



Biogeography of Deep-Water Chemosynthetic Ecosystems (ChEss)

Prof Paul A. Tyler (PI)

National Oceanography Centre, Southampton, SOES, European Way, Southampton, SO14 3ZH,
UK

Phone: +44 (0)2380 592557 FAX: +44 (0)2380 593052 E-mail: pat8@noc.soton.ac.uk

Prof Christopher R. German (PI)

Woods Hole Oceanographic Institution, MS #24, Woods Hole MA 02543, USA

Phone: +1 508 289 2853 FAX: +1 508 457 2150 E-mail: cgerman@whoi.edu

Dr Eva Ramirez-Llodra (Project Manager & OBIS liaison)

Institut Ciències del Mar (CSIC), Psg. Marítim de la Barceloneta 37-49, 08003 Barcelona, Spain

Phone: +34 93 2309544 FAX: +34 93 2309555 E-mail: ezr@icm.csic.es

Dr Maria C. Baker (Project Manager and E&O Liaison)

National Oceanography Centre, Southampton, GDD, European Way, Southampton, SO14 3ZH,

UK Phone: +44 2380 596352 FAX: +44 (0)2380 593052 E-mail: mb11@noc.soton.ac.uk

And the **21 members of the ChEss international scientific steering committee**

(For contact details see: <http://www.soc.soton.ac.uk/chess/ssc.php>)

<http://www.noc.soton.ac.uk/chess>

1. 2006 ACCOMPLISHMENTS & SCIENTIFIC HIGHLIGHTS

Cruises

- **Southern MAR cruise (AEB field programme).** Chris German (*ChEss* co-PI) and the WHOI ABE Team as well as Nicole Dubilier and the Bremen ROV team (Marum) returned in May 2006, from a second season at the new vent sites at 5-10°S on the Mid-Atlantic Ridge, where they continued to sample vent communities for comparison with north Atlantic vent-sites (T. Shank, co-PI; NOAA OE) aboard the German research vessel Meteor. The German-US research team located a new vent-site which may be the first in the Atlantic to be seemingly uncolonised by vent-endemic organisms (detailed chemical analysis are underway to provide essential data to understand potential reasons for the apparent lack of fauna) and also the hottest hydrothermal vent discovered: 407°C at 3000 m water depth (Nature 441: 563, 1 June 06).
- **Deep Gulf of Mexico cruise (AEB field programme).** In May 2006, a USA cruise on board *Atlantis* with the *Alvin* submersible investigated the deep Gulf of Mexico cold seep sites (Fisher, Cordes, Carney, Bright, Boland). Seep megafaunal communities were

imaged and quantitatively sampled from 10 sites, 7 of which had never been dived on before. Meiofauna were also sampled from most sites. One of the largest free living nematodes ever collected was recovered during this cruise – probably a new species of pogonophoran tubeworm. Peterson, a student of Nicole Dubilier that was on the cruise and is currently investigating the symbionts of mussels collected during the cruise, to gain a better understanding of the biogeography of mussel symbionts of seeps and vents in AEB region.

- **Ashphalt seeps in Campeche Knolls, southern GoM (AEB field programme).** In May 2006, Antje Boetius was one of the PIs on a German cruise on board Meteor with the German ROV Quest (Marum) to these seeps and the biogeography of the mussel and tubeworm symbionts from this cruise will be investigated by Nicole Dubilier.
- **Costa Rica Seeps (AEB field programme).** Cruise to investigate the Costa Rica cold seeps on board RV *Atlantis* and *Alvin*. PIs. Hilton/Thurber/Levin. June 2006.
- **New Zealand cruise (NZ field programme).** An international team of researchers from New Zealand, USA, Germany, UK and Brazil will be investigating deep chemosynthetic sites around NZ in November 2006 - RENEWZ project (PI A. Baco; NOAA-OE). The major aims are (1) to explore for new cold seep, whale fall and sunken wood sites; 2) to investigate variations in community composition and diversity levels within and between habitat types; and 3) to reveal the physiographic, geologic and chemical setting of cold seep sites, whale fall and wood habitats and the relationship of these habitat parameters to community structure.
- **Indian Ocean cruises.** During late 2006, 3 geophysical exploratory cruises along the Indian Ocean Ridge will take place, in the framework of an Indian research programme led by Dr K. Raju (NIO, Goa) and in collaboration with *ChEss* researchers (C. German, WHOI). The first cruise will explore the slow spreading Carlsberg Ridge: the northernmost section of the Central Indian Ridge. The second cruise will explore the Andaman Sea: the isolated Back-Arc Basin north of the Sumatra Earthquake site with potentially isolated ecosystems. Cruise 3 will be an ROV cruise to investigate the Andaman Sea sites and any new targets found on the Carlsberg Ridge during cruise 1, or go to the Edmond & Kairei vent sites (CIR) on the way back from Andaman.
- **Barents Sea Cold Seeps (Polar field programme).** In June 2006 the interdisciplinary cruise VICKING was carried out in the framework of the EU 6th FP project HERMES, using the new French research vessel “Pourquoi pas?” and the deep water ROV *VICTOR* (chief scientist Herve Nouze (IFREMER)). The cruise studied localised fluid escape features (pockmarks and mud volcanoes) off northern Norway. The objectives of the cruise were to assess the impact of these fluid escape features on methane release to the atmosphere, to determine their relevance to slope stability and their importance for the development of benthic ecosystems. Several new fluid escape structures were detected in the Storegga area, mostly characterized by carbonate cements populated by dense biomasses of diverse echinoderms. Key communities indicative of reduced habitats were patches of siboglinid tubeworms and mats of filamentous sulphide bacteria. Secondly, the

