

DEEP-SEA NEWSLETTER

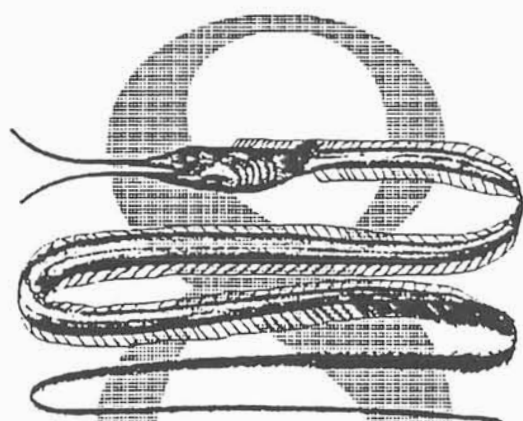


No. 27, June 1998

EIGHTH DEEP-SEA BIOLOGY SYMPOSIUM – Monterey Bay Aquarium, Monterey, California, 22-26 September 1997

When starting to count Symposia for deep-sea biologists, this special breed of scientists have met in Stockholm (1977), Kristineberg (1977), La Jolla (1981), Hamburg (1985), Brest (1988), Copenhagen (1991), Crete (1994), and Monterey (1997). What a wonderful achievement for a group that depends on volunteers and the occasional nudge from Torben Wolff. It is my pleasure (although my ribs still hurt where Torben elbowed me) to report on the Eighth Deep-Sea Biology Symposium, which was held in Monterey, California, between 22 and 26 September 1997.

The venue was Monterey Bay Aquarium, set in historic Cannery Row. Most of the attendees had read the Steinbeck novel of the same name and found the chance to see the area and to visit in our minds with Doc, Mack, Lee Chong, and Steinbeck's other vivid characters a delightful addition to the scientific activities and the opportunity to see old friends. The aquarium was the setting for most of the meeting activities, and what a setting it was! The auditorium and conference room we used were state of the art. We enjoyed coffee breaks on a balcony overlooking the sea, the surf, and pelicans, cormorants, gulls, and an occasional sea otter. The



EIGHTH DEEP SEA BIOLOGY SYMPOSIUM

Monterey, California 1997

meeting banquet was a "strolling dinner" set in front of a huge tank filled with barracuda, tuna, sunfish, and sharks, which also served as the illustrious background where Torben once again performed the extraordinary Maori haka.

Once again in the US

Attendance set an impressive record of 213 registered participants from 17 countries. Some familiar faces were missing, such as Bob Hessler, Hjalmar Thiel, Tony Rice and others of the crowd from the Institute of Oceanographic Sciences, and our French colleagues. Illness, cruises, and competing meetings kept them away. I look forward to seeing them at the ninth meeting (see below). In Crete, the wish was expressed that the meeting return to the United States, after an extended stay in Europe, so that American graduate students could present their work and be presented to the group. As hoped, many such students participated.

The meeting's four days of talks and an evening poster session were very rich scientifically. The topics of the sessions and the list of contributors are given below. See also <http://www.mbari.org/~barry/dsbs97.htm>. Work on

soft-bottom habitats, particularly carbon flux and the role of disturbance, was well represented. The number of talks on vents and seeps increased noticeably over previous meetings. Also, the trend begun at Crete for workers on mid-water organisms to attend and report on their fascinating organisms blossomed in Monterey into substantial sessions on pelagic communities and sensory systems.

Simultaneous sessions

My impression (and that of everyone I talked to) was that the quality of the talks was noticeably higher than at previous meetings, which bodes well for the future of deep-sea biology. The cornucopia of good talks created a difficulty for the organizers; more talks were submitted than could be accommodated in four days without simultaneous sessions. In Tony Rice's report after the Crete meeting (D.-S.N. No. 23), he suggested that simultaneous sessions be avoided because we are a small and intimate family. I suspect that he would also admit, if pressed, that (like me) he simply enjoys learning about all aspects of deep-sea biology and wants to hear all the talks. Certainly for those who teach, the meeting is an opportunity to become current in specialties outside our own and to accumulate new "gee whiz" anecdotes to spice up our classes. I suspect that the next organizers will be faced with this problem, and there is no easy solution. Tony suggested that the slots for oral presentations be filled by age, youngest first. Torben reminded me that the excursion was cut to one-half day in Copenhagen so that all the talks could be accommodated. Another solution might be to have sessions from Monday through to Friday and to devote Saturday (instead of Friday) to excursions, none of which lasted a whole day anyway. Perhaps some of the sessions could be organized according to the format that Bob Hessler used, in which each presenter is allowed one slide and five minutes to say why it is interesting. If simultaneous sessions must be adopted at the next meeting, I suggest that the topics doubled up at Monterey not be doubled again, so that no second-class topics are created.

The poster session

The poster session was held in a room where one wall was open to one of the aquarium's large tanks, a spectacular a setting. The level of the science in the posters was as high as that in the talks. I was pleased to note that phylogenetic analyses were frequently important to the results. Systematics is making a comeback! Although it was obvious that much effort had been invested in poster preparation, some were not as successful as they might have been. For example, the text could not always be read from 1 m away over someone's shoulder. Also, many posters (including my own) were organized too much like manuscripts. A poster should have a small number of easily grasped points. After all, with 70 offerings to consider in a few hours, most people were skimming each poster and only spending time at a few.

In Monterey, the poster session could only be a bit more than three hours because of limited access to the room. At the next meeting, perhaps the posters could be up and available for inspection during most of a day so people could read them during breaks. The period with the authors present could then be used more profitably because readers would have chosen the authors they wished to talk to and formulated their questions. However, everybody seems to have gone to the poster session. It was truly a buzzing event, with lots of discussion and inspiration.

Those in charge

The organizing committee (Jim Barry, Bruce Robison, Kurt Buck, Randy Kochevar, Ginger Hopkins, and Chris Harrold) deserve great thanks from the deep-sea community. They welcomed us to a spectacular part of the world and arranged a very smoothly run meeting. I was particularly struck by the quality of the food at the strolling dinner and at the reception at the Monterey Bay Aquarium Research Institute at Moss Landing further up the Bay. It was wonderful! They also introduced competitions for the best oral presentation by a student (won by Allen Andrews of Moss Landing Marine Laboratories) and best poster by a student (won by Sarah McHatton of the University of California, Davis). The competitions made more work for the organizing committee, but I feel these valuable innovations should be continued.

The next meeting will be hosted by John Patching in Galway, Ireland during the summer of 2000. John was not at the meeting to reissue his long-standing invitation, so should he be unable to host the meeting, it will be at the Southampton Oceanography Centre in Southampton, England. When the host is announced, please write to him/her and indicate your desires about simultaneous sessions, student competitions, the excursion day, or other matters. I look forward to seeing everyone in three years.

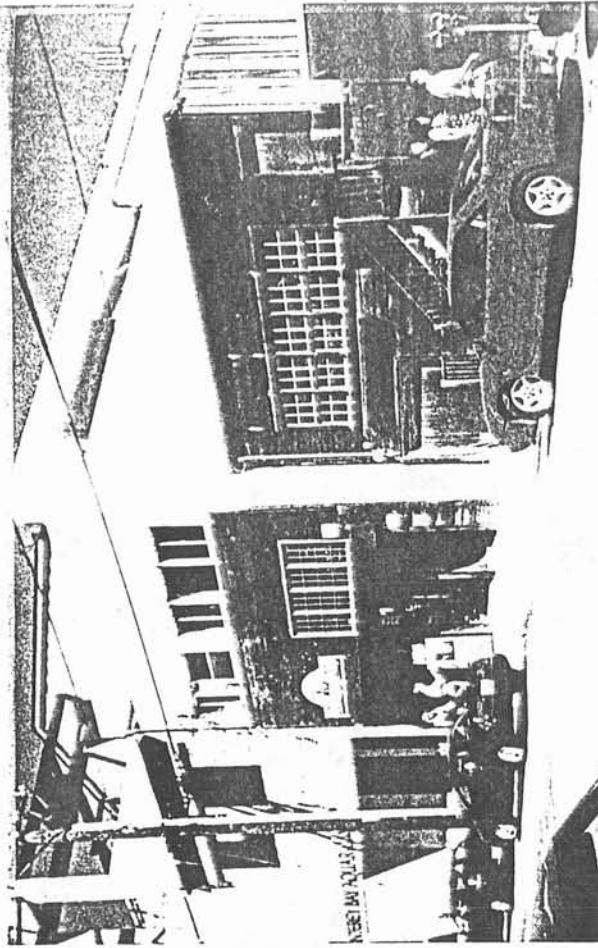
David Thistle
Florida State University, Tallahassee, USA



John Steinbeck (left) made Cannery Row and Monterey world famous. Together with "Doc", the marine biologist Edward F. Ricketts (right), he wrote *The Sea of Cortez* (1941). Ed Ricketts was also the author of the highly esteemed *Between Pacific Tides* (1st ed. 1939). T.W. phot.

