

COMARGE

- Continental Margin Ecosystems on a Worldwide Scale -

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1. 2006 ACCOMPLISHMENTS & SCIENTIFIC HIGHLIGHTS

In 2006, COMARGE refined its major scientific questions, strengthened its network internationally and set up its action plan. Three steps were initiated to achieve these goals: 1) a call for contributions to the COMARGE science plan was distributed widely to the international community in February, 2) the responses to this call were synthesized in April and presented to the COMARGE community as a report and 3) a workshop was organized in July 2006 at the Institut Océanographique, Paris to discuss the responses and forge a new coordinated COMARGE science plan.

a. COMARGE Globalization effort

The call for contribution entitled “CoML/COMARGE: Towards a globalization of the project” described the aims, the rationale and presented a strawman document of the main questions COMARGE might address. The document was sent in early February to a list of ca 60 scientists all over the world as well as to all NRICs. The scientists selected together covered all oceanic regions where continental margins have been studied, or will be studied in the near future. They also covered a wide range of skills in taxonomy, biology and ecology as well as all major components of the benthic fauna in the various benthic habitats of the continental slope. The document was intended to (1) foster discussion on the questions addressed by COMARGE, (2) provide a census of existing and planned projects on continental margins and (3) encourage contributions and participations in COMARGE. About 50 scientists answered the call for contributions, 50% provided information on data available for collaborative work within the COMARGE network and about 40 attended a workshop held at the Institut Océanographique, Paris in July 2006.

b. Synthesis of the globalization effort

All contributions and reactions to this document were summarized and taken into account in the proposal for COMARGE Phase II, submitted to the Census of Marine Life in April 2006. The document included a map of knowledge indicating the location of past and ongoing studies relevant to the project, also presented below (Figure 1).

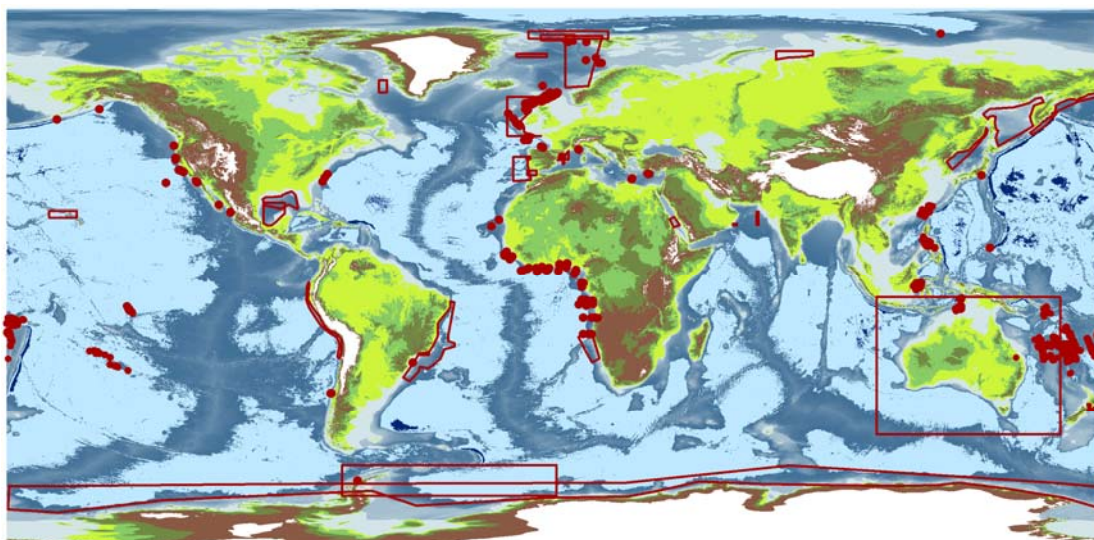


Figure 1 - Map of stations (circles) or areas (polygons) studied during one or several expeditions on margins worldwide. The map is not comprehensive and the nature of data available (taxa, taxonomic level, environmental parameters, sampling methods) varies from site to site.

Although most continental margins have been studied, the sampling effort varies greatly between ocean basins (Figure 2). The Northern Atlantic and Northeastern Pacific are by far the most extensively studied areas whereas the Indian Ocean and the South Pacific have received little attention.