cruise continued a long-term project studying the cold seep ecosystem of the Arctic mud volcano Haakon Mosby (HMMV). Comparisons with earlier video imaging of the seafloor indicated a rapidly changing environment at this active mud volcano.

- **Chile Margin Cold Seeps (INSPIRE SE Pacific field programme).** SeepOx: Exploratory cruise to the Chile margin seep and OMZ site on board RV *Vidal Gormaz* (PI: J. Sellanes). Aug.-Sept. 2006. Two *ChEss* representatives on board: Lisa Levin and Victor Gallardo.
- **Whale fall cruises in Sagami Bay (Japan).** Two biological cruises (January & August, 2006) were conducted at a whale fall site in Sagami Bay, Japan using ROV *Hyper-Dolphin* (PI: Y. Fujiwara; JAMSTEC). A sperm whale carcass was dropped at a depth of approximately 900 m in April 2005. Many cold-seep sites were reported within 10 miles from the whale fall site. The main aims are (1) to explore a new whale fall site, (2) to conduct a comparative study of ecological succession and faunal similarity with shallower and deeper sperm whale falls in Japan, and (3) to reveal the phylogenetic relationships between the whale fall community and cold-seep one in Sagami Bay.
- **Food chain of methane seep communities in Sagami Bay (Japan).** March 2006. Deep-sea methane seep community was found at the Off Hatsushima site in Sagami Bay from 700 to 1200m depth. This community is composed over 20 species of megabenthic organisms including *Calyptogena soyoae*, *C. okutanii*, *Provanna glabra* and zoarcid fish. A diving survey was conducted at this site using ROV *Hyper-Dolphin* (PI: K. Fujikura; JAMSTEC). The main aim is to investigate the food chain of deep-sea methane seep communities. Dense aggregations of two species of gastropods, namely *Oenopota sagamiana* and *Phymorhynchus buccinoides* in rust color areas were found. There was no food found in the stomachs of these gastropods. What do they eat?
- **Metazoan Life at Extreme Sulfide Concentrations:** The Dorvilleidae as a Model. Seeps located within the oxygen minimum zone off the Oregon and California margins were sampled for this work with RV *Atlantis* (Levin, Halanych, Lee, Ziebis). July 10-30 and September 26 – October 13 2006.
- **Azores vents.** MoMARETO with Pourquoi pas? and Victor 2000 under the project EXOCET/D. The cruise is essentially biological/chemical and technology related. Five people from Ricardo Santos team participated (PI's Sarradin and Sarrazin). During this cruise 4 acoustic retrievable cages were deployed for later recovery by Arquipelago.
- **Azores vents.** GRAVILUCK was a geology/ geophysics cruise (Santos). During this cruise a new vent field close to Lucky Strike was found and named Ewan.

New projects & proposals (submitted or accepted in 2006)

1. POLAR field programme

- **ChEsSo – Chemosynthetic Ecosystems in the Southern Ocean.** In July 2006, the *ChEss* Southern Polar UK research programme led by Paul Tyler was accepted for funding. The programme will start in 2008, for 4 years, with cruises planned for early 2009 and late 2009 to early 2010. This is the beginning of the *ChEss* Polar field programme. A companion proposal has been submitted to NSF Office of Polar Programs (T. Shank, G. Klinkhammer, C. German, co-PIs) to utilize autonomous vehicle technologies to determine the biological character of hydrothermal vent fields of the Southern Ocean Ridge systems and how these potentially unique chemosynthetic ecosystems genetically relate to the global biogeographic framework. If funded, the autonomous deep-submergence vehicle, Autonomous Benthic Explorer (ABE), will locate, micro-bathymetrically map and image the first known Antarctic vent sites for coincident ROV sampling.
- **Arctic – Gakkel Ridge.** T. Shank, R. Sohn, H. Singh, H. Edmonds, and S. Humphris have been funded through NSF Polar Programs and the NASA astrobiology program (ASTEP) (in collaboration with the University of Maryland) to develop and utilize two polar-ready (under ice) AUVs (*Puma* and *Jaguar*) to examine the technical challenges of working through ice, hydrothermal plume sniffing, benthic sampling, and simulating such deployments for future work on other planetary bodies. Through systematic and adaptive imaging surveys, these AUVs, and a newly-developed fiber-optic camera and hydraulic benthic sampler will provide seafloor images, through which the distribution, abundance, and variation in microhabitat structure as they relate to hydrothermal activity and geological features will be assessed, and chemosynthetic fauna will be sampled. Through detailed genetic investigation of recovered fauna, the role isolation has played in the evolution and biogeography of Arctic vent fauna will be examined. This featured International Polar Year field programme is scheduled to take place in 2007.
- **Arctic** - In the framework of the EU project HERMES the German research vessel POLARSTERN will undertake further studies of Norwegian margin cold seeps as a contribution to the International Polar Year in 2007.
- **Antarctic** – IPY proposal to NSF (submitted 1 May, field programme in 2008) to study the seep system that was discovered where the Larsen Ice Shelf used to be. This proposal includes a barcoding effort. (PI: C. Van Dover).
- **Antarctic** – IPY proposal (submitted): **SEASOAM: Study of the Separation between Antarctica and South America: its geological and biological implications** (PI Lucia Campos, Brazil). This proposal includes sampling of the tectonically active Bransfield Strait spreading axis, which has extensive bathymetric range. The project aims to explore patterns of gene flow across this range in this region. Potentially, the Antarctic region under investigation may represent an entirely new biogeographic province for chemosynthetic organisms. This Brazilian-led project may grow in the future into a major international collaborative programme studying both geological and biological processes.

- **Antarctic** – IPY proposal (submitted): **MABIREH: Marine Antarctic Biodiversity in Relation to Environmental Heterogeneity** at Admiralty Bay, King George Island, and adjacent areas at the Bransfield Strait (PI Lucia Campos, Brazil). The initiative for the Bransfield Strait is strongly supported by the *ChEss* programme as the intent is to explore biodiversity and ecosystem functioning within the area, using hi-tech photographic equipment.

2. INSPIRE (SE Pacific) field programme

- **Geochemical investigations of the Chile Triple Junction and Chilean margin:** NSF (PI C. German). Submitted August 2006.
- **Geochemical investigations of the Chile Triple Junction and Chilean margin:** NOAA-OE (PI C. German). Submitted September 2006.
- **Investigations of the Chilean margin:** NOAA-OE (PI L. Levin). Submitted September 2006.
- **Investigations of whale fall and sunken wood habitats on the Chilean margin:** NOAA-OE (PI C. Smith). Submitted September 2006.

3. RENEWEZ (NZ) field programme

- **RENEWEZ:** No up to date information available at present

4. AEB (Atlantic Equatorial Belt) field programme

- **South MAR.** In 2008, an NSF –ITR funded programme entitled New Methods for Exploration of the Deep-Sea Hydrothermal Vents (H. Singh, T. Shank, R. Sohn, S. Humphris co-PIs) will mount an expedition to the SMAR (8-12°S) not only to locate, map, and image hydrothermal vents and their ecosystems to the south of all known vent areas, but do so through novel information technology that enables the simultaneous deployment of multiple AUVs to enable large-scale continuous oceanographic mapping and exploration of the SMAR.
- **South MAR.** A German proposal to revisit the South MAR vent sites in 2008 on board the RV *Meteor* using the German ROV was accepted (Nicole Dubilier PI).
- **North MAR.** A proposal to revisit the North MAR vent site Logatchev in 2008 using both a ROV (Geomar) and AUV (Geomar or Marum) has been submitted by Nicole Dubilier (PI).

- **Laurentian fan.** US-Canada collaborative effort to investigate the biology of seep fauna on the Laurentian Fan and their links with AEB chemosynthetic fauna, NSF proposal (P.I. C. Van Dover) for commencement in 2008. Submitted 15th August 2006. NSERC Proposal (PI A Metaxas), October 2007. This will include a component dedicated to barcoding Blake Ridge archival material for biogeographic comparisons.
- **Blake Ridge.** NOAA-OE - proposal to study the Blake Ridge Seep system and associated communities. Proposal includes a barcoding effort to build a reference library for Blake Ridge taxa. (PI: C. Van Dover). Full proposal submitted 5 September 2006. In addition, C. Van Dover has a proposal pending with NOAA UNC-Wilmington Undersea Research Center for *JASON* work on the Blake Ridge to map the distributions of organisms in relation to sediment geochemistry.
- **Cayman Rise:** NOAA-OE proposal for a mapping and plume survey of the entire Cayman Rise in 2007. (PI's: C. Van Dover, C. German & Lupton). Full proposal submitted 5th September 2006.
- **EuroDEEP.** In March 2006, ESF published the Call for Proposals within the EuroDEEP programme, which was set up following an initiative led by the deep-sea CoML projects. Of the 11 Outline projects submitted, 9 have been invited for Full Proposals. Sept. 2006. Two of the proposals are related to the chemosynthetic environment. One lead by Françoise Gaill, entitled "Monitoring the colonization process in chemosynthetic ecosystems", the other by François Lallier, entitled *ChemVentMussel: The biology of the chemosynthetic vent mussel Bathymodiolus azoricus: an innovative evolution through symbiosis in an extreme environment.*
- **Congo and Angola.** As collaboration between the Research Centre on Ocean Margins (RCOM, Univ. Bremen) and IFREMER, cruises to the deep water cold seeps off Congo and Angola are planned. The proposal for a first cruise GUINECO has been accepted. The cruise has been scheduled for summer 2008 and will include work with the ROV *QUEST* on RV *METEOR*.

5. Global/Other

- **2 Gastropod taxonomy projects.** 1) Review (with descriptions of many new species) of the Gastropod fauna in seeps and vents; 2) Gastropod fauna of sunken driftwood in the South Pacific. PI. Anders Warén (Swedish Museum of Natural History, SE). This work is funded by the SMNH and private sources. The vent work is based on material sent by many of the people in *ChEss* and other organizations.
- **Circumnavigation chemosynthetic cruise.** Shirshov Institute is planning a circumnavigation 2-year cruise visiting many of the known and recently discovered hydrothermal fields and some methane seep sites. The programme is expected to start in 2006. (Andrey Gebruk)

- **Guaymas Basin cruise.** IFREMER cruise (Daniel Desbruyeres) - 2007 or 2008. Elva Escobar participating.
- **PNG/Fiji vent cruise.** Biological cruise will be conducted at hydrothermal vents in the Manus and North Fuji Basins in September 2006 using the submersible *Shinkai 6500* (PI: Y. Suzuki). The main aim is to clarify the relationship between types of symbiotic bacteria in vent gastropods and their environment (Fisher participating).
- **Vent/seep activities recorded in mussel shells.** Biogeochemical cruise will be conducted at hydrothermal vents on Myojin Knoll and cold seeps in Sagami Bay in December 2006 using ROV *Hyper-Dolphin* (PI: T. Omata). The main aim is to reveal the transitions of vent/seep activities recorded in shells of deep-sea mussels using isotopic techniques.
- **ESONET.** Network of Excellence (EU-FP6) ESONET – European Seas Observatory Network. The coordinator is Roland Person of IFREMER, and ESONET includes also several of the German partners (e.g. A. Boetius, MPI; G. Bohrmann, RCOM). The aim of the ESONET Network of Excellence is to create an organisation capable of implementing, operating and maintaining a network of multidisciplinary ocean observatories in deep waters around Europe from the Arctic Ocean to the Black Sea. MoMAR in the Azores with a set of hydrothermal vent fields is one of the networks of ten observatories targeted by this project. The contract for this new Network of Excellence to be funded by the EC under the FP6 is to be signed in September.
- **ChEss barcode effort.** CoML encourages all projects to have a barcode component. The barcode is a 650 bp sequence of the gene for cytochrome c oxidase I, and the barcode initiative is designed to build a reference library of barcodes with corresponding metadata, including photos and collection information that are entered into the Barcode of Life Database of Genbank, with voucher specimens deposited in museum or university (or other qualified) reference collections. An ecological proof-of-concept might be useful for *ChEss*. To this end, Van Dover and Metaxas are including a barcoding effort in a proposal to NSF for work on the Laurentian Fan and Blake Ridge seeps; this effort will include barcoding of biomass and numerically dominant adults and of larvae collected in plankton tows at the Laurentian Fan site.
- **RCOM (Bremen, Germany):** The RCOM submitted a proposal called “Lithosphere – biosphere interactions in oceanic hydrothermal systems” to the German DFG within their Initiative of Excellence to study the geology, biogeochemistry, and biology of hydrothermal vents worldwide. The proposal sum requested is 500 000 Euros per year for 5 years (PIs: Nicole Dubilier and Antje Boetius).

Meetings & Symposia

- **3rd International Hydrothermal Vent & Cold Seep Symposium.** *ChEss* co-funded the symposium held in September 2005 in Scripps. Recent results from *ChEss*-related research were described in talks and posters and ChEssBase was presented to the research community.

- **ChEss Steering Committee Meeting.** The 3rd *ChEss* SSC meeting was held in Scripps, in conjunction with the vent and seep symposium. At this meeting, the committee decided to expand the field programme to two new major regions: Polar Regions and Indian Ocean Region (see section 5). The SSC also decided the basic rules for the first Call of the *ChEss* Training Awards for New Investigators (TAWNI). For report please see ChEss website: http://www.soc.soton.ac.uk/chess/ssc_meeting_05.html
- **AEB Workshop.** In March 2006, *ChEss* held its first Atlantic Equatorial Belt workshop in Barcelona. The participants presented available results and identified gaps for future research. One of the major outcomes was the identification of the need for larval ecology studies to understand the dispersal and distribution of species from chemosynthetic sites from the Gulf of Mexico to the Gulf of Guinea. For workshop report please see ChEss website: http://www.soc.soton.ac.uk/chess/equatorial_belt.html
- **11th Deep-Sea Biology Symposium.** *ChEss* scientists participated in the symposium held in Southampton in July 2006. The *ChEss* programme was presented in a poster, along with DESEO O&E activities. *ChEss* co-funded this Symposium, providing funds for registration and accommodation for participants from less advantaged countries.
- **2nd preliminary ChEss Barcode meeting.** During the DSBS in Southampton, *ChEss* held a small meeting attended by 25 researchers to discuss the aims of a potential *ChEss* barcode laboratory. The meeting participants considered whether *ChEss* should select a model group or question and test the efficacy of CO1 and barcoding. Although a consensus response was not given to this point, the fact is that CO1 gene sequencing is routinely done for certain taxa at vents and seeps. Van Dover and Metaxas are including a barcoding effort in a proposal to NSF for work on the Laurentian Fan and Blake Ridge seeps. The *ChEss* barcoding effort is in early stages and this will be a hot topic at the planned SSC meeting in June 2007.
- **2nd DESEO meeting.** An E&O meeting to discuss the developments of the Deeper than Light (MARR-ECO) travelling exhibition and the Deep-sea Guide Book was held in parallel of the DSBS in Southampton in July 2006. The DESEO group established an agenda for the book, which will be published in early 2007.
- **InterRidge Polar Ridges meeting.** *ChEss* has co-funded the IR ‘Polar Ridges’ meeting to be held in Italy in September 2006 (www.interridge.org). This meeting and workshop will address various aspects of polar ridge science, including biology. *ChEss* will be well represented at this meeting and will provide insight as to our plans for the newly funded project *ChEsSo* (*ChEss* in the Southern Ocean, PI: P. Tyler) and other potential projects in the Antarctic and Arctic regions.
- **The International Census of Marine Microbes Annual Meeting.** This took place June 12th-15th, 2006 in Noordwijkerhout, The Netherlands. New strategies and methods for microbial biodiversity research were discussed. Among the main projects on which ICOMM will focus are several studies of vent microbial biodiversity.

- **Workshop on Deep Sea Floor Frontiers:** 1-2 June, 2006, Napels. This meeting examined an integrative approach to study the deep sea floor and its history. Aim: The Deep Sea Floor Frontier initiative aims to develop a major coordinated European research and technology effort on Deep Sea Floor Science. (Participants from ChEss: P Tyler, E Ramirez, RS Santos)
- **Ridge 2000 Theoretical Institute** “Modeling Hydrothermal Processes at Oceanic Spreading Centers: Magma to Microbe” in Mammoth Lakes, California in June 2006. *ChEss* SSC members Fisher, Metaxas and Van Dover, participated both as presenters and discussion leaders.
- **1st symposium on whale fall ecosystems in Japan** (Organizers: Y. Fujiwara & K. Kubokawa). *ChEss* scientist Fujiwara organized this symposium at Ocean Research Institute (ORI), the University of Tokyo in July 2006. Recent results from *ChEss* related research were described in oral presentations and future studies were discussed.
- **MomarNet.** The Marie Curie Research Training Network MomarNet held a short course titled “Hydrothermal environments at mid-ocean ridges: biodiversity and geological / geophysical context” from Oct. 4-6, 2005 in Paris (Nicole Dubilier lecturer)

Other highlights

- **Handbook of Deep-Water Hydrothermal Vent Fauna.** In April 2006, the 2nd edition of the Handbook was published: Desbruyères, D., Segonzac, M. & Bright, M. (Editors), 2006, Handbook of Hydrothermal Vent Fauna; Second completely revised edition, Denisia 18: 544 pp. Numerous *ChEss* researchers contributed with taxonomical expertise to the book and the *ChEss* project contributed funds for publishing it. The *ChEss* web site is also home for the online Corrigendum and Full species list of the Handbook of Hydrothermal Vent Fauna: <http://www.soc.soton.ac.uk/chess/handbook.php>.
- **Database.** *ChEss* is continuing to develop ChEssBase with the addition of sample data. The initial stages of this work were carried out in the laboratory of Chuck Fisher, Penn State University, in January 2006 and the data are currently being uploaded into ChEssBase. In August/September 2006, ChEssBase is being edited and updated with new species data. A request has been made to the wider community for any additions to the database – especially from cold-seep environments. <http://www.soc.soton.ac.uk/chess/database/database.html>.
- **TAWNI.** In June 2006, *ChEss* awarded the first 3 Training Awards for New Investigators in relation with taxonomy projects. The candidates profile and research projects can be found on the *ChEss* web site: http://www.soc.soton.ac.uk/chess/tawni_winners.php

2. SOCIETAL BENEFITS, IMPACT & APPLICATIONS

- In 2006 InterRidge and *ChEss* signed the Code of Conduct for research on hydrothermal vent ecosystems, to endorse the right use of sampling and experimentation on vent sites at the international level. The document is available on the IR and *ChEss* web sites. http://134.245.210.163/public_html/INFORMATION/IR_statement_Feb06.pdf. We continue to work with the International Seabed Authority as they assimilate our recommendations into the workings of their Legal and Technical Framework.
- *ChEss* endorses the scientific work for the development of MPAs on vent sites (Ricardo Santos PI) on the Mid-Atlantic Ridge. Two sites on Portuguese national waters have been approved by the Portuguese government (Lucky Strike and Rainbow) and one new site has been proposed to OSPAR (Menez Gwen). In October 2006 during the intergovernmental MASH meeting of OSPAR to take place in Horta (Azores) [2-5 October], Portugal will propose Rainbow, Lucky Strike and Menez Gwen as potential MPAs for the OSPAR network.
- *ChEss* endorses the establishment of long-term observatories and is investigating further ways to support and participate in ongoing and developing projects such as MoMAR on the Mid-Atlantic Ridge and the NEPTUNE (Canada) and ORION projects in USA and Canada.
- *ChEss* has strengthened its links with industry through the newly established collaborations with Fondation Total, both in terms of research and outreach activities. The projects will start in later 2006. *ChEss* is also in contact with Petrobras through collaborations with Brazilian scientists in the St. Com. A project proposal has been submitted within Petrobras and to the Brazilian National Funding Agency (CNPq) to compare the Brazilian continental margin and processes in the Antarctic region. The Study of the Separation between Antarctica and South America: its geological and biological implications – SEASOAM, has as one of its aims to sample across the Bransfield Strait spreading axis, which is tectonically active and has an expressive bathymetric range, and explore patterns of gene flow along its bathymetric range. The planned activity is to start within Admiralty Bay in a transect all the way to the Bransfield Strait. The project was presented in the last SCAR meeting by Luiz A P Gamboa and had the ACE and PLATES & GATES support.
- *ChEss* is increasing awareness of chemosynthetic environments by presentations at international meetings, attended by marine policy and management bodies. *ChEss* SSC members were actively involved in deep sea management discussions at the 11th Deep Sea Biology Symposium, Southampton, July 2006.
- *ChEss* SSC member, Antje Boetius, was asked to join the international DIVERSITAS scientific committee starting 2006, to represent marine as well as microbial biodiversity programmes and networks.

3. WORK PLANNED FOR 2007

Cruises

1. Polar cruises.

- **Arctic – Gakkel Ridge.** T. Shank, R. Sohn, H. Singh, H. Edmonds, and S. Humphris have been funded through NSF Polar Programs and the NASA astrobiology program (ASTEP) (in collaboration with the University of Maryland) to develop and utilize two polar-ready (under ice) AUVs (*Puma* and *Jaguar*) to examine the technical challenges of working through ice, hydrothermal plume sniffing, benthic sampling, and simulating such deployments for future work on other planetary bodies. Through systematic and adaptive imaging surveys, these AUVs, and a newly-developed fiber-optic camera and hydraulic benthic sampler will provide seafloor images, through which the distribution, abundance, and variation in microhabitat structure as they relate to hydrothermal activity and geological features will be assessed, and chemosynthetic fauna will be sampled. Through detailed genetic investigation of recovered fauna, the role isolation has played in the evolution and biogeography of Arctic vent fauna will be examined. This featured International Polar Year field programme is scheduled to take place in 2007.
- **Arctic** - In the framework of the EU project HERMES the German research vessel POLARSTERN will undertake further studies of Norwegian margin cold seeps as a contribution to the International Polar Year in 2007.
- **Antarctic** – IPY proposal (submitted): **SEASOAM: Study of the Separation between Antarctica and South America: its geological and biological implications** (PI Lucia Campos, Brazil). This proposal includes sampling of the tectonically active Bransfield Strait spreading axis, which has extensive bathymetric range. The project aims to explore patterns of gene flow across this range in this region. Potentially, the Antarctic region under investigation may represent an entirely new biogeographic province for chemosynthetic organisms. This Brazilian-led project may grow in the future into a major international collaborative programme studying both geological and biological processes.
- **Antarctic** – IPY proposal (submitted): **MABIREH: Marine Antarctic Biodiversity in Relation to Environmental Heterogeneity at Admiralty Bay, King George Island, and adjacent areas at the Bransfield Strait** (PI Lucia Campos, Brazil). The initiative for the Bransfield Strait is strongly supported by the *ChEss* programme as the intent is to explore biodiversity and ecosystem functioning within the area, using hi-tech photographic equipment.

2. NZ cruises.

- **RENEWZ** ROV cruise to NZ whale fall sites. Baco et al (WHOI).

3. AEB cruises.

- **SERPENTINE.** Geological, ecological and microbiological investigations of vent sites at 13°N-15°N on MAR, 2007. PI: Yves Fouquet (Daniel Desbruyères & D. Prieur for biology), France & Russia. RV *Pourquoi Pas?* & ROV *Victor 6000*.
- **GoM – Deep Seeps.** Cruise for biological investigations of the GoM deep cold seep habitats on board RV *Atlantis* and *Alvin*. (PI. Chuck Fisher, PSU). Summer 2007.
- **South MAR.** A German cruise to revisit the South MAR vent sites will take place in November 2007 using the new German ROV from Geomar (Kiel) (Nicole Dubilier PI).
- **North MAR.** Two German cruises to Logatchev will take place, one on the RV *Merian* in Jan-Feb. 2007 with a proposal pending to use Jason II (Woods Hole), and one in Oct. 2007 on the RV *Meteor* using the new German ROV from Geomar (Kiel). Nicole Dubilier will be a PI on both cruises.
- **Blake Ridge.** NOAA-OE - proposal to study the Blake Ridge Seep system and associated communities. Proposal includes a barcoding effort to build a reference library for Blake Ridge taxa. (PI: C. Van Dover). Full proposal submitted 5 September 2006. In addition, C. Van Dover has a proposal pending with NOAA UNC-Wilmington Undersea Research Center for *JASON* work on the Blake Ridge to map the distributions of organisms in relation to sediment geochemistry.
- **Cayman Rise:** NOAA-OE proposal for a mapping and plume survey of the entire Cayman Rise in 2007. (PI's: C. Van Dover, C. German & Lupton). Full proposal submitted 5th September 2006.

4. INSPIRE SE Pacific cruises.

- **Geochemical investigations of the Chile Triple Junction and Chilean margin:** NSF (PI C. German). Submitted August 2006.
- **Geochemical investigations of the Chile Triple Junction and Chilean margin:** NOAA-OE (PI C. German). Submitted September 2006.
- **Investigations of the Chilean margin:** NOAA-OE (PI L. Levin). Submitted September 2006.
- **Investigations of whale fall and sunken wood habitats on the Chilean margin:** NOAA-OE (PI C. Smith). Submitted September 2006.

5. Other/Global cruises.

- **Circumnavigation chemosynthetic cruise.** Shirshov Institute is planning a circumnavigation 2-year cruise visiting many of the known and recently discovered hydrothermal fields and some methane seep sites. The programme is expected to start in 2006. (Andrey Gebruk)

- **Guaymas Basin cruise.** IFREMER cruise (Daniel Desbruyeres) - 2007 or 2008. Elva Escobar participating.

Meetings (2007)

- **4th ChEss SSC meeting.** The meeting will be held on 27th – 29th June 2007 in Galapagos, to discuss the project's results and new developments and to celebrate the 30th Anniversary of the discovery of vents. Public and outreach events will be organised in the framework of the Anniversary and joint activities and discussions will be planned with the CoML St. Com., meeting in Galapagos at the same time. InterRidge are also to be involved in the Anniversary celebrations in terms of outreach events.
- **CoML All Programme meeting.** *ChEss* will participate in the meeting, to be held in Nov. 2007 in New Zealand.
- **PhD Hydrothermal Vent Workshop.** *ChEss* will partially support a 1 day PhD workshop on geological and biological investigations of hydrothermal vent habitats in Leeds Uni. (UK). The initiative is led by PhD Luciana Génio (Leeds Uni.). Mid 2007.
- **DESEO meeting.** The CoML deep seas groups are to meet in Bergen in February 2007 to finalise book editing and to observe *MAR-ECO's Deeper than Light* travelling exhibition with a view to extending it in the future to include *ChEss*, *CoMargE*, *CeDAMar* and possibly *CenSeam*.
- **RENEWZ** field program workshop
- **INSPIRE** field program workshop
- **1st ChEss Polar regions** workshop
- **DESEO meeting.** To be held in conjunction with the CoML All Program meeting and O&E workshop – November, New Zealand

Education & Outreach (2007)

- ***Deeper than Light* DESEO book.** Publication of the book in Feb. 2007, in conjunction with the inauguration of *MAR-ECO's Deeper than Light* travelling exhibition.
- **DESEO school educational posters.** Production of educational posters on chemosynthetic ecosystems, in coordination with the DESEO group, EU-HERMES project and Fondation Total (PIs: M. Baker and E. Ramirez-Llodra), mid-2007.

- **Handbook Vent Fauna DVD.** Initiation of the interactive and multilingual DVD for the Handbook of Hydrothermal Vent Fauna (PIs: D. Desbruyères & E. Ramirez-Llodra).
- **Vent comic book.** First drafts of the *ChEss* comics book on the discovery and history of investigation of hydrothermal vents.
- **Educational CD:** With support from NSF, NOAA OE, and the Woods Hole Oceanographic Institution, An educational CD entitled, “Beyond the Discovery” - 30 Years of Deep-sea Hydrothermal Vent Exploration and its Impact on Society is being produced (T. Shank, D. Fornari, and S. Humphris co-PIs) for spring 2007 release. This educational package will feature timelines of discovery and the major scientific milestones from various disciplines.
- **JAMSTEC:** have conducted an ROV cruise for primary and middle school students at a whale fall site. 13 students, who were prize winners of drawings of “Your Dream of the Ocean,” and their parents were invited to the vessel and experienced the ROV operations, ship controlling, and scientific research using ROV. Same event will be held in 2007. (Fujiwara)

4. EDUCATION & OUTREACH

- **DESEO (Deep Seas Education and Outreach) group.** In January 2006 we formed a deep seas group for the purposes of education and outreach among some of the CoML field programmes – *ChEss*, MAR-ECO, COMARGE and CeDAMar. A poster describing DESEO activities, present and future plans, was presented at the 11th Deep Sea Symposium in Southampton, July 2007 by EuroCoML.
- ***ChEss* educational web site.** The *ChEss* educational web pages (describing hydrothermal vents, cold seeps and whale falls) are in the process of being updated and translated. This task is nearly complete.
- **GLOBE:** Ridge2000 have recently received funding for participation within the GLOBE project, an excellent science education programme that reaches tens of thousands of students worldwide. *ChEss* will be actively involved in this programme, providing scientists with experience of chemosynthetic systems to contribute ideas for learning activities and lab protocols, to host educators at sea to collect GLOBE protocol data (starting 2008-2010), to compose and respond to student ‘questions of the week’ related to protocols, to help develop teacher training modules and to provide written summary commentary on student data and protocol results.
- **Comic Book:** We have now found an illustrator for our planned comic book and have started the process of research and development for the book. This book intends to educate about the discovery and investigation of hydrothermal vents and cold seeps.

- **Children's Book:** "Journey to Undersea Gardens", Celebration Press, intends to educate children about the discovery and hydrothermal vents, vent fauna, and seafloor eruptions based on exploration of the Galápagos Rift in 2002 (T. Shank and S. Hammond, co-chief scientists).
- **Image Competition:** An international deep sea underwater image competition complemented the 11th Deep Sea Biology Symposium. The *ChEss* office ensured that many chemosynthetic-related images were submitted for this competition. Three members of *ChEss* SSC had winning entries (from a total of just 12 places) – Craig Smith, Hawaii; Daniel Desbruyères, Ifremer, Maria Baker, NOCS. There were 3 additional *ChEss*-related winning entries. These images were displayed in the Southampton Art Gallery, the NOC and some have been published in various media including *Nature* and *New Scientist*. They are available to view on the *ChEss* website: http://www.soc.soton.ac.uk/chess/image_competition_winners_files/slide0001.htm
- **30th Anniversary of Vent Discovery Public Meeting:** We are in the process of planning a public meeting to celebrate the 30th Anniversary of hydrothermal vent discovery in the Galapagos, June 2007. We are hoping to have keynote speakers at this event that will be open to the general public and media.
- **Exhibition on deep-sea hydrothermal vents 'Hot and toxic – oasis of the deep sea'.** At the Linzer Biologiezentrum, oö. Landesmuