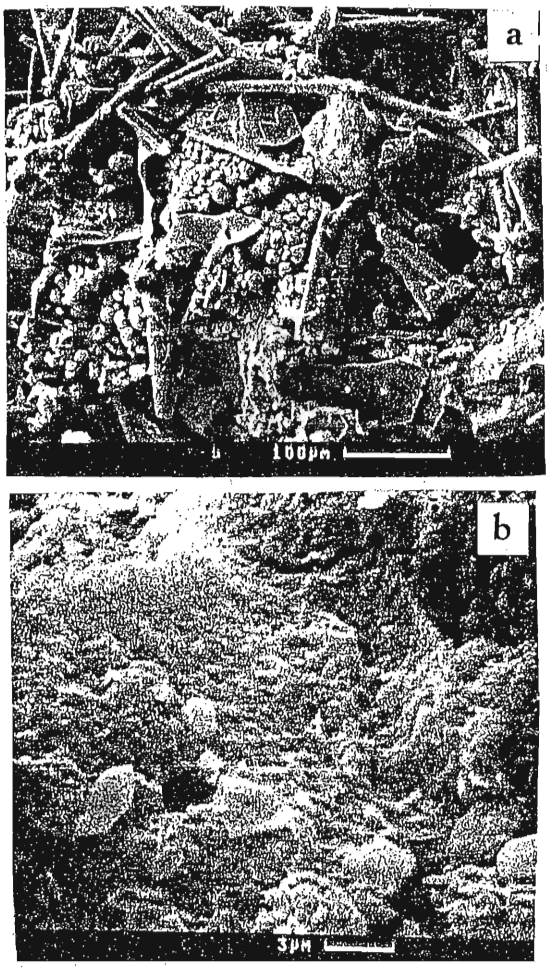


Fig. 3. *Lobammina* rigida, inner structures of paratype No.1: a – stercomare and stercomes in dried test; b – granellare with granellae. Scales: a = 100 µm, b = 3 µm.

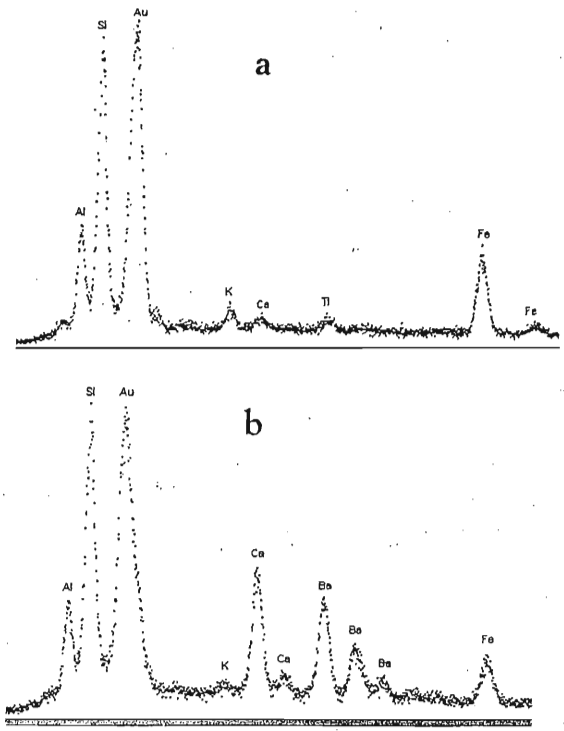


Fig. 4. *Lobammina rigida*, elemental composition of inner structures of paratype: a – single stercome; b – single granellae. [From left to right, a – Al, Si, Au, K, Ca, Ti, Fe, Fe; b – Al, Si, Au, K, Ca, Ca, Ba, Ba, Ba, Fe]

*Lobammina rigida* **sp. nov. (see figs. 1–3)**

**Diagnosis.** As for the genus.

**Type material.** R/V "Dmitry Mendeleev", 16th cruise, 11°30.5'S, 152°10.2'E – 11°30.5'S, 152°11.7'E, Galathea Trawl, 3070–3080 m, holotype size 12x13x15 mm is stored in the collection of the P.P. Shirshov Institute of Oceanology RAS [Moscow], paratype No. 1 10x13x13 mm, paratype No. 2, fragments.

**Description.** Test of irregular form consisting of flattened lobes pointing in all directions (fig. 1, a–d). Some of them are rounded (fig. 2, a), others bear bunches of sponge spicules at the end (fig. 2, b). The test is very strong, hard, reaching 15 mm in length. Spicules of sponges are the only type of xenophyae. These sponge spicules are horizontal on the surface of the lobes. //**page 106**// They are cemented, so that the surface is rather smooth. In the inner part of the test xenophyae are distributed chaotically and are cemented only at the points of contact. Strings of stercomare up to 50 μm in width and granellare 10–15 μm in width are runnning between the xenophyae under the surface film. Due to dense position of xenophyae, the shape and length of these structures are unrecognizable. Stercomare consists of globular stercomes up to 10 μm in diameter (fig. 3, a). Elemental analysis of a single stercome with the spectrographic analyzer SB S-50 shows the presence of Si, Al, Fe, K, Ca, Mg, and Ti (fig. 4, a). In granellare there are a lot of oval crystals, granellae, reaching 1–2 μm in length (fig. 3, b), with high concentration of Ba (fig. 4, b).

**Distribution.** Abyssal depths of the Coral Sea.

**List of Literature Used**

Kamenskaya O.E. Xenophyophorea (Protozoa. Xenophyophorea) from the material of the 16th cruise of the R/V "Dmitry Mendeleev". 1. New species of the genus *Reticulammina* / Benthos of the high latitudes. – VNIRO, 1998. – P. 121–124

Gooday A.J., Tendal O.S. New xenophyophores (Protista) from the bathyal and abyssal north-east Atlanthic [sic] Ocean // J. nat. Hist., London – 1988. – V. 22. P. 413–434

Tendal O.S. A monograph of the Xenophyophoria (Rhizopodea, Protozoa) // Galathea Rep. – 1972. – V. 12. – P. 7–99

//**End of page 106**//

//**Page 110** [Russian and English summaries]//

Xenophyophores *Lobammina rigida* gen. et sp. nov [sic] were caught by Sigsbee trawl at the depth of 3060–3080 m. Test is very strong, reaching 15 mm in length, of irregular shape with flattened lobes looking in all directions. Spicules of sponges are the only type of xenophae. They are attached flat and cemented by film, so that the test surface is //**page 111**// rather smooth. In the inner part of the test xenophae are distributed chaoticly and cemented only at the point of contact. Stings [sic, strings] of stercomare and granellae are situated between xenophae under the surface film. Genus *Lobammina* occupies an intermediate position between the families Psammettidae and Psamminidae. They have primitive irregular test with a single type of xenophae, and therefore, we attribute this genus to the family Psammettidae. But there is a tending to concentrate a cementing matter on the test surface; however this surface layer is not well developed, as it is typical of the family Psammetidae. [For all "xenophae" read "xenophyae"]

//**End of page 111**//

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Translated by O.E. Kamenskaya, revised by A.L. Vereshchaka.
Note re Figs.: All are reduced; Fig. 1c, d are rotated slightly counterclockwise; 2a has had excess background removed.

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**THE DEADLINE FOR THE NEXT ISSUE OF D-SN IS 1st DECEMBER 2002**

Contributions may be sent as e-mail attachments in Word (any version), WordPerfect 5.x to 6.0 (Windows), RTF or ASCII to: Torben Wolff or Mary E. Petersen (mepetersen@zmuc.ku.dk)

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