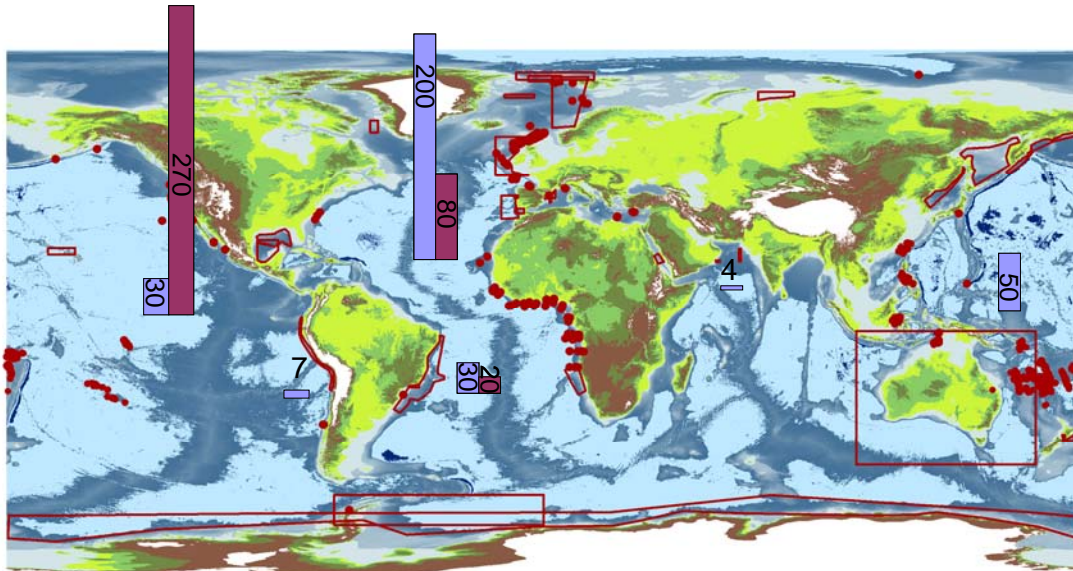


Figure 2 – Map of sampling effort on continental margins of the North Atlantic, South Atlantic, Western Pacific, North Eastern Pacific, South Eastern Pacific and Indian Ocean. The blue bars indicate the number of benthic cruises and the red bars the number of submersible/ROV dives.

The nature of information available accordingly varies between ocean basins. Among the parameters describing hydrological and sedimentological settings, temperature and organic carbon are the more commonly used. The availability of these two parameters reflects the intensity of sampling effort, from widespread in the North Atlantic to rare in the Indian Ocean (Figure3). For this figure and the following ones, the North and South East Pacific have been clustered for clarity. The South East Pacific, as the Indian Ocean, has been marginally sampled with only two known benthic studies.

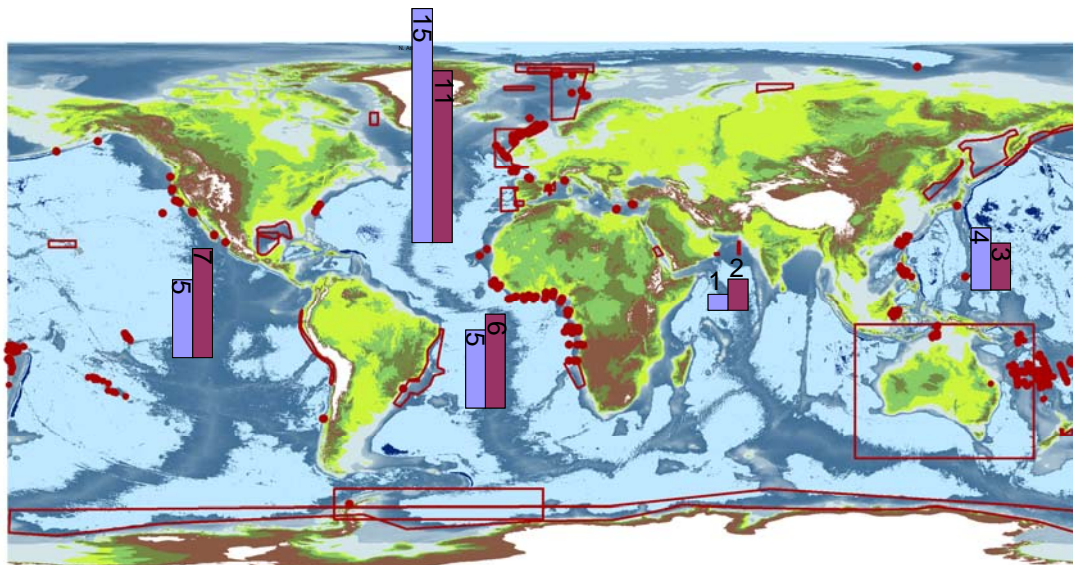


Figure 3 – Map of environmental data available on continental margins of the North Atlantic, South Atlantic, Western Pacific, Eastern Pacific and Indian Ocean. The blue bars indicate the number of studies reporting water temperatures and the red bars the number studies reporting organic content.

In the same way, the geographical distribution of benthic species highlights the greater availability of data in the North Atlantic (Figure 4). Macrofaunal data tends to be more widespread across oceans than for megafauna and meiofauna. However, for the purpose of a global synthesis, the megafauna probably is the most suitable group because the taxonomy of this size class is better known than for the other components of the benthic community.