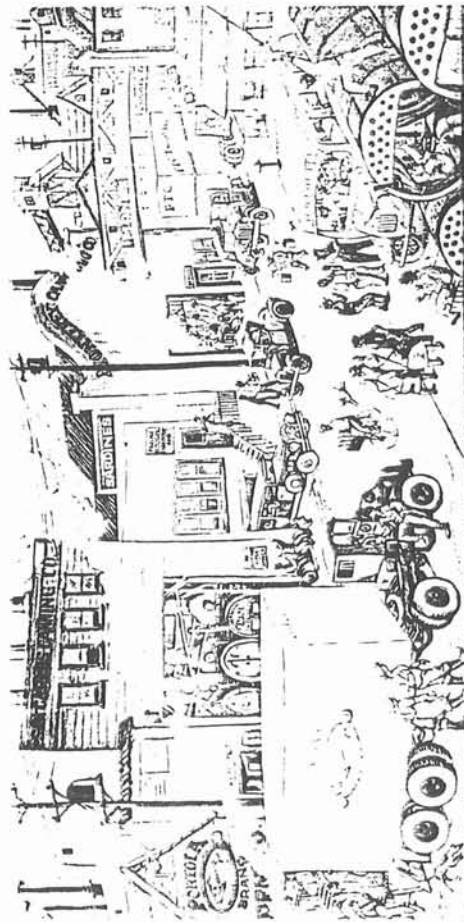
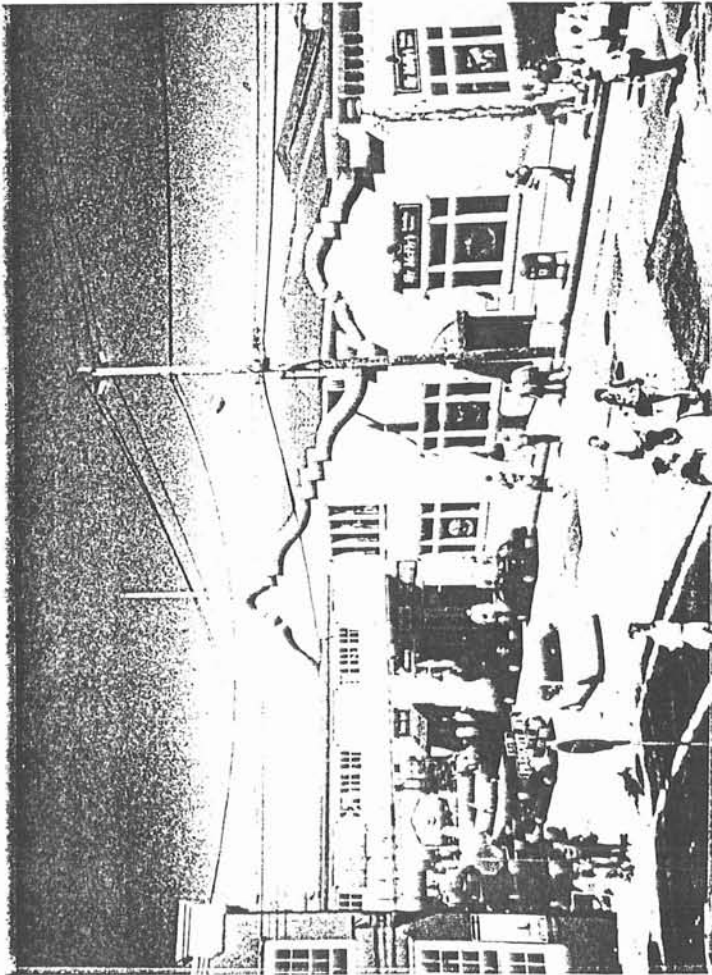
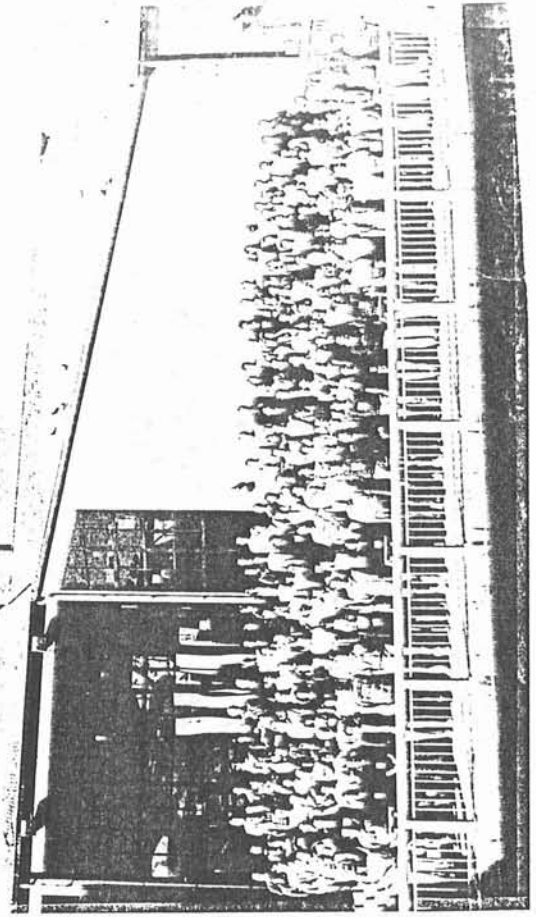


Ed Ricketts' statue is placed where he in 1948 was killed in his car at the (now closed) train crossing (the road in the foreground, left of middle in photo; statue is under crossing sign). T.W. phot.

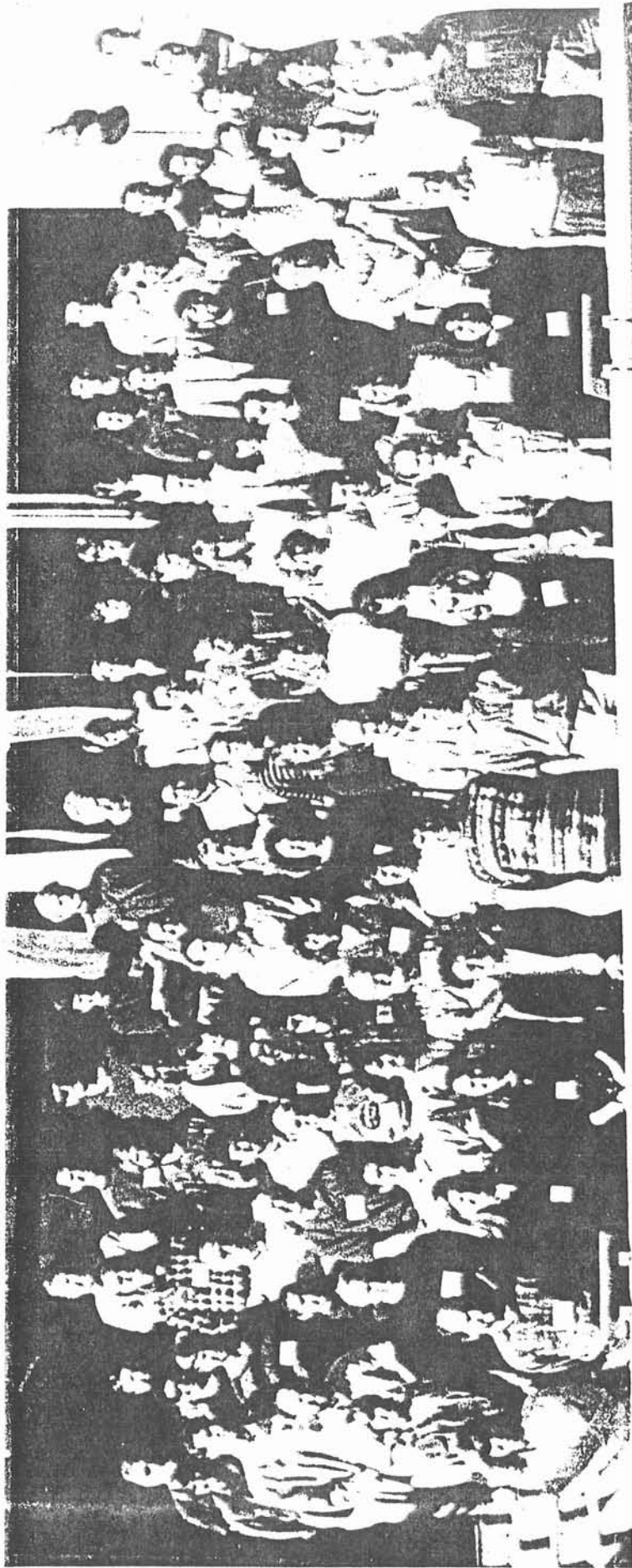


"Doc's" lab (right) in Cannery Row is exteriorly and interiorly almost as he left it (see also centre of lower left picture). In the background, part of the Outer Bay Aquarium. T.W. phot.

See photo next page.



STEINBECK'S
Cannery Row
CANTERLEY, CALIFORNIA



LIST OF ATTENDEES

AUSTRALIA

Koslow, Tony
Marshall, Justin
Wilson, George D. F. (Buz)

BELGIUM

Janssens, Bernadette
Rees, Jean-Francois

CANADA

Leys, Sally P.
Mackie, George

DENMARK

Wolff, Torben

FRANCE

Shillito, Bruce

GERMANY

Beck, Lothar A.
Boetius, Antje
Brandt, Angelika
Collin, Shaun P.
Frölich, Eleonore
Gomara, Robert Verne
Gross, Onno
Heinz, Peter,
Koppelman, Rolf
Kurbjewweit, Frank
Linke, Peter
Looser, Ralf
Pfannkuche, Olaf
Riess, Wolfgang
Sahling, Heiko
Scherzinger, Till
Schriever, Gerd
Sobjinski, Kathrin
Soltwedel, Thomas
Thomsen, Laurenz
Vopel, Kay
Wagner, Hans-Joachim
Witte, Ursula

GREECE

Eleftheriou, Anastasios
Tselepides, Anastasios

JAPAN

Fujikura, Katsunori
Fujiwara, Yoshihiro
Hashimoto, Jun
Hunt, James
Kikuchi, Tomohiko
Kojima, Shigeaki
Toda, Tatsuki

MEXICO

Escobar Briones, Elva G.

NETHERLANDS

Lavaleye, M. S. S.

NEW ZEALAND

Diebel, Carol
Montgomery, John C.

PORTUGAL

Martins, Helen R.

RUSSIA

Galkin, Sergey V.
Vereshchaka, Alexander L.

SCOTLAND

Jones, Emma G.
Priede, I. G. (Monty)

SWEDEN

Strömberg, Jarl O.

UNITED KINGDOM

Byatt, Andy
Copley, Jon
Creasey, Simon
Douglas, Ron
Gage, John D.
Herring, Peter J.
Jones, Roger
Lambhead, John D.
McAlece, Neil
Nicholson, Peter
Parks, Peter
Partridge, Julian C.
Roberts, David
Rogers, Alex
Sumida, Paulo Y. G.
Tyler, Paul

UNITED STATES OF AMERICA

Ahnert, Ahmed
Andrews, Allen
Amofsky, Pamela
Baco, Amy
Barr, Nancy
Barry, Jim
Beatty, Rosalind
Beaulieu, Stace
Benedict, Thom
Bergeron, Louis
Bernhard, Joan
Braby, Caren
Bradbury, Margaret G.
Brigham, Lawson
Brooke, Sandra
Buck, Kurt
Bull, Ed
Burton, Erica J.
Cailliet, Gregor M.
Carey, Jr., Andrew G.
Carney, Robert S.
Carr, Jr. MD, Walter E.
Cebula, Alison
Childress, Jim J.
Company, Joan B.
Conner, Judith
Cosby, Krystn
Cowles, David L.
Dawe, T. C.
Deaver, Allen Paul
Doan, Shawn
Donaldson, Leslie
Drazen, Jeff
Dybas, Cheryl
Eberl, Renate
Eckelbarger, Kevin J.
Eckman, James E.
Etter, Ron
Faulkner, Tamara
Fautin, Daphne G.
Ferguson, Ava
Fisher, Erin
Flores, Jason
Fowler, John
Fraley, Natasha
Frank, Tammy
George, Robert Y.
Girguis, Peter
Goffredi, Shana
Gowing, Marcia M.
Grantham, Greg
Haddock, Steven
Harrold, Chris
Herren, Christy
Heyer, Bruce W.
Hood, Sarah
Hopcroft, Russ
Jacobsen, Nancy
Jones, Amanda
Julian, David
Kaplan, Kristen Brynie
Knowlton, Ann L.
Kochevar, Randy
Lauerma, Lynn M. L.
Lauritzen, Dean Vincent
Layden, Noreen M.
Lesen, Amy E.
Levin, Lisa A.
Light, Karen
Lisin, Sue
Longozo, Vickie
Lorenson, Tom
MacDonald, Ian R.
Mah, Christopher
Martin, Christopher
Matsumoto, George
McGann, Mary
McHatton, Sarah
Meyer, Debbie
Miller, Robert J.
Moore, Jon A.
Morgan, Steve
Murray, Dawn
Narum, Shawn
Nelson, Douglas C.
Neumeister, Heike

Nybakken, James

Nyden, William
Orange, Dan
Paduan, Jenny
Parks, Noreen
Pennington, Tim
Pfingst, Tynan
Pile, Adele
Poland, John H.
Powell, Dave
Press, Thomas
Raskoff, Kevin A.
Rathburn, Anthony
Ream, Rachael
Reisenbichler, Kim
Rex, Michael A.
Rich, Virginia
Richardi, Danielle
Richardson, Carol
Robison, Bruce
Rodgers, Kristine
Roepke, Troy
Scheltema, Amelie H.
Schlining, Kyra
Schurmeier, Jennifer
Seibel, Brad A.
Sherlock, Rob
Smiley, Jeff
Smith, Craig R.
Smith, Kenneth L.
Somero, George
Stahle, Jennifer
Stevens, Bradley G.
Stuart, Carol T.
Sunstov, Andrew
Tamburri, Mario
Thistle, David
Thuesen, Erik V.
Tomulonis, Jaci
Torres, Marta E.
Trask, Jennifer
Van Dover, Cindy Lee
Van Dusen, Christina
Van Dykhuizen, Gil
Vanden Branden, Katherine A.
Voight, Janet R.
Weber, Robin
Whaling, Patrick
Widder, Edith
Wieting, Susan
Williams, Gary C.
Wishner, Karen
Woo, Michelle
Wood, Bradley
Young, Craig M.
Zal, Frank
Zirbel, Marnie J.

ORAL PRESENTATIONS

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

Studies of Specialized Habitats (Vents, Seeps, Whale-falls)

- | | |
|-------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MacDonald, I. R., R. Sassen
& A. Pichabchy | Large-area imaging of hydrocarbon seep habitats |
| Carney, R. S. | Explaining edge-to-center, bed-to-bed, and site-to-site monotony of non-chemosynthetic seep associates at five upper slope hydrocarbon seeps in the Gulf of Mexico |
| Linke, P., K. Wallmann,
E. Suess, G., Bohrmann,
H. Sahling & A. Dähmann | Manifestations of fluid flow and biogeochemical turnover at cold seeps of the Aleutian Subduction Zone |
| Barry, J. P. & R. E. Kochevar | Contrasting life styles of two closely-related vesicomyid clams from cold seeps in Monterey Bay |
| Torres, M. E. & J. P. Barry | Can clam shells reveal the nature and history of fluid discharge at a vent site? |
| Fujiwara, Y., J. Tsukahara,
J. Hashimoto & K. Fujikura | In situ spawning of a deep-sea vesicomyid clam by increasing the water temperature |
| Smith, C. R. & A. R. Baco | Whale-fall communities on the Northeast Pacific Slope: Succession and food-web structure |
| Baco, A. R., C. R. Smith,
A. S. Peek & R. C. Vrijenhoek | Phylogenetic relationships of whale-fall vesicomyid clams based on mitochondrial COI sequences |
| Fujikura, K., Y. Fujiwara,
J. Hashimoto & T. Okutani | Community ecological characteristics of the seep community at the Off Hatsushima Site, Sagami Bay, Japan |
| Galkin, S. V. & Q. P. Kuznetsov | Bottom fauna in the area of Paramushir gas-hydrate seepage (Sea of Okhotsk) |
| Hashimoto, J., Y. Fujiwara,
K. Fujikura & J. C. Hunt | Locomotor activity patterns in deep-sea crabs (Custacea, Decapod, Bythograeidae) collected from hydrothermal vent sites in the western Pacific |
| Beck, L. A. | Symbiosis with sulfur and methane-oxidizing bacteria in hot-vent molluscs – New findings |
| Copley, J. T. P., P. A. Tyler &
C. L. Van Dover | Gametogenic ecology of hydrothermal vent polychaetes from High Rise vent field, Juan de Fuca Ridge |
| Vereshchaka, A. L. | Life cycles and reproduction of the deep-sea shrimps inhabiting hot vents: Facts and hypotheses |
| Goffredi, S. K., J. J. Childress,
N. T. Desaulniers & F. H. Lallier | Sulfide acquisition by the vent worm <i>Riftia pachyptila</i> appears to be via uptake of HS ⁻ , rather than H ₂ S |
| Shillito, B., J. Ravaux,
F. Menard, G. Goffinet,
J. J. Childress, E. Thiebaut,
J. Delachambre & F. Gaill | Rate and process of deep-sea vestimentiferan tube growth |
| Trask, J. & C. L. Van Dover | Site-specific and ontogenetic variations in mussel carbon and nitrogen stable isotope compositions at Lucky Strike |
| Voight, J. R. | Assessing the endemism of vent predators and resultant implications for the evolution of hydrothermal vent fauna |

Pattern and Function of Deep-Sea Populations and Communities

- | | |
|--------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Young, C. M. & P. A. Tyler | Potential for deep-sea invasion through isothermal water columns I. The Mediterranean |
| Tyler, P. A. & C. M. Young | Potential for deep-sea invasion through isothermal water columns II. The North Atlantic |
| Gage, J. D. & P. A. Lamont | Ecology and demographic characteristics of a dense brittle star population on the Scottish continental slope |
| Escobar, E. G. & G. T. Rowe | Biomass patterns of deep-sea benthos in the Gulf of Mexico |
| Soltwedel, T. | Activity and biomass of the small benthic biota under permanent ice-coverage in the central Arctic Ocean |
| Nybakken, J., L. Smith-Beasley,
G. Moreno, A. Summers &
L. Weetman | Distribution density and relative abundance of benthic invertebrate megafauna from three sites at the base of the continental slope off central California as determined by camera sled and beam trawl |

- Stevens, B. G. Through a porthole darkly: Observations of behavior changes associated with aggregative mating of Tanner crab, *Chionoecetes bairdi*: A five-year retrospective
- Miller, R. J., C. R. Smith & D. J. Demaster Food selection by deep-sea megafaunal surface deposit feeders as indicated by ^{234}Th , chlorophyll, and amino acid measurements
- Sumida, P. Y. G., P. A. Tyler, R. S. Lampitt & J. D. Gage Seasonal dispersal and allopatric settlement and growth of the bathyal brittle star *Ophiocten gracilis*
- Andrews, A. H., G. M. Cailliet & K. H. Coale Radiometric age determination of the Pacific grenadier (*Coryphaenoides acrolepis*), a rapidly developing fishery in Monterey Bay
- Koslow, T. & K. Gowlett-Holmes The fauna of mid-slope seamounts off southern Tasmania: Impacts of deepwater trawling and its conservation
- Moore, J. A. The challenges of deep-sea fisheries

Sensory Systems of Deep-Sea Fauna

- Widder, E. A. & P. J. Herring Signal economics of coelenterate bioluminescence displays
- Herring, P. J., E. A. Widder & O. Munk Flashing anglerfish; an unexpected signalling system
- Douglas, R. H. & J. C. Partridge Long-wave sensitivity in stomiid fish with far red bioluminescence
- Partridge, J. C. The spectral sensitivities of deep-sea fish visual systems
- Wagner, H.-J. & E. Fröhlich Development of multibank rod retinæ in deep-sea fishes
- Fröhlich, E., W. de Grip & H.-J. Wagner Quantitative analysis of rhodopsin densities in rod outer segments of deep-sea fish retinæ: An electron microscopic immuno-gold study
- Collin, S. P. & R. V. Hoskins Topographic mismatching of the displaced amacrine and ganglion cell populations in the retinæ of deep-sea lanternfish
- Frank, T. M. & E. A. Widder Electrophysiologically determined spectral sensitivities of deep-sea crustaceans
- Tamburri, M. N. & J. P. Barry The chemical ecology of deep-sea scavengers
- Leys, S. P. & G. O. Mackie Excitability and electrical signalling in hexactinellid sponges
- Montgomery, J. C. & C. Diebel The mechanosensory lateral line in deep-sea fishes: Functional considerations
- Marshall, J. The lateral line and other sensory systems of deep-sea fish

Source and Utilization of Carbon Inputs in Deep-Sea Systems

- Lauerman, L. M. L. & R. S. Kaufmann Deep-sea epibenthic echinoderms and temporally varying food supply: a time series for the abyssal North-east Pacific
- Smith, Jr., K. L., R. J. Baldwin, R. C. Glatts & R. S. Kaufmann Detrital aggregates on the sea floor: Chemical composition and aerobic decomposition rates at a time-series station in the abyssal NE Pacific
- Levin, L., C. Martin, N. Blair, D. Demaster, G. Plaia & C. Thomas Macrofaunal processing and bioturbation of phytodetritus in the North Carolina Continental Slope: An in situ, time series approach
- Pfannkuche, O., A. Boetius, K. Lochte & U. Lundgreen Responses of deep-sea benthos to sedimentation patterns in the North-East Atlantic
- Lavaleye, M. S. S., G. C. A. Duineveld, E. M. Berghuis & P. A. W. J. de Wilde Relations between the distribution of benthic fauna and food input on the slope and in canyons of the Celtic margin
- Witte, U. & O. Pfannkuche Scavenging communities in the deep Arabian Sea: Observations by baited camera
- Tselepidis, A., S. Stavrakakis, R. Danovaro, P. Wassmann, S. Heussner, G. Duineveld & G. Chronis Seasonal variability in POM flux in the oligotrophic Cretan Sea (NE Mediterranean)

- Thomsen, L., E. Flach & T. V. Weering Spatial and temporal variability of particulate matter in the benthic boundary layer at the North East Atlantic continental margin
- Jones, E. G., M. A. Collins, S. Addison, P. M. Bagley & I. G. Priede Rapid dispersal of a dolphin carcass in the deep-sea

Deep-Sea Pelagic Community Studies

- Priede, I. G., S. Addison, P. M. Bagley, M. C. Collins, A. Smith & N. R. Merrett Studies on behaviour of the abyssal demersal Grenadier Fish, *Coryphaenoides (Nematonurus) armatus*, in North Atlantic and Pacific Oceans
- Toda, T., M. Terazaki, J. Hashimoto & T. Kikuchi Benthopelagic zooplankton biomass in the western North Pacific
- Hopcroft, R. Assessment of midwater mesozooplankton by an optical plankton counter mounted on an ROV
- Hunt, J. & D. Lindsay Submersible observations of the meso-pelagic and benthopelagic fauna in Japanese waters
- Kikuchi, T., M. Terazaki, J. Hashimoto & T. Toda Faunal characteristics of deep-sea benthopelagic zooplankton in Sagami Bay and Okinawa Trough, Japan
- Robison, B. Advances in midwater biology
- Riess, W. Real in situ measurements of respiration and metabolism of the deep-sea shrimp *Heterocarpus grimaldii*
- Janssens, B., J. J. Childress, F. Baguet & J.-F. Rees Living far from oxidative stress: Adaptation of meso- and bathypelagic fish to reduced oxygen toxicity
- Seibel, B. A., J. J. Childress & E. V. Thuesen Flight of the vampire squid: Scaling of metabolism and aquatic "flight" in *Vampyroteuthis infernalis* (Vampyromorpha: Cephalopoda)
- Herring, P., H. S. J. Roe, G. G. Griffiths, B. Boorman & A. T. Mustard The effects of the oxygen minimum on the distribution of the mesopelagic fauna in the Gulf of Oman
- Wishner, K. F., M. M. Gowing & C. Gelfman Mesozooplankton biomass in the upper 1000 m in the Arabian Sea: Overall seasonal and geographic patterns, and relationship to oxygen gradients
- Koppelman, R. Deep Arabian Sea mesozooplankton distribution and its respiratory potential
- Cowles, D. Laboratory measurements of metabolism and swimming speed during routine swimming and vertical migration in *Sergestes similis*

Evolution and Diversity of Deep-Sea Fauna

- Etter, R. J., M. R. Chase & M. A. J. Quattro Evolution in the deep sea: A molecular genetic approach
- George, R. Y. Origin and evolution of the asellote isopod Crustacea in the Atlantic deep-ocean environment with emphasis on the eurycopid genus *Storhyngura*
- Wilson, G. D. F. Historical Influences on deep-sea isopod diversity in the Atlantic Ocean
- Rees, J.-F., B. Janssens, M. Dubuisson, B. de Wergifosse, O. Noiset, A. Trouet & F. Baguet Shifting targets: Anti-oxidative mechanisms as an origin of bioluminescent anti-predation systems in the deep-sea
- Brandt, A. Biodiversity of Peracarida (Crustacea, Malacostraca) from the shelf to the deep Arctic Ocean : (New results from an expedition with RV *Polarstern* in autumn 1995)
- Williams, G. C. Diversity and evolution of deep-sea pennatulacean octocorals
- Creasey, S., A. Rogers, C. Young & J. Gage Population genetics and biology in a deep-sea spider crab
- Rogers, A., S. Creasey, P. Tyler & J. Gage Genetic and morphometric comparison of two continental slope populations of the squat lobster *Munidopsis scobina* (Decapoda: Anomura: Galatheididae) from the North West Arabian Sea, with notes on the phylogeny of the Galatheididae

- Beaulieu, S. Diversity of epizoids on glass sponge "stalks": A unique investigation of a deep-sea hard substrate community
- Scheltema, A. H. Aplacophoran molluscs of seamounts
- Arnofsky, P. L. A comparison of species in the new aplacophoran genus *Spiomenia* with a systematic overview of the deep-sea Family Simrothiellidae
- Zal, F., Y. Kawasaki, J. J. Childress, F. H. Lallier & A. Toulmond Phylogenetic relationship between Annelida, Vestimentifera and Pogonophora revealed by the amino acid sequence of globin chains
- Kojima, S., S. Ohta, Y. Fujiwara, K. Fujikura, J. Hashimoto & T. Okutani *Calptogena* (Bivalvia) around Japan: Taxonomy, distribution, and speciation process
- McAleece, N., J. D. Gage & T. Brey BioGrowth, a computer workbench for analysis of the demographic characteristics of deep-sea invertebrates from measurements of body size frequencies and growth markers
- Lambshead, J. D., N. McAleece, G. Paterson & J. Gage BioDiversity Professional ecological analysis package

Microbial and Meiofaunal Processes in Deep-Sea Habitats

- Bernhard, J. M. & S. S. Bowser Microaerophilic meiofauna of the Santa Barbara Basin: Novel symbioses
- Rathburn, A. E. & K. C. Lohmann The ecology and stable isotopic composition of living (stained) deep-sea benthic Foraminifera from the California current system
- Gross, O. Migration and bioturbation of benthic deep-sea Foraminifera
- Boetius, A., P. Schäfer, S. Grandel, K. Wallmann & K. Lochte Extremely high microbial biomass and degradative activity in deep-sea sediments of the Arabian Sea

Effects of Disturbance in Deep-Sea Habitats

- Thistle, D. Harpacticoid copepod diversity at two physically reworked sites in the deep-sea
- Schriever, G., A. Ahnert, B. Grupe, W. Langner & K. Vopel Does an anthropogenic alteration of sediment parameters induce a shift in the deep-sea meiofaunal community?
- Schriever, G., Thiel, H. Environmental risks of large-scale deep-sea impacts

POSTER SESSION

Source and Utilization of Carbon Inputs in Deep-Sea Systems

- Duineveld, G., A. Tselepidis, E. Berghuis, J. van der Weele, G. Nieuwland & R. Bak Benthic-pelagic coupling on the shelf and slope of the oligotrophic Cretan Sea (E-Mediterranean)
- Mitchell, L., K. D. Black, E. Bradbeer, R. Carrie, A. E. Fallick, J. D. Gage, S. M. Harvey & K. Jones Origin and fate of organic carbon at the Hebridean shelf edge, west of Scotland

Effects of Disturbance in Deep-Sea Habitats

- Bluhm, H., G. Schriever & H. Thiel Megabenthic recolonization in the DISCOL Area (Abyssal Peru Basin): Results from the environmental research programs DISCOL and ECOBENT
- Borowski, C. & H. Thiel Macrofauna recolonization after physical disturbance in the Peru Basin. Results from the environmental research programs DISCOL and ECOBENT
- Froese, O., R. Looser, K. Ballschmiter, W. Jarman & G. Cailliet Does the deep-sea function as the ultimate sink for semivolatile POPs?

Roberts, M.

The sensitivities of the cold water coral *Lophelia pertusa* to oil, gas and fishing activities

Evolution and Diversity of Deep-Sea Fauna

Creasey, S., A. Rogers,
P. Tyler & J. D. Gage

Details of the morphometric comparison of two continental slope populations of the squat lobster *Munidopsis scobina* (Decapoda: Anomura: Galatheididae) from the North West Arabian Sea

Fisher, E. C. &
L. M. L. Lauerma

Ophiura bathybia: An enigmatic ophiuroid from the abyssal NE Pacific

Fuiman, L. A., J. D. Gage
& P. A. Lamont

Shell morphology in the deep-sea protobranch bivalve *Ledella pustulosa* in the Rockall Trough, N.E. Atlantic

Hood, S. & R. Mooi

Phylogenetics and taxonomy of *Brisaster*, a genus of deep water schizasterid spatangoids

Levin, L. A. & J. D. Gage

Oxygen and organic matter controls on macrobenthic diversity in the bathyal Indian and Pacific Oceans

Mah, C.

Paedomorphosis, range extensions and an answer to the question: Can brisingidans swim?

Mah, C.

Phylogeny and taxonomic revision of the Brisingida

Schulze, A.

A morphological approach to the phylogeny of Vestimentifera

Trask, J., C. L. Van Dover,
D. Fornari & S. Humphris

Comparative biodiversity: Hydrothermal vent and intertidal mussel communities

Microbial and Meiofaunal Processes in Deep-Sea Habitats

Boetius, A. & K. Lochte

Relation between substrate supply and degradative capacities of microbial assemblages in deep-sea sediments

Buck, K., J. Ashen,
S. McHatton, D. Nelson
& J. Barry

Thiopla spp. from cold seep sites in Monterey Bay

Dawe, T. C., J. Erikson,
J. Hedrick, S. Etchemendy,
J. McFarlane, J. P. Barry
& K. Buck

Adaptation of the deep-sea multicorer for obtaining sediment samples with a ROV

Heinz, P. & C. Hemleben

Response of deep-sea benthic foraminifera from the Gulf of Tarrent (Mediterranean Sea) to phytoplankton

Kurbjewit, F., P. Heinz
& C. Hemleben

Population dynamics of deep-sea benthic foraminifera in the Arabian Sea (Indian Ocean)

McHatton, S. C., A. Ahmad,
J. P. Barry & D. C. Nelson

Nitrate respiration by seep populations of *Beggiatoa* from Monterey Canyon

Pattern and Function of Deep-Sea Populations and Communities

Company, J. B., E. V. Thuesen,
G. Rotllant & J. J. Childress

Effects of starvation on enzymatic activities of the deep-sea crab *Geryon longipes* (Decapoda, Geryonidae) from the western Mediterranean Sea

Drazen, J. C.

Seasonal variation in nutritional condition of *Coryphaenoides armatus* and *C. yaquinae* from the abyssal NE Pacific

Fautin, D. G.

Reproductive periodicity in an abyssal sea anemone

Gage, J. D., L. Mitchell &
J. D. Humphrey

Megafauna distributions on the Hebridean continental slope from sea-bed photographs provide an integrated expression of hydrodynamic forcing of sediment processes

Knowlton, A. L., J. Trask &
C. L. Van Dover

Reproductive biology and population structure of commensal and free-living polynoid polychaetes at the Lucky Strike hydrothermal vent field

Lamont, P. A., J. D. Gage &
L. A. Levin

Benthic size structure and the oxygen minimum zone (OMZ) in the Arabian Sea

Lamont, P. A. & J. D. Gage

Estimates of growth and production in a deep-sea lumbrinerid polychaete from jaw mandible growth banding

- Martin, C., L. A. Levin,
N. Blair, D. J. DeMaster,
G. Plaia & C. Thomas Changing patterns of macrobenthic community structure across the Arabian Sea oxygen minimum zone
- Pfannkuche, O. BIGSET: A new German deep-sea programme
- Roberts, D., H. M. Moore,
J. Patching & M. Carton Sediment distribution, enzyme profiles and bacterial activities in the guts of *Oneirophanta mutabilis*, *Psychropotes longicauda* and *Pseudostichopus* sp. - What do they tell us about digestive strategies of abyssal holothurians?
- Thistle, D., J. E. Eckman,
G. L. J. Paterson, P. J. D.
Lamshead & W. C. Burnett Evaluating impacts of predation by large motile epifauna on macrofauna and meiofauna in the deep sea: A test of cage performance
- Thomsen, L. & I. N. McCave Aggregation processes in the benthic boundary layer at the Celtic Sea continental margin
- Vopel, K., A. Ahnert,
G. Schriever & H. Thiel Does physical disturbance cause a persistent change in the structure of an abyssal meiobenthic community? Results from the environmental research programmes DISCOL and ECOBENT
- Young, C. M. & E. Vazquez Unexpected feeding strategies of ascidians from the deep Arabian Sea

Deep-Sea Pelagic Community Studies

- Braby, C. E., B. H. Robison &
J. C. Hunt Sensory adaptations of midwater squids
- Gowing, M. M. & K. F. Wishner Feeding ecology of the copepod *Lucicutia grandis* near the lower interface of the Arabian Sea oxygen minimum zone: Implications for carbon flux
- Parks, P. Oceanic and midwater plankton from Pacific and Atlantic waters (SLIDE SHOW at MBARI RECEPTION)
- Raskoff, K. A. Feeding behaviors and vertical distribution of the medusa, *Solmissus* (Narcomedusae): In situ studies with the MBARI ROV Ventana
- Richter, C. Invertebrate predator control of zooplankton seasonal vertical migration in the Greenland Basin
- Richter, C. Zooplankton community structure and seasonal dynamics in the Greenland deep-sea
- Scherzinger, T. Nutritional patterns of mesopelagic copepod species in the Arctic Ocean - Indications for selective feeding
- Schlining, B. M., B. H. Robison
& K. R. Reisenbichler Observations and analysis of midwater animal distributions using the ROV Ventana
- Seibel, B. A., F. G. Hochberg,
D. Carlini & J. J. Childress Post-spawning egg care in the mesopelagic squid, *Gonatus* (Teuthoidea: Cephalopoda)
- Sherlock, R. E., B. H. Robison
& K. R. Reisenbichler Effects of temperature on development of the siphonophore, *Nanomia bijuga*
- Suntsov, A. Distribution of larvae of mesopelagic fishes in the western South Pacific
- Sutton, T. T. & T. L. Hopkins Trophic ecology of the deep-sea fish *Malacosteus niger* Ayres: Planktivory by a top mesopelagic predator?

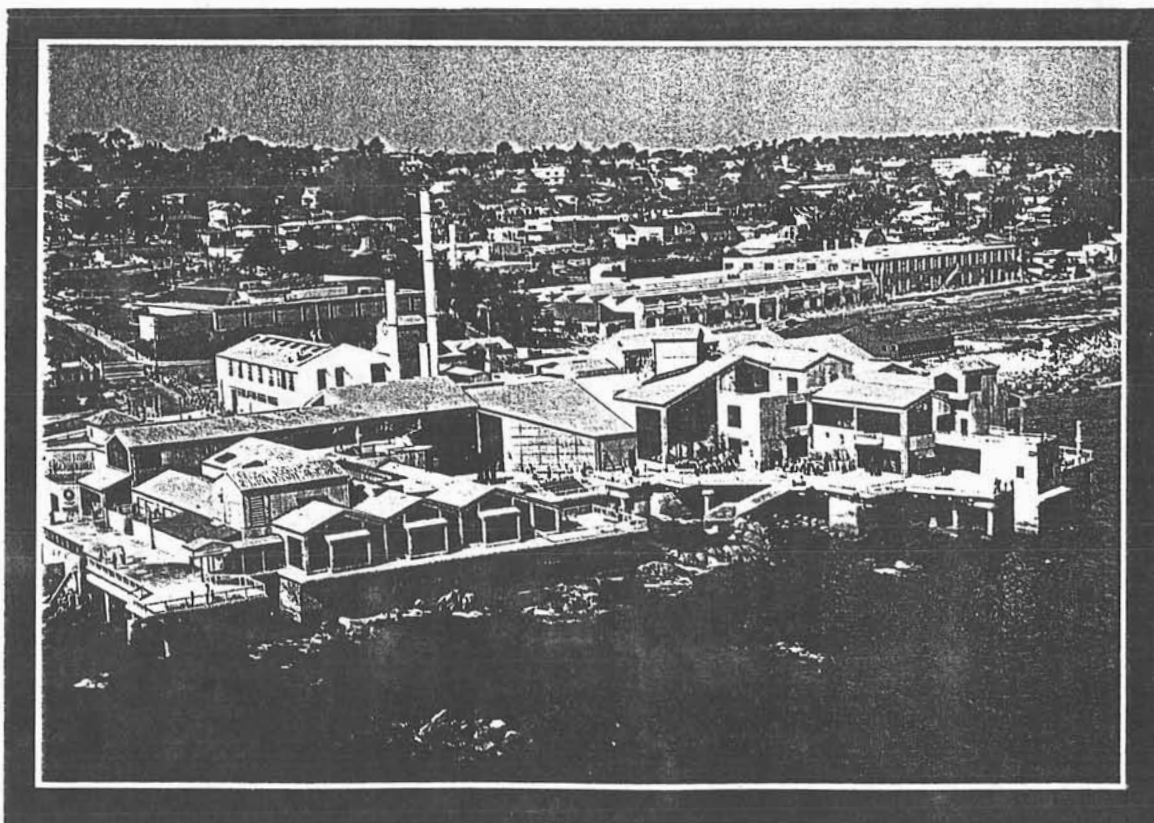
Sensory Systems of Deep-Sea Fauna

- Diebel, C., J. Montgomery,
M. Halstead & J. Downer Olfactory search tracks in an Antarctic fish
- Kent, J., J. Partridge, P. Herring
& T. Cronin Visual pigments in deep-sea crustaceans
- Witte, U. & O. Pfannkuche Patterns of benthic activity and standing stock in the deep Arabian Sea: Do bulk parameters tell the whole story?

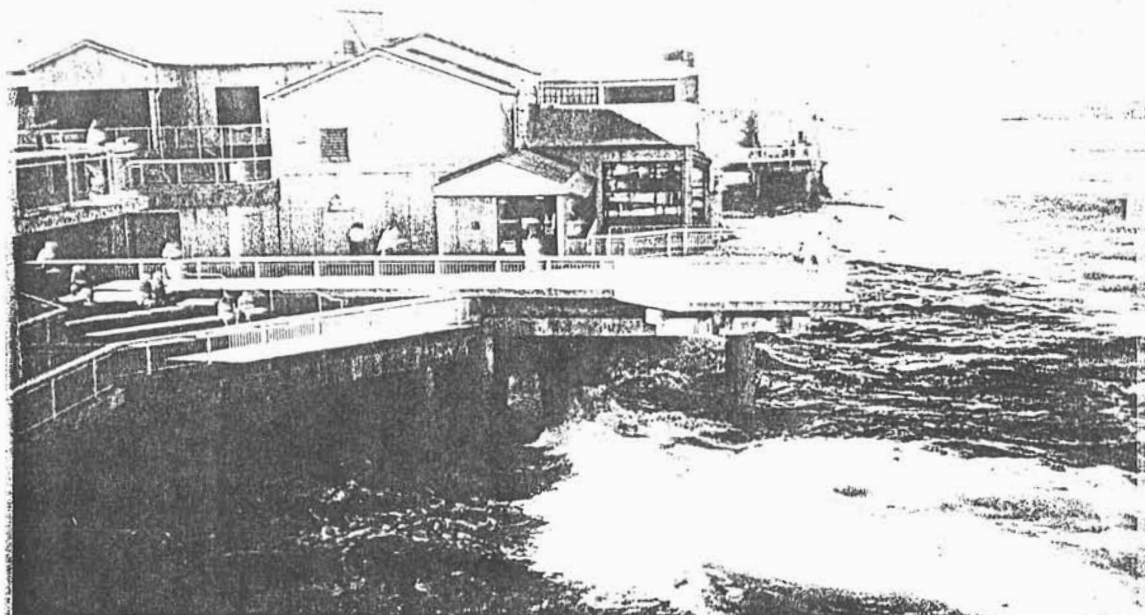
Studies of Specialized Habitats (Vents, Seeps, Whale-falls)

- Chevaldonné, P., D. Desbruyères, T. M. Shank, G. Lévai & R. A. Lutz Temperature temporal variability within deep-sea hydrothermal-vent animal communities: a global overview
- Eckelbarger, K. J. & C. M. Young Ultrastructure of the ovary and oogenesis in the methane-seep mollusc *Bathynnerita naticoidea* (Gastropoda: Neritidae) from the Louisiana slope

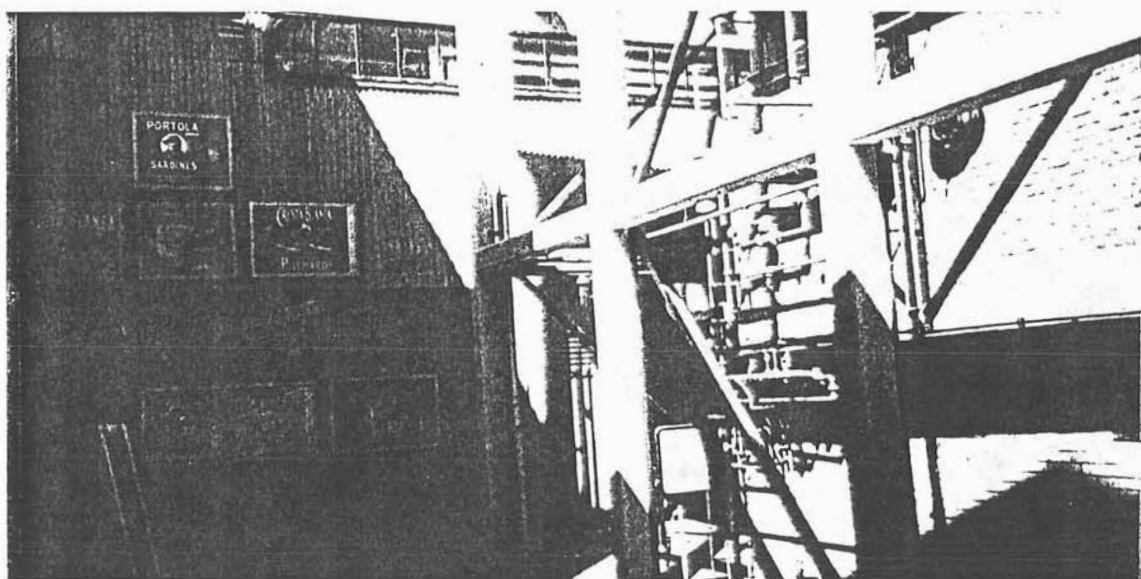
- Escobar, E., L. A. Soto & L. A. Fuentes
Pelagic vs. vent carbon input in megafauna of the Guaymas Basin hydrothermal vents
- Girguis, P.
Inorganic nitrogen assimilation and utilization by the tubeworm *Riftia pachyptila*
- Lévai, G., W. Wakefield, T. M. Shank, P. Chevaldonné & R. A. Lutz
Preliminary trophic studies of the hydrothermal vent-endemic fish *Thermarces cerberus* (Zoarcidae)
- Pfingst, T., C. L. Van Dover, R. Haymon, K. MacDonald & D. Wright
Characteristics of hydrothermal vent communities along the southern East Pacific Rise, 17°15' to 17°40'S
- Sahling, H., P. Linke, N. von Mirbach, E. Suess, G. Levai & R. Lutz
Faunal community structure at cold seeps of the Aleutian subduction zone
- Schurmeier, J., J. Trask & C. L. Van Dover
An illustrated guide to Lucky Strike hydrothermal vent fauna
- Shank, T., D. J. Fornari, G. Levai & R. A. Lutz
Environmental periodicities and faunal colonization associated with nascent low-temperature hydrothermal venting; results of time-lapse videography and multi-probe temperature measurements at 9°49.8'N on the East Pacific Rise
- Sobjinski, K.
Systematics and phylogeny of the hot vent family Lepetodrilidae McLean, 1988 (Gastropoda: Lepetodrilioidea) – a cladistic analysis
- Zal, F., E. Leize, A. Van Dorsselaer & J. J. Childress
Identification of the sulfide-binding sites on the hemoglobin from the hydrothermal vent tube worm *Riftia pachyptila*



Monterey Bay Aquarium is generally regarded as the best in the world. Shown here is the first part covering the inner Monterey Bay, before inclusion of the oceanic Outer Bay section, also mainly in former cannery buildings.



Platforms in the middle are outside aquarium premises. Left Outer Bay Aquarium balconies. T.W. phot.

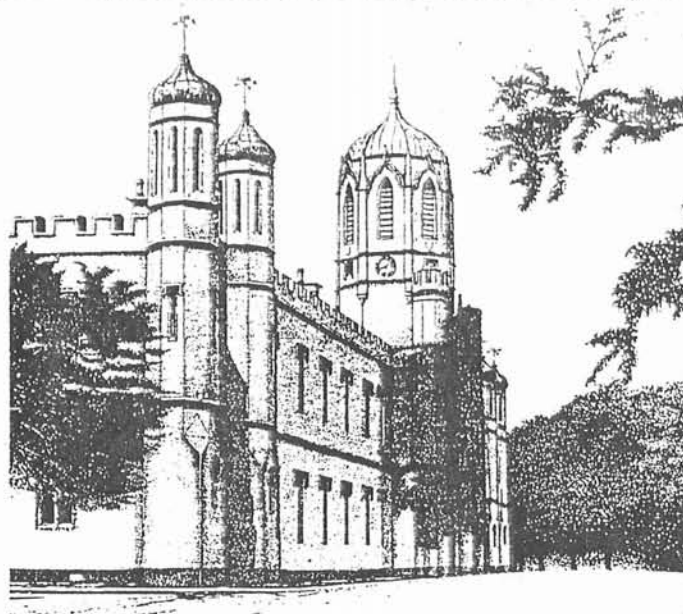


One of the old cannery boilers at the entrance to MBA. T.W. phot.



Only Angelika Brandt followed the Editor's request for symposium photos with this exquisite picture showing Jalle Strömberg, your Editor, Angelika and Bob George.

THE 9TH DEEP-SEA BIOLOGY SYMPOSIUM – GALWAY 2000



A date for your diaries and a plea for comments and suggestions.

After last year's hiccup, the Deep-Sea Biology Symposium will at last be held in Galway, Ireland in 2000. The final date has yet to be decided, but you may like to make a note of the meeting now.

Galway is one of the fastest growing cities in Europe, with a lively population, partly due to the presence of the University of Galway and the regional technical college. This, coupled with the traditional Irish welcome, makes it a pleasant base for the tourist and those who plan to stay longer. The city boasts a full range of cultural, sporting and entertainment facilities including a grand selection of pubs, restaurants, etc. The city is still small enough to avoid the disadvantages of city living. It has its own personality and a centre which has strong echoes of its history. Walking is still a feasible method of getting around. It is possible to walk to the edges of the city and into the country from any point in town. The unspoilt countryside, mountains and seashores of the Burren and Connemara are less than an hour's drive away. The University of Galway is located on the banks of the River Corrib in the centre of Galway city. Opened to students in 1845, the student population now exceeds 9,000 and there are some 1000 staff. Thanks to its location on the West coast of Ireland, with direct access to varied, pristine inshore environments and the Atlantic itself, the college has a long tradition of involvement with marine sciences. This commitment to marine science was given particular recognition in 1992 with the establishment of the Martin Ryan Marine Science Institute. Housed in purpose-built accommodation paid for by a private donation and fully equipped, thanks to funding under the EC STRIDE programme, the institute consists of sections specialising in marine botany, marine microbiology, physical and chemical oceanography, meteorology and marine zoology.

Though 2000 seems a long way away, now is the time to pass on your suggestions, whilst the 1997 meeting is fresh in your minds. Here are a few ideas that I have already received:

- The cost of accommodation etc. should make it possible for students to attend.
- We should not introduce parallel sessions.
- More time is needed for discussion, formal and informal.
- The best time for the meeting would be around June/July.

With respect to the timing of the meeting, I must avoid the end of July/beginning August (Galway races and arts week!), but otherwise plan for a period during the University summer recess (June to mid-September). If you have other views, please pass them on. Email or write to me if you wish to be placed on a mailing/Email list for further announcements. A conference web page will be set up. Its address will be available through the MRI Marine Microbiology home page: <http://mri.ucg.ie/marinemicro/home.html>

Here are some further web pages to whet your appetite!

An Interactive Travel Guide to the Best of Ireland: <http://www.iol.ie/~discover/welcome3.htm>

The Complete Guide to Galway: <http://wombatix.iol.ie/galwayguide/>

University of Galway Home Page: <http://www.ucg.ie/>

The Martin Ryan Marine Science Institute: <http://seaweed.ucg.ie/mri/mri.html>

The Marine Institute (Ireland's national agency for the promotion of marine R&D): <http://www.marine.ie/>

John Patching, Marine Microbiology, The Ryan Institute, University of Galway, Ireland

Tel: +353-91-750456 – Fax: +353-91-525005

Email: John.Patching@UCG.IE

<http://mri.ucg.ie/marinemicro/home.html>

ARABIAN SEA CONFERENCE IN EDINBURGH 1-3 JULY 1998 CANCELLED

Special Volume on **Benthic Processes in the Deep Arabian Sea** to be published

Owing to the small number of registrations made after the first deadline the Scottish Association for Marine Science (SAMS) has been forced to cancel the conference at Edinburgh. Budgetary constraints based on such small number would have led to a very large deficit that SAMS would have not been able to absorb.

Despite this disappointing news the Scientific Committee remains highly committed to the Special Volume of Deep-Sea Research Series II on this topic as arranged with the editor Prof. John Milliman. We have heard from many intending participants who have already submitted Abstracts that they intend providing a manuscript for consideration for this volume, and we look forward to receiving more (please adhere to the same deadline of mid August), but send the MS to Prof. John Gage at Dunstaffnage Marine Laboratory, P.O. Box 3, Oban, Scotland PA34 4AD; e-mail jdg@dml.ac.uk) so that it can be considered in the same way as advertised previously for inclusion in this lasting contribution to Benthic Processes in the Arabian Sea. Alternatively, the manuscript can be brought to the workshop (see below) and passed to John Gage there.

Impromptu Workshop

The Natural History Museum in London has kindly offered facilities for an **Impromptu Workshop on Benthic Processes in the Deep Arabian Sea** in the Museum over the 1st to the 3rd of July to take the place of the cancelled conference. One purpose of the workshop will be on exchange of information necessary for the collation and cross-referencing of data for contributions to the Special Volume of Deep-Sea Research II. Note the Museum has an arrangement for substantial discounts at a local hotel and the Linnean Society have kindly agreed to assist if we run out of beds. London is in the middle of the tourist season and time is short. If you wish us to help you find a room contact Nicola Debenham (see contact details below) immediately.

Please contact the address below urgently if you would like to take part. We anticipate a smaller and more informal gathering than that planned for the Edinburgh meeting, which, in its way, could be very productive.

Contact:

Nicola Debenham

Nematode Research Group, Department of Zoology, The Natural History Museum
Cromwell Road, LONDON, SW7 5BD, U.K.

Tel: +44 (0)171 938 8721 * Fax: +44 (0)171 938 9158 * E-Mail: njd@nhm.ac.uk

REPORT ON THE FIRST INTERNATIONAL SYMPOSIUM ON DEEP-SEA HYDROTHERMAL VENT BIOLOGY – 20-24 October 1997, Funchal, Madeira (Portugal)

Since the discovery in the deep sea of hydrothermal vent communities in 1977, there has been explosive growth in hydrothermal vent research. This has been enhanced by the discovery of seeps and dead whales, because all three systems are based on same fundamental process – a food web grounded in the oxidation of reduced compounds as an energy source.

Initially, research was largely conducted by American and French scientists. But as the number of people investigating these communities has grown, so too has the number of countries that are involved. The organization INTERRIDGE was formed to encourage international cooperative research and intellectual interaction. Its membership now includes 20 countries.

During 20-24 October 1997, INTERRIDGE held the First International Symposium on Deep-Sea Hydrothermal Vent Biology, in Funchal, Madeira (Portugal). The Organizational Committee consisted of Manuel Biscoito (Portugal), Craig Cary (USA), David Dixon (UK) and Heather Sloan (USA). The Scientific Committee included Robert Hessler (USA), Daniel Desbruyères (France), Charles Fisher (USA), Daniel Prieur (France), Verena Tunnicliffe (Canada) and Paul Tyler (UK).

There were four days of oral presentations and posters, broken down into six general topics: 1.- Ecology, micro-distribution, and temporal change (one day); 2.- Physiology and adaptation (one day); 3.- Biological cycles, larval dispersal and plankton (half day); 4.- Microbiology, ultra-thermophiles and bacterial symbiosis (half day); 5.- Seeps and other reducing environments (half day); 6.- Biogeography, evolution, genetics and taxonomy (half day).

In addition to contributed talks, the Scientific Committee solicited a plenary speech and overview talks for each of the general topics. Our plenary speaker, John Delaney (Univ. Washington, USA), explored the possibility of hydrothermal environments on Jupiter's moon, Europa, and showed how work on our hydrothermal systems could make a meaningful contribution to understanding the possibility of extraterrestrial life. Daniel Desbruyères (IFREMER, France) summarized what is known about the temporal cycle of communities at vents. Chuck Fisher (Pennsylvania State Univ., USA) reviewed physiological adaptation in the context of environmental constraints. Paul Tyler (Univ. Southampton, UK) assembled the varied information on reproduction and larval development to develop a coherent picture of life cycles of vent and seep organisms. Douglas Nelson (Univ. California, Davis, USA) presented an overview of the molecular phylogenetics of symbiotic and free-living hydrothermal vent microbes as well as an update on physiological investigations of mat-forming and subsurface microbes. Joergg Ott (Univ. Vienna, Austria) told us about some comparable animal-bacterial symbioses from shallow water, soft-bottom reducing environments. Finally, Verena Tunnicliffe (Univ. Victoria, Canada) reviewed global biogeographic patterns, including other deep-sea reduced environments as well as vents, in the context of biogeographic mechanisms.

The quality of the talks, both invited and contributed, was wonderfully high. The many talks that were given by students matched the level of those by established investigators; the coming generation is impressive. I sat through all four days of presentations (we were able to avoid concurrent sessions) and felt continually rewarded. The diversity of topics was incredible, yet they were all clearly pieces of the same puzzle. It was four days of stimulating education.

Madeira was an excellent place to have this meeting, even if it did rain most of that week. Of course it is beautiful. Even better are the people, who are a delight to interact with. Finally, I must praise our hosts, particularly Manuel Biscoito. Every aspect of the meeting was well worked out. There was someone ready to solve each new problem. It was a pleasure to be here.

Robert R. Hessler
Scripps Institute of Oceanography
La Jolla, California, U.S.A.

SESSION SCHEDULE

Presentations will be given by the first author or by the underlined author

Monday, 20 October - Conference Opening & Ecology Talks

PLENARY TALK: Temporal/Spatial Exploration of Physical, Chemical, and Biological Linkages in a Submarine Hydrothermal Laboratory: The Endeavour Ridge

John R. Delaney, D. S. Kelley, D. A. Butterfield, M. D. Lilley, J. Baross, and R. E. McDuff

ECOLOGY INVITED TALK: Temporal successions within the vent ecosystem on the EPR
Daniel Desbruyères

Ecology of the Menez Gwen hydrothermal vent field (Mid-Atlantic Ridge/Azores Triple Junction)
A. Colaço, D. Desbruyères, T. Comtet, F. Dehairs, and A.-M. Allayse

Description of the environment of hydrothermal mussel beds at Lucky Strike and Menez Gwen vent fields, MAR

Pierre-Marie Sarradin, Jean-Claude Caprais, Thierry Comtet, and Alain Aminot

Spatial and interannual variation in the faunal distribution at Broken Spur vent field, 29°N Mid-Atlantic Ridge

J. T. P. Copley, P. A. Tyler, B. J. Murton, and C. L. Van Dover

Life history strategy and nutritional ecology of the hydrothermal vent shrimp *Chorocaris fortunata*
David Pond, Michel Segonzac, Michael Bell, David R. Dixon, Anthony Fallick, and John Sargeant

Lipid profiles of hydrothermal vent organisms
Catherine E. Allen Copley, Paul A. Tyler, and Mark S. Varney

In situ growth of the vestimentifera *Ridgeia piscesae* living in highly diffuse flow environments in the main Endeavour Segment of the Juan de Fuca Ridge
I. A. Urcuyo, C. R. Fisher, G. Massoth, V. Tunnicliffe, and I. R. MacDonald

Biological and geological dynamics over four years on a high temperature sulfide structure at the Juan de Fuca Ridge hydrothermal observatory
Jozée Sarrazin, Véronique Robigou, S. Kim Juniper, and John R. Delaney

Remote Sensing of faunal community dynamics on hydrothermal chimneys
S. Kim Juniper and Jozée Sarrazin

Isolation and characterization of heterotrophic aerobic thermophilic bacteria from three geographically separated deep-sea hydrothermal vents
Jean-Louis Birrien, Viggó Thór Marteinsson, Christian Jeanthon, and Daniel Prieur

Molecular Phylogenetic Analysis of the Microbial Diversity of a Vent Cap sample
Erwan Corre, Anna Louise Reysenbach, and Daniel Prieur

Characterization of a Novel Group of Chemolithoautotrophic Bacteria Isolated from Hydrothermal-Vent Environments
Jonathan Z. Kaye and John Baross

The Enzymes of Synthesis and Utilization of Carbamylphosphate in the Deep-Sea Tube Worm *Riftia pachyptila* and its Bacterial Symbiont
V. Simon, C. Purcarea, K. Sun, J. Joseph, F. Gaill and G. Hervé

Tuesday, 21 October - Physiology/Adaptation Talks

PHYSIOLOGY/ADAPTATION INVITED TALK:

Physiological ecology of hydrothermal vent and cold seep fauna
Charles Fisher

Hemoglobins, key molecules for deep sea hydrothermal vent life
André Toulmond, François H. Lallier, Franck Zal, and Stéphane Hourdez

Respiratory adaptations in the scaleworm *Branchipolynoe* spp., a Polychaete commensal with deep-sea mussels
S. Hourdez, F. H. Lallier, C. Jouin-Toulmond, B. N. Green, R. E. Weber, and A. Toulmond

Structure and function of hydrothermal vent crustacean hemocyanin: an update
F. H. Lallier, L. Camus, F. Chausson, and J. P. Truchot

Identification of one sulfide-binding site of the hemoglobin of the hydrothermal vent tube worm *Riftia pachyptila*
Franck Zal, Emmanuelle Leize, François H. Lallier, André Toulmond, and Jim J. Childress

Sensory Adaptations in Hydrothermal Vent Shrimp from the Mid-Atlantic Ridge
Robert N. Jinks, Barbara-Anne Battelle, Erik D. Herzog, Leonard Kass, George H. Renninger, and Steven C. Chamberlain

Eye morphology in juvenile vent shrimps
E. Gaten, P. J. Herring and P. M. J. Shelton

Acid-base regulation in the hydrothermal vent tubeworm *Riftia pachyptila*
S. K. Goffredi and J. J. Childress

**Proton-equivalent ion elimination by the tubeworm *Riftia pachyptila*:
Ramifications for inorganic metabolite transport**
Peter Girguis

Rate and process of tube production by the deep-sea hydrothermal vent tubeworm *Riftia pachyptila*
Juliette Ravaux, Bruce Shillito, and Françoise Gaill

Carbon transfer from the bacterial symbionts of the hydrothermal vent tubeworm *Riftia pachyptila*
H. Felbeck and J. Jarchow

30 minute Break

Anaerobic metabolism in the hydrothermal vent tubeworm *Riftia pachyptila*
Cordelia Arndt, Doris Schiedek, and Horst Felbeck

Nitrate respiration in the hydrothermal vent tube worm *Riftia pachyptila*
U. Hentschel, M. Pospesel, and H. Felbeck

Spanning the thermal limits: an extreme eurythermal symbiosis
Craig Cary and Jeffrey L. Stein

Sulfur-amino acids in symbiotic species from hydrothermal vents and cold seeps
Audrey Pruski, Aline Fiala-Medioni, Jacques Boulegue, and Jean-Charles Colomines

Wednesday, 22 October - Biological Cycles Talks

BIOLOGICAL CYCLES INVITED TALK: Reproduction at vents and cold seeps: a tractable jigsaw?

Paul Tyler

Reproductive biology of mytilid bivalves from the Lucky Strike and Menez Gwen vent fields (37°17'N and 37°50'N on the Mid-Atlantic Ridge)

Thierry Comtet, Marcel Le Pennec, and Daniel Desbruyères

Larval biology and dispersal potential of cold-seep vestimentiferans from the Gulf of Mexico

Craig M. Young, Paul A. Tyler, Elsa Vazquez and Anna Metaxas

Larval coverage above vent fields: are Mid-Atlantic hydrothermal communities 2- or 3-dimensional?

A. L. Vereshchaka

Biological Facilitation and Inhibition of Species Colonizing Hydrothermal Vents

L. S. Mullineaux, C. H. Peterson, and C. R. Fisher

Molecular identification of early life-history stages hydrothermal vent shrimp (bresiliidae) from the Broken Spur segment of the Mid-Atlantic Ridge

D. R. Dixon, L. R. J. Dixon, P. J. Herring, and S. B. Piertney

The distribution of the pelagic early stages of bresiliid shrimp in relation to the bathypelagic biomass at MAR vent

Peter J. Herring

Microbiology Talks

MICROBIOLOGY INVITED TALK: Recent Findings in the Microbiology of Hydrothermal Vents and Seeps

Douglas Nelson

Signal Transduction Pathways in the Endosymbiont of the Hydrothermal Vent Tubeworm

Riftia pachyptila

Deborah S. Hughes, Horst Felbeck, and Jeffrey L. Stein

The burden of independence: Inorganic carbon utilization strategies of the hydrothermal vent isolate

Thiomicrospira crunogena, and the symbionts of hydrothermal vent and cold seep vestimentiferans

Kathleen M. Scott, Monika Bauer-Nebelsick, and Charles R. Fisher

Polymetal Sulfide Oxidation by Hydrothermal Vent Chemoautotrophs at Near Neutral pH

Carl O. Wirsen

Microbiology of shallow hydrothermal vents off Milos (Hellenic Volcanic Arc)

P. R. Dando, M. Thomm, H. Arab, M. Brehmer, L. Hooper, B. Jochimsen, H. Schlesner, and R. Stöhr

In situ growth chambers deployed at deep-sea vents: Providing clues to novel archaeal and bacterial diversity

A.-L. Reysenbach, J. Kirshtein, E. Corre, and D. Prieur

Detection by whole-cell hybridization and isolation of new thermophilic microorganisms from deep-sea hydrothermal vents

Christian Jeanthon, Hermie J. M. Harmsen, Stéphane L'Haridon, Valérie Cilia, A. Gambacorta, and D. Prieur

Thermococcus fumicolans and *Thermococcus hydrothermalis*, two new hyperthermophilic Archaea isolated from deep-sea hydrothermal vents

A. Godfroy, G. Raguene, F. Lesongeur, J.-R. Meunier, J. Guezennec, E. Antoine, J. Quérellou, and G. Barbier

Pressure-induced proteins in a new barophilic and hyperthermophilic Archaeon isolated under high hydrostatic pressure from a deep-sea hydrothermal vent

Viggó Thór Marteinsson, Jean-Louis Birrien, Anna-Louise Reysenbach, Marc Vernet, and Daniel Prieur

Thursday, 23 October - Biogeography Talks

INVITED BIOGEOGRAPHY TALK: Biogeographic Relations Among the World's Vent Faunas

Verena Tunnicliffe, Andrew G. McArthur, and Damhnait McHugh

Global biogeographical patterns of the hydrothermal vent fauna: a comparison with "non-vent biogeography"

A. N. Mironov, A. V. Gebruk, and L. I. Moskalev

Molecular phylogeny of deep-sea hydrothermal-vent and cold-seep polychaetes of the genus

Branchipolynoe (Polychaeta: Polynoidae): results from mitochondrial genes (16S rRNA and COI)

P. Chevaldonné, D. Jollivet, R. A. Feldman, D. Desbruyères, R. A. Lutz, and R. C. Vrijenhoek

Molecular Phylogenetics and Evolution of Vestimentiferans

Kenneth M. Halanych, Richard A. Lutz, and Robert C. Vrijenhoek

20 minute Break

Antiquity at vents? Investigation of the neomphalid gastropods using ribosomal RNA sequences

Andrew G. McArthur, Ben F. Koop, and Verena Tunnicliffe

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COLD SEEPS INVITED TALK: Chemoautotrophic symbioses in shallow marine ecosystems

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Nano-, micro- and meiofauna of deep-sea cold seeps in Monterey Bay, California
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A. C. Andersen, L. Hamraoui, and F. H. Lallier

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Biogeography Posters

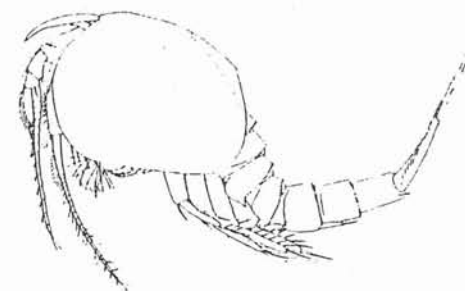
Cytochrome *c* oxidases from *Thermus thermophilus* HB8
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Cirripeds (Crustacea) from the Mid-Atlantic Ridge collected by the submersible Nautilus
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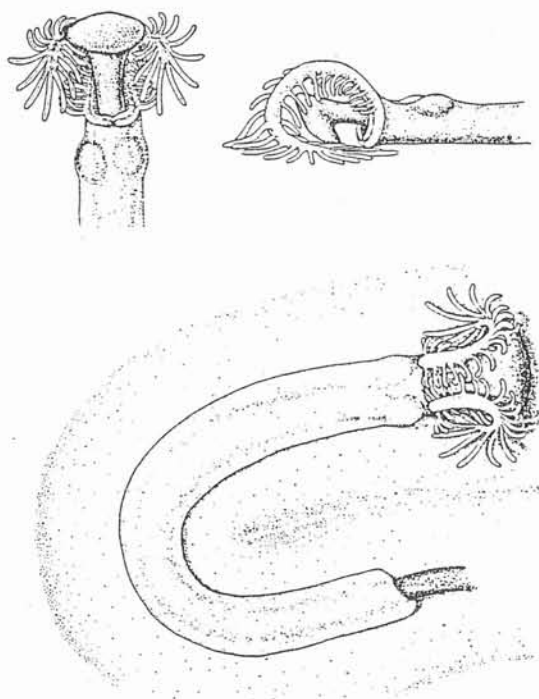
WHAT BECAME OF LEMCHE'S LOPHENTEROPNEUST?

In 1976, Henning Lemche of the Zoological Museum of Copenhagen introduced the name *Lophenteropneust* in the scientific literature (Lemche et al., 1976). His intention was to cover a suprafamily taxon of supposed hemichordates, which were often seen in deep-sea photographs, but apparently never had been identified in samples. In the intervening years, these animals have been recognized in many larger series of abyssal photographs, but they still, after 20 years, represent an enigma and seem not to have been collected.

Lemche's description and ideas were based on 7 borrowed series of bottom photographs provided in 1962 during a Scripps Institution of Oceanography expedition to 5 trenches in the SW Pacific. At the time they represented the deepest taken photographs analysed for fauna (6758-8930 m).

Among the close to 100 different kinds of organisms distinguished there are some peculiar-looking worms, interpreted as hemichordates. They have a somewhat transparent bodywall, are cylindrical, 0.5-1 cm in diameter, and 5-10 cm long. The anterior end is almost flat frontally, about twice as wide as the body, and carries some kind of extensions, interpreted as a tentacle arrangement. Lemche concluded that the animals have an anterior end much like a pterobranch and a body like an enteropneust.

A uniform string of faecal material emerges from the rear end of the animal, and is deposited on the sediment surface in a meander or spiral pattern. Such strings are common in the photographs, but often neither animal nor holes in the bottom are to be seen, and Lemche suggested that the animal is an intermittent swimmer.



After Lemche et al. 1976

The organisms have since been photographed on the deep-sea bottom in many parts of the world (Table 1), and the concept of *lophenteropneust* has won some acceptance, both in connection with the peculiarly looking animals and with the specific kinds of traces. The term is now in use both in textbooks and among authorities on photographic analysis (for example, Ohta 1984, Foell & Pawson 1986, Belyaev 1989, and Gage & Tyler 1991). Described as "... a bilaterally symmetrical worm-like animal ... anterior end characterized by a pair of lateral projections ... resembles an acorn-worm (class Enteropneusta) in morphology.", the *lophenteropneust* has even entered the fossil record (Twitchett 1996).

Two observations should be emphasized. One concerns Lemche's interpretation of the anterior end carrying a kind of lophophore. In most photographs the magnification is not large enough for anything else to be seen than a kind of extensions from the sides of the anterior end, but there are a few where the structure seems fringed, as if it was divided into smaller entities (Heezen & Hollister 1971, fig. 5-1 - same as Bourne & Heezen 1965,

fig. 2, but better reproduced); Segonzac 1987, photo 5). The other observation is on the size of the animal, which Lemche estimated to be about 10 cm body length. Other photographs show gigantic animals, sizes like 54 cm and 1 m in length being reported (Bourne & Heezen 1965; Paul et al. 1978).

Table 1. Photographic records of possible lophenteropneusts.

Author, year	Figure	Area	Depth (m)	Designation
Bourne & Heezen 1965	*2	SW Pacific	4872-5068	acorn worm
	3	SE Pacific	3480	echiurid?
Ewing & Davis 1967	24,5	NW Atlantic	3821-3751	enteropneust ?
	24,4	E Pacific	3678-3684	enteropneust ?
	*24,3	SW Pacific	4872-5068	enteropneust
Thorndike et al. 1982	13-16	C Pacific	4906	enteropneust
Foell & Pawson 1986	3f	C Pacific	5099	acorn worm
Heezen & Holl. 1971	*5,1	SW Pacific	4872-5068	acorn worm
	5,5	SW Pacific	2018	
	5,6	SW Pacific	6725	
Gaillard 1991	6	W Pacific	2030-2050	enteropneust
Paul et al. 1978	p.812	C Pacific	4873	lophenteropn.
Lemche et al. 1976	pl. 24-25	SW Pacific	7847-8662	lophenteropn.
Menzies et al. 1973	5-21	SE Pacific	2916	enteropneust
		SE Pacific	6260	enteropneust
Segonzac 1987	5	E Pacific	> 2000	enteropneust
Thiel 1979	4	C Pacific	5089	lophenteropn.

* same photograph

Much more commonly seen than the animals themselves, are their meandering or spirally coiled faecal strings. Early in the history of deep-sea photography they were mapped from practically all parts of the World Ocean (Bourne & Heezen 1965, p. 61), and many more are either reported or are to be seen in photographs in the literature cited above, and in a number of other publications (Zenkewitch 1970, figs 31, 98-100, 130; Ekdale & Berger 1978, fig. 10; Kitchell et al. 1978a, fig. 2; 1978b, fig. 3). As lebensspuren, they are such a pronounced structure that they have played a role in ecological discussions (Kitchell et al. 1978a, b; Kitchell 1979; Roginskaya 1991). Classified from the paleontological point of view as "traces", they have quite a number of fossil analogs, i.e. the ichnogenera *Nereites*, *Helminthoidea*, *Helminthopsis*, *Spirographe* and *Taphrhelminthopsis*, some of them dated back to Cambrian (Ekdale & Berger 1978, Kitchell et al. 1978a, Crimes & Fedonkin 1994).

The lophenteropneust concept plays potentially important roles in phylogeny and ecology. Detailed investigation of their anatomy and histology might settle longstanding problems concerning relationships between hemichordates. Therefore it is a challenge at some time to capture these very fragile animals and treat them properly with a non-alcoholic fixative such as formaline, bouin, or something more advanced.

The ecological role of enteropneusts in the deep sea remains to be properly assessed. Three aspects are obvious. 1) Enteropneusts are numerous. This appears from the large number of faecal strings seen in the photographs, although it is uncertain how often a new string is produced and how long it remains in a recognizable condition on the bottom. A mucus sheath left disappeared in 15 days (Paul et al. 1978; Thorndike et al. 1982). 2) They alter sediment properties, both through their feeding activities and, for some species, when making burrows. 3) There is obviously a number of ecological types. Apart from several different morphologies seen on the surface of soft

sediment bottoms, among which are the lophenteropneusts, one can mention the "nest"-making *Stereobalanus* (Romero-Wetzel 1989, Jensen 1992), the enteropneust responsible for the widely recognized "mound-burrow" trace (Mauviel et al. 1987), possibly the maker of the "horseshoe"- or "FC"- trace (Gaillard 1991), and the "spaghetti worm", *Saxipendium*, of some hydrothermal vents (Woodwick & Sensenbaugh 1985).

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DEEP-SEA SWAN SONG

In his "Epigram on a Volunteer Singer", the English poet Samuel Taylor Coleridge (also, somewhat appropriately, author of "The Ancient Mariner") wrote the following:

"Swans sing before they die - 'twere no bad thing
Did certain persons die before they sing."

I have no intention of dying just yet, but this is my "deep-sea benthic swan song", so I will keep it short in case you also feel that I should have delayed it until after my demise.

I retire in May 1998 after a working lifetime in marine biology, and 26 years of it with the NERC in deep-sea biology. I may be around occasionally for some time to come, and I may haunt you at the odd meeting (including the millennium Deep-Sea Biology Symposium in Galway). But I have neither the stamina nor the scientific reputation to justify becoming a revered elder statesman like a Hessler, a Thiel or the editor of the DSN. Nor can I perform a Maori haka!

So this is simply to tell you that it has been a lot of fun, to say goodbye to my many deep-sea friends around the world, and to thank you for the privilege of knowing you and, from time to time, working (and drinking) with you.

Good luck, tight lines and a safe landfall,
Tony Rice
Southampton Oceanography Centre, U.K.

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