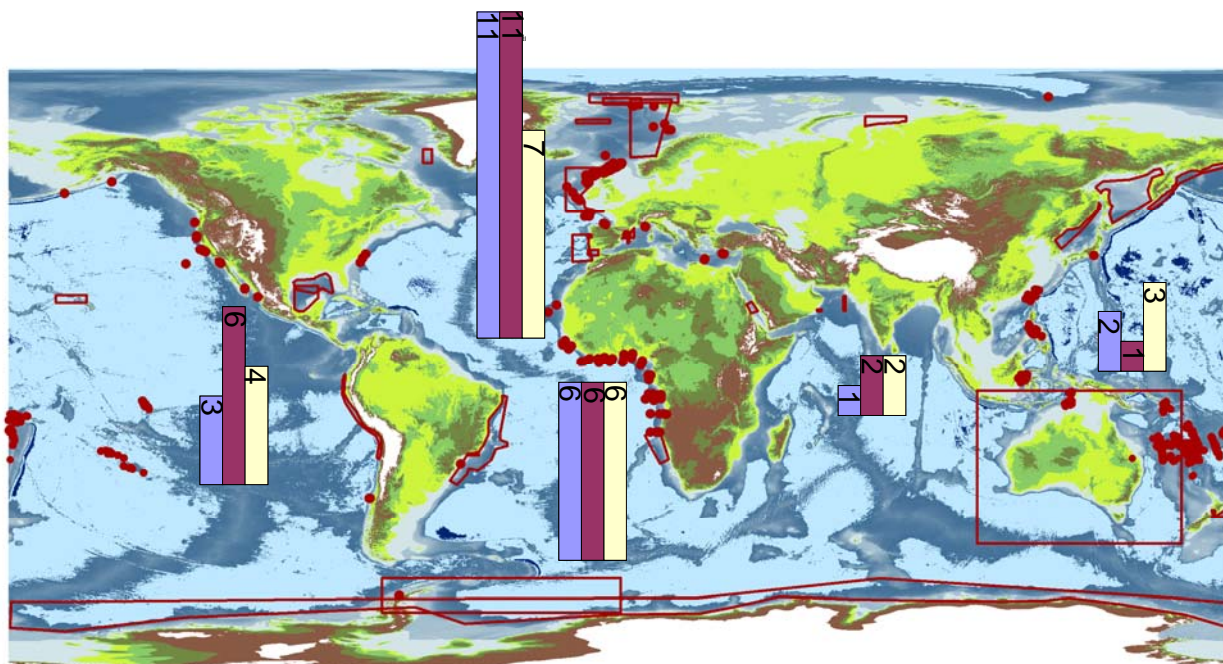


Figure 4 – Map of faunal data available on continental margins of the North Atlantic, South Atlantic, Western Pacific, Eastern Pacific and Indian Ocean. The blue bars indicate the number of studies reporting quantitative data for megafauna, the red bars quantitative data for macrofauna and the yellow bars quantitative data for meiofauna.

All together, the answers to the questionnaire sent by COMARGE in February 2006 sum up about 300 cruises and 350 dives. Rough and conservative estimates of the number of samples per cruise, the number of species per samples and the number of individuals per sample give a potential of 180000 records for species and 600000 records for individuals already existing on continental margins. About a third of the answers report the use of a database, mostly access database, for faunal data archiving. Two third thus remain to be archived and almost all have to be connected with OBIS portal.

c. COMARGE workshop: Toward globalization

A workshop, held at the Institut Océanographique in Paris, was organized the 6th and 7th of July 2006. The workshop was meant to introduce the objectives of COMARGE to a large audience of 36 invited scientists from 18 countries that had expertise in margin studies in terms of taxonomy and ecology. The general aims were to share interests and agree on a list of major scientific questions in order to plan the future actions of COMARGE in a collaborative way. The workshop allowed i) defining four themes that should be addressed by COMARGE in the future, ii) planning actions for years 2006-2008 in order to progress on each of these themes and iii) identifying leaders for each action.

Themes	Leaders	Purpose	Actions
A. Large scale biodiversity patterns and processes	Dr G. Poore Dr A. Gooday Dr A. Vanreusel	Determine depth ranges of species and communities of species over large segments of continental margin. Test the hypothesis of a maximum in alpha and beta diversity at mid-lower slope depth along large segments of the margin ecosystem Used observed patterns to develop predictive models based on faunal control by non-biological habitat factors	1) To identify suitable data, taxonomically and geographically 2) To organize a workshop on Large-Scale Margin Patterns, preliminary analysis of actual datasets
B. Landscape-scale classification, habitat mapping	Dr Alan Hughes E. Le Guilloux Dr A. Grehan	Define and map habitats on continental margins, including the border of the shelf, in order to: a) quantify and compare habitat heterogeneity on continental margins b) refer to a common framework for habitat description	To organize a workshop on this theme in early 2007
C. Habitat heterogeneity in relation to regional diversity - Corals - Canyons - Oxygen Minimum Zone - Cold seeps - Wood and food falls - Slides - Small scale heterogeneities	Dr K. Olu Dr T. Schlacher Dr J. Sellanes Dr L. Levin Dr C. Smith Dr A. Gooday Dr M. Klages	Assess the effects of habitat heterogeneities on biodiversity patterns and processes of benthic communities at several spatial scales.	1) For each habitat, identify data available for comparisons 2) To plan analysis workshop(s) for 2008

Themes	Leaders	Purpose	Actions
D. Anthropogenic impacts on margins	Dr B. Ingole	Identify the types of anthropogenic impacts on continental margins, map their occurrence and intensities and finally provide an assessment of their impacts, including their unique effects on continental margins.	<ol style="list-style-type: none"> 1) To look for information/data available on impact intensities and effects 2) To map impact intensities for selected kind of human activities 3) To map Marine Protected Areas on continental margins

d. Cruises

April 2006 In the framework of the EU program HERMES scientists sampled in and around the canyons of the Portuguese margin. The cruise was the penultimate expedition of RRS *Charles Darwin*, which came into service in 1982. A wide variety of samples were taken in the Setúbal, Lisbon, Cascais and Nazaré canyons at depths ranging between 300 and 4500m. The principal sampling activities were seabed photography, coring, trawling and benthic boundary layer sampling. Photo-transects across the canyon thalwegs (central channels) revealed distinct zonation in seabed fabric (e.g. ripple patterns) and fauna. Of particular note were numerous individuals of a new form of giant protozoan (xenophyophores) on the flanks of the thalweg in the Nazaré Canyon at depths of about 4400m. Burrowing molpadiid holothurians were evident in all three canyons at c. 3400m, but they were particularly abundant in the Nazaré Canyon. These sea cucumbers appear to be particularly well adapted to surviving the periodic strong down-canyon current events that resuspend and then deposit large amounts of organic-rich sediment. Cold-water corals and a deep-water oyster pavement were sampled at depths of about 1000 to 1400m depth.

May 2006

In the framework of the E.U. program Hermes, the new French research vessel *Pourquoi Pas?* and ROV Victor were used to study methane seeps in the deep waters of the Nordic margin. In this region highly active seeps at the Håkon Mosby mud volcano covered by mats of giant sulphur oxidizing bacteria, quiet seeps at the Storegga slope harbouring dense populations of pogonophorans as well as carbonate substrates hosting a sessile fauna typical of deep-sea corals highlight the diversity of habitats on continental margins (H. Nouze, K. Olu).

In the same time and still in the framework of Hermes, took place the third cruise of the project ENVAR on board the R.V. *Suroit*. ENVAR is a time series study of the activity of the Var Canyon (Mediterranean Sea) and its consequences on the benthic ecosystem. Sediment traps, current meters and nephelometers were recovered from a previous cruise are moored again. Benthic oxygen fluxes were measured and sediment samples were taken in order to describe sediment chemistry and faunal assemblages (A. Khripounoff, J. Galéron).

July 2006 RV *Atlantis/ALVIN* were used to study faunal response to sulfide at methane seeps off Oregon (600-900 m) and California (500 m). Multicore transect sampling at 500, 800, 1000 and 1200 m was done off OR and CA to (a) provide non-seep faunal comparisons and to examine the effects of the oxygen minimum zone on macrobenthic community structure. Colonization experiments were deployed at seeps to examine settlement response to sulfide levels with sediment, wood and carbonate substrates. (L.A. Levin, W. Ziebis, R. Lee)

August -September 2006 The RV *Vidal Gormaz* was used to core OMZ sediments and trawl methane seeps off Concepcion. The first living Lamellibrachia were recovered from the Chile margin (J. Sellanes, P. Munoz, C. Neira)

September 2006

The R.V. Suroit went back to the Var Canyon in the Mediterranean Sea for the fourth cruise of the ENVAR project (A. Khripounoff, J. Galeron).

The RV Celtic Explorer was used for a deepwater fishing survey of the North Eastern Ireland shelf and slope. The objectives were to investigate the distribution and relative abundance of shelf edge, slope and deepwater fishes along three different transects with trawls carried out at 500, 750, 1000 and 1500 m depth. In addition, benthic macroinvertebrates have been sampled at five different depths between 500 and 2000 m.

2. SOCIETAL BENEFITS, IMPACT & APPLICATIONS

In 2006, COMARGE initiated the development of an international network of excellence. COMARGE aims to 1) foster the emergence and dissemination of new ideas, 2) generate an international research agenda designed to test the hypothesis that emerge from the COMARGE synthesis and thus 3) guide ecological research on continental margins for the next decade.

We expect the COMARGE network will be a key partner:

- For the offshore oil and gas and fishing industries, where scientific expertise is needed to advise on environmental survey protocols, to provide a taxonomic clearing house and to forecast environmental risks.
- For the conservation stakeholders, enabling them to address conservation issues in the deep sea on a sound scientific basis.
- For national interests (governments) that are responsible for the protection of biodiversity and natural resources within Exclusive Economic Zones (EEZs).

Following the COMARGE workshop in Paris most participants attended the 11th International Deep-sea Biology Symposium in Southampton, UK, 9-14 July 2006. As part of the Symposium a special session on Science and Ocean Management issues was held on Tuesday 11 July 2006. A summary of the main conclusions was produced and is currently available for consultation by the deep-sea community before being published in a suitable journal and being sent to major policy making organisations and NGOs. The document will also be linked from the Census of Marine Life web pages.

3. WORK PLANNED FOR 2007

In 2007, COMARGE will focus on the four scientific themes defined at the end of the Paris workshop. For each theme, the work plans include either or both:

- Active networking in order to foster discussion, sharing of existing data and data archiving.
- Valorization, in a broader context, of ongoing national projects and cruises.

a. Large scale biodiversity patterns and processes**▪ Networking**

The taxa-specific and community-specific questions addressed by this theme can be answered only using very high quality archived data. The taxa-specific question requires correct and consistent identification to species over large areas from many studies. The community-specific question requires similarity of methods across many studies and consistent identification within each study.

The first step forward will be to identify the suitable datasets. Data can be sought either by taxa or by region of the margin.

Once data have been identified, a workshop should be held with the purpose of carrying out preliminary analysis with an emphasis on the Atlantic synthesis of taxa-specific distributions. That workshop will also identify data gaps and most effective taxonomic focus. The workshop should be carried out at a national museum with large holdings of margin species and readily accessible data bases. The aim is to collate existing data from scientific and offshore oil and gas environmental surveys and to supplement these with new data being collected in new hydrocarbon provinces in the South Atlantic, notably off Brazil, Zaire and Angola.

▪ Cruises

In 2007 work on the biodiversity megafauna off Angola by the National Oceanography Centre, Southampton will continue through the SERPENT project. SERPENT aims to use stand-by time in commercial ROV operations for scientific research. The work will increase knowledge of large epifaunal invertebrates in the region and will be coupled with the setting up of a long-term observatory. In addition, it is intended to collaborate with young scientists to build capacity in the region for deep-sea biology and environmental surveying.

b. Landscape-scale classification, habitat mapping**▪ Networking**

Whether shallow or deep seas, habitat classification is an actual concern, developed by different projects in different contexts. The first step will be to identify current similar initiatives and come into contact with their leaders. Collaborations will especially be sought with FMAP and ICES.

A workshop on this theme should be organized during the first semester of 2007.

▪ Cruises

Work on habitat mapping and large-scale seabed classification will be developed by the National Oceanography Centre, Southampton within the SERPENT project (see above) offshore West of Shetland and offshore Angola.

Further research will be undertaken on cruises to the Portuguese margin canyons, Gulf of Cadiz asphalt volcanoes, Mediterranean Sea canyon, corals and seeps as part of the EU HERMES project in 2007 (see below).

c. Habitat heterogeneity in relation to regional diversity**▪ Networking**

For each habitat of concern in this theme, there is a need to identify what can effectively be compared and, according to data available, which questions can effectively be addressed. This first step will be achieved throughout the next year, via email or using a dedicated forum on the COMARGE website.

One or several workshops on this theme will have to be planned, most probably for 2008.

▪ Cruises

October 2006 RV *Atlantis/ALVIN* will be used to recover colonization experiments deployed in July 2006 off CA and OR and to continue studies of physiology, ecology and evolution of Dorvilleidae in relation to sulfide. (L.A. Levin, W. Ziebis, R. Lee, K. Halanych, Ebbe)

November 2006 RV *Tangaroa* will be used to explore methane seep, canyon and other slope faunas off New Zealand. (A. Baco, A. Rowdan, C.R. Smith, L.A. Levin, T. Shanks, S.M. Sievert).

Summer 2007 the new UK research ship RRS *James Cook* will undertake 3 cruises using the Remotely Operated Vehicle ISIS as part of the EU HERMES project. The first cruise will study the recently discovered asphalt volcanoes in the Gulf of Cadiz, the second will focus on the Portuguese margin canyon systems (Nazaré, Setúbal, Cascais and Lisbon canyons) and the third will explore the canyon systems off the UK and Ireland (Whittard and Dangeat canyons, and Gollum Channel System) (D. Billett).

April and September 2007 The two last cruises of the ENVAR project on board RV *Europe*.

Autumn 2007 In the framework of the EU program Hermes, the Medeco cruise on board the RV *Pourquoi Pas?* and ROV *Victor* will explore the deep Mediterranean Sea and study no less than four of the most common habitats on continental margins: the Var canyon, deep-sea corals off Italy, cold seeps and their bordering soft sediments (J. Sarrazin, K. Olu).

d. Anthropogenic impacts on margins**▪ Networking**

A provisional list of potentially deleterious human intrusions on continental margins have been defined during the Paris workshop, it includes: trawling, hydrocarbon extraction (added substrate, impact of artificial drilling mud, oil spill), CO₂ sequestration, heavy metal loading, waste disposal/heavy metal loading, nutrient enrichment, sediment and pollutant supply to canyons, global warming.

The first tasks for the working group on this theme will be in 2007 to look for information/data available on impact intensities and effects, to map impact intensities for selected kind of human activities and to map Marine Protected Areas on continental margins.

e. Data management

COMARGE will offer the scientific community the use of a copy of the BIOCEAN database¹, developed and maintained at Ifremer (http://www.ifremer.fr/isi/biocean/acces_gb/index.htm). For this purpose, a user interface is under development. In 2007, the interface will allow data providers to easily upload their data from spreadsheets into the database. Once the first datasets would have been uploaded, the protocol already used to link BIOCEAN to OBIS will be applied to the COMARGE database.

¹ Fabri MC, Galéron J, Larour M, Maudire G (2006) Combining the Biocean database for deep-sea benthic data with the online Ocean Biogeographic Information System. Mar. Ecol. Prog. Ser. 316: 215-224 (http://www.int-res.com/articles/meps_oa/m316p215.pdf)

In parallel, data mining will likely be required in order to address such question as large scale biodiversity patterns on continental margins. An effort will thus be made to archive old datasets in paper format. Priority will be given to datasets most relevant to COMARGE topics, in relation with the leaders of each theme.

4. EDUCATION & OUTREACH

Education and Outreach activities had two goals in 2006, the development of a web site and contributions to the Deep-Sea Education and Outreach group (DESEO).

The web site was on line at the end of May 2006 (www.ifremer.fr/comarge). From May to August, web pages have been visited about 900 times. The website is developed both in English and in French. It has two main sections, one dealing with science and one dealing with education and outreach.

The Science section is intended to provide information regarding the scientific questions addressed by COMARGE and the research projects involved within COMARGE. It is expected that the information shared with the scientific community will help to increase commitments in COMARGE. The science section is regularly updated as new information are provided by the members of the Steering Committee or other scientists involved in the project. By the end of the year, a forum will be created in order to foster discussion among scientists on the four scientific themes of COMARGE.

The Education and Outreach (i.e. 'Public') is intended to provide basic knowledge on continental margin ecosystems and made it attractive through the use of visual material. Short movies from ROV dives onboard Ifremer research vessels have been prepared to feed the Public section of the web site. A slide show and movie of cold seeps from the Biozaire project (Ifremer/Total) are on line since May 2006. By the end of the year, the Public section will be updated with new slide shows and movies of deep-sea corals from the Caracole cruise (Ifremer).

The Deep-Sea Education and Outreach group was created in January 2006 following a meeting among Education and Outreach liaisons of the following projects: ChEss (Eva Ramirez, Maria Baker), CeDAMar (Brigit Hilbig), COMARGE (Lenaick Menot), MAR-ECO (Jo Hoyer, Morten Steffensen) and EuroCoML (Bhavani Narayanaswamy). The meeting, held at the National Oceanography Center Southampton was funded by EuroCoML. Education and Outreach priorities for this group are linked to the MAR-ECO "Deeper than light" exhibition:

- Firstly to help display the exhibition in Europe - To this end contact has been taken with Oceanopolis in Brest, one of the largest aquariums in France.
- Secondly to edit, translate and publish a deep-sea guide book for the general public. The book is intended to be a guide for the exhibition, which will be largely visual but may also be a stand alone product. Chapters of the book related to continental margin habitats are being prepared. The book will be published in Norwegian, English, Spanish, French, German and Portuguese. COMARGE will ensure French translations.

5. GEOGRAPHIC EXPANSION

COMARGE is organized as an umbrella program and has ensured collaborations with local, national and international projects in the North East Atlantic (HERMES, AFEN), the South East Atlantic (Ifremer/Total and NOC/BP oil fields and regional surveys), the North West Atlantic (University State of Louisiana and Texas A&M projects in the Gulf of Mexico), South West Atlantic (Federal University Rio de Janeiro - Petrobras and REVIZEE), North and South East Pacific (SCRIPPS). These programs

have already produced or are expected to produce a large quantity of material regarding faunal samples, sea bottom imagery and environmental parameters as well as pictures and movies of slope landscapes.

The main goal of COMARGE for 2006 was to globalize its network. As described earlier, the large number of positive answers to the call for contribution as well as the international participation to the COMARGE workshop in July are proof of the global scope of COMARGE.

The website has also proved to be a point of entry to the COMARGE network. As Dr Edward McCormack from the Marine Institute in Galway, Ireland, who is taking part in a benthic survey on the Irish margin and was introduced to the aims of COMARGE through the website.

In 2007, the Steering Committee will increase with the introduction of three new members in order to further expand the geographical and scientific scope of the project.

6. PARTNERSHIPS & COLLABORATION

a. Partnerships

Organization Name	Point-of-Contact (Name)	Nature of Relationship
Fondation Total	Bernard Tramier	Funding for science and Education and Outreach
Lounsbery Foundation	Prof Philippe Bouchet	Funding of a cruise for the exploration of the Philippines deep-sea (P.I. Pr Philippe Bouchet, Museum National d'Histoire Naturelle, Paris, France)
HERMES	Dr. David Billett Dr Myriam Sibuet	Funding for European research teams, ROVs and cruises on canyons, cold seeps, anoxic microbial systems, deep-water corals and open slopes.
NOAA Ocean Explorer	Dr Robert Carney Dr Lisa Levin	Funding of a deep-sea cruise in the Gulf of Mexico (P.I. Robert Carney) Proposal for a deep-sea cruise off Chile in 2007 (P.I. Lisa Levin)
US Mineral Management Service	Dr Gilbert Rowe	Funding of the Deep Gulf of Mexico project. Provided data to OBIS.
Ifremer	Joëlle Galéron	Funding of deep-sea cruises Host for COMARGE database and website
Natural Environment Research Council	Dr David Billett	Core strategic funding for multidisciplinary deep-sea research (Oceans 2025).

Natural Environment Research Council	Dr Brian Bett	DIEPS - Deep-water Industry, Environment, Policy and Science – Knowledge Transfer research grant.
Esme Fairburn Foundation	Dr Brian Bett	DC-UK – Deep-sea Conservation for the UK. Outreach website
BP, Transocean, Statoil, Total, Wooside Energy Ltd, Chevron Texaco, Nexen Inc., Kongsberg Maritime, Subsea 7,	Dr Brian Bett	SERPENT – Scientific and Environmental Rov Partnership using Existing iNDustrial Technology.
REVIZEE Programme	Dr Helena P. Lavrado	Provided data to OBIS

b. Links to Other CoML Ocean Realm Projects

Project Name	Cross-Over Person(s)	Nature of Relationship
ChEss	Dr Robert Carney Dr Lisa Levin	Steering Committee Steering Committee Education and Outreach
CeDAMar	Dr David Billettt Dr Myriam Sibuet	Steering Committee Steering Committee Education and Outreach
MAR-ECO		Education and Outreach

c. Links to CoML National and Regional Implementation Committees (NRICs)

NRIC	Liaison or Cross-over personnel	Nature of Relationship
The document “CoML COMARGE: toward a globalization of the project”, which acted as a call for contribution, was sent to all NRICs in February 2006		
Australia		
Canada		
Caribbean		
China		
Europe		Education and Outreach
Indian Ocean		
Japan		
South America		
Sub-Saharan Africa		
USA		

d. Liaisons to CoML Cross-Cutting Groups

Project Name	Liaison Name & Institution	Nature of the Relationship
OBIS	Dr Lenaick Menot, Institut Oceanographique, Paris & Ifremer, Brest	COMARGE database manager
HMAP		
FMAP	To be defined	Collaborations on habitat classification
SCOR Tech Panel		
E&O	Dr Lenaick Menot, Institut Oceanographique, Paris & Ifremer	Education and Outreach Network Liaison
Barcoding	Dr Lenaick Menot, Institut Oceanographique, Paris & Ifremer	Participation in the CoML Barcoding workshop in Amsterdam, 15-17 May 2006

7. INPUT TO COMMUNITY DATABASE**a. Publications****Book**

Benthic diversity of the central region of the Brazilian Economic Exclusive Zone. Helena Passeri Lavrado & Bárbara Lage Ignácio (eds.). Museu Nacional, Série Livros n.18, Rio de Janeiro, Brasil 389p (in Portuguese), 2006. ISBN 85-7427-014-8

Papers published

Papers published in 2006 by scientists of the COMARGE network and relevant to COMARGE problematic.

Arntz, WE, Gallardo VA, Guteierrez D, Isla E, Levin LA, Mendo J, Neira C, Rowe G, Tarazona J, Wolff M (2006) ENSO and similar perturbation effects on the benthos of the Humboldt, California and Benguela Current upwelling ecosystems. *Advances in Geosciences* 6: 243-265

Baguley JG, Montagna PA, Lee W, Hyde LJ, Rowe GT (2006) Spatial and bathymetric trends in Harpacticoida (Copepoda) community structure in the Northern Gulf of Mexico deep-sea. *J Exp Mar Biol Ecol* 330:327-341

Blankenship LE, Yayanos AA, Cadien DB, Levin LA (2006) Vertical zonation patterns of scavenging amphipods from the Hadal zone of the Tonga and Kermadec Trenches. *Deep Sea Research Part I: Oceanographic Research Papers* 53:48-61

Bühning SI, Lampadariou N, Moodley L, Tselepides A, Witte U (2006) Benthic microbial and whole-community responses to different amounts of ¹³C-enriched algae: In situ experiments in the deep Cretan Sea (Eastern Mediterranean). *Limnol. Oceanogr.* 51: 157-165

Fleeger JW, Carman KR, Weisenhorn PB, Sofranko H, Marshall T, Thistle D, Barry JP (2006) Simulated sequestration of anthropogenic carbon dioxide at a deep-sea site: Effects on nematode

abundance and biovolume. Deep Sea Research Part I: Oceanographic Research Papers 53:1135-1147

Nomaki H, Heinz P, Nakatsuka T, Shimanaga M, Ohkouchi N, Ogawa NO, Kogure K, Ikemoto E, Kitazato H (2006) Different ingestion patterns of super(13)C-labeled bacteria and algae by deep-sea benthic foraminifera. Mar. Ecol. Prog. Ser. 310: 95-118

Hilbig B, Blake, JA (2006) Deep-sea polychaete communities in the northeast Pacific Ocean off the Gulf of the Farallones, California. Bull. Mar. Sci. 78: 243-269

Hirche HJ, Muyakshin S, Klages M, Auel H (2006) Aggregation of the Arctic copepod *Calanus hyperboreus* over the ocean floor of the Greenland Sea. Deep Sea Research Part I: Oceanographic Research Papers 53:310-320

Levin LA, Ziebis W, Mendoza GF, Growney-Cannon V, Walther S (2006) Recruitment response of methane-seep macrofauna to sulfide-rich sediments: An in situ experiment. J Exp Mar Biol Ecol 330:132-150

Middelboe M, Glud RN, Wenzhofer F, Oguri K, Kitazato H (2006) Spatial distribution and activity of viruses in the deep-sea sediments of Sagami Bay, Japan. Deep Sea Research Part I: Oceanographic Research Papers 53:1-13

Oliver P, Graham P, Levin L (2006) A New Species of the family Thyasiridae (Mollusca:Bivalvia) from the oxygen minimum zone of the Pakistan Margin. J. Mar. Biol. Assoc. U.K. 86: 411-416.

Palanques A, Martin J, Puig P, Guillen J, Company JB, Sarda F (2006) Evidence of sediment gravity flows induced by trawling in the Palamos (Fonera) submarine canyon (northwestern Mediterranean). Deep Sea Research Part I: Oceanographic Research Papers 53:201-214

Richer de Forges B (2006) Discovery in Coral Sea of a second species of glypheid (Crustacea, Decapoda, Glypheoidea). Zoosystema 28: 17-29.

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Van Gaever S, Moodley L, de Beer D, Vanreusel A (2006) Meiobenthos at the Arctic Håkon Mosby Mud Volcano, with a parental-caring nematode thriving in sulphide-rich sediments. Mar. Ecol. Prog. Ser. 321: 133-142

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Posters and talks

Posters and talks presented during the 11th Deep Sea Biology Symposium by COMARGE steering committee members or leaders of COMARGE working groups.

Alves D.M., Cunha M.R., Ravara A. & Billett D.S.M. The Portuguese submarine canyons - 'hotspots' of benthic biodiversity?

Aranda de Silva A., Larkin K.E., Pawlowski J., Bowser S.S. & Gooday A.J. Gromiids: an important group of large protists on bathyal continental margins in the Arabian and Weddell Seas.

Bagley P., Smith K.L., Bett B., Priede I.G., Rowe G., Clarke J. & Walls A. Deep ocean Environmental Long term Observatory System (DELLOS): Long term monitoring of the deep ocean demersal community in the vicinity of offshore hydrocarbon operations.

Barboza C.A.M., Campos L.S. & Lavrado H.P. Population structure of *Ophiura Ijungmani* (Lyman, 1878) (Echinodermata: Ophiuroidea) from Campos Basin off Brazil, SW Atlantic.

Bergmann M., Dannheim J. & Klages M. Trophic relationships between demersal fish and benthic fauna at 'Hausgarten' (79°N west of Svalbard).

Bernardino A.F., Sumida P.Y.G., Smith C.R. & Yoshinaga M.Y. Assessing benthic megafauna abundance through image analysis: contrasting results from a time-lapse and an underwater video camera.

Brind'Amour A., Menot L., Galéron J. & Sibuet M. Multiscale spatial distribution of a sedimentary macrobenthic community on the Angolan margin.

Dolan E., Tyler P.A., Rogers A.D. & Billett D.S.M. Taxonomic revision of deep-sea Pennatulacea.

Huguet C., Thurston M.H. & Billett D.S.M. Factors controlling the bathymetric distribution of crustaceans on the continental slope and abyssal plain in the Porcupine Seabight.

Ingels J. & Vanreusel A. Biodiversity of meiofauna on margins of European seas.

Jeffreys R., Wolff G., Levin L.A., Whitcraft C., Gooday A.J. & Lamont P. Temporal and spatial changes in trophic patterns of benthos across the Pakistan Margin: a response to oxygen?

Larkin K.E., Gooday A.J., Pond D.W. & Bett B.J. Fatty acid analysis reveals the importance of Foraminifera in benthic organic matter recycling.

Lavrado H.P., Campos L.S., Curbelo-Fernandez M.P. & Falcão A.P.C. Macrofauna community structure at Campos Basin continental slope, Southeast Brazil.

Lavrado H.P., Campos L.S., Curbelo-Fernandez M.P. & Falcão A.P. Benthic megafauna distribution at the southeastern Brazilian continental margin: Campos Basin.

Le Guilloux E., Olu-Le Roy K., Lorance P., Lecornu F., Galéron J., Fifis A., Sibuet M., Vacelet M., Zibrowius H., Grehan A. & Henriot J.P. Structure of megafaunal community associated with deep-sea corals on carbonate mounds and distribution at the regional scale.

Lecroq B., Gooday A.J., Cedhagen T. & Pawlowski J. Origin of the Komokiacea – molecular insight.

Murty S.J., Bett B.J. & Billett D.S.M. Benthic megafauna responses to strong oxygen gradients on the Pakistan Margin in the Arabian Sea.

Madurell T., Cartes J.E., Fanelli E. & Billett D.S.M. First results and perspectives of trophodynamics for bathyal suprabenthos from the Catalano-Balearic Basin: stable isotopy, secondary production, and biomarkers.

Olu-Le Roy K., Galéron J., Cosel R., Vangriesheim A. & the BIOZAIRE 3 scientific team. Unexpected megafauna community structure in the surroundings of the deep Zaire Canyon (East Equatorial Atlantic).

Pawlowski J., Cornelius N., Lecroq B., Longet D., Fahrni J., Cedhagen T. & Gooday A.J. Bipolar gene flow in deep-sea Foraminifera.

Rothe N., Hudson I.R., Bett B.J., Billett D.S.M., Tyler P. A. Recolonization in the Deep Sea: Experimental Approaches using Remotely Operated Vehicles (ROVs).

Rowe G.T., Deming J., Montagna J., Baguley J., Bernhard J., Escobar E., Haedrich R., Wei C., Nunnally C., Soliman Y., Wicksten M. & Ammons A. Carbon cycling by deep, northern Gulf of Mexico food webs.

Schlacher T. A., Schlacher-Hoenlinger M.A., Williams A. & Althaus F. Megabenthos diversity in submarine canyons: aspects of sponge richness and distributions in deep-sea canyons off Tasmania (Australia).

Sibuet M., Menot L., Carney R.S., Billett D.S.M., Levin L., Passeri Lavrado H. & Rowe G.T. CoML/COMARGE-- Continental Margin Ecosystem on a worldwide scale.

Smith C.R., Altamira I. & Nation J.B. Whale-fall communities, whaling and species extinctions at the deep-sea floor.

Thatje S., Shillito B., Hauton C., Billett D.S.M. & Tyler P.A. Discovering the unknown: experimental laboratory studies in deep-sea organisms.

Tyler P.A., Marsh L. & Smith C.R. *Idas washingtonia*: why be a protandric hermaphrodite on whale falls?

Van Gaever S. Vanreusel A., Moodley L., de Beer D. & Galeron J. Meiofauna at deep-sea cold seeps: diversity, adaptation and trophic position.

Vetter E.W. & Smith C.R. Canyon and slope assemblages on the oceanic island of Oahu: detrital enrichment in the deep blue sea.

Wei C. & Rowe G.T. The bathymetric zonation of deep-sea macrobenthos in the northern Gulf of Mexico.

Wiklund H., Glover A.G., Pleijel F., Johannessen P.J., Smith C.R. & Dahlgren T.G. The cosmopolitan carpet-worm: new species and records *Vigtorniella* (Annelida) at both deepsea and shallow-water reducing environments.

In preparation

Gilbert Rowe and Mahlon Kennicutt (edit.) – Special issue of Deep-Sea Research II on the continental margin of the Gulf of Mexico

Lavrado, H.P. & Viana, M.S. (eds). Atlas of marine invertebrates from the central region of the Brazilian EEZ. Volume I. Museu Nacional, Série Livros

Lisa Levin and Greg Cowie (edit.) - Benthic processes on the Indus Margin: mechanistic relationships between benthos, sediment biogeochemistry, and organic matter cycling. Special issue of Deep-Sea Research

L. Levin, J. Barry, H. Felbeck, C. Smith and C. Young (ed.): Vents, Seeps and Whale Falls. Special issue of the Journal of Marine Ecology [shared with ChEss]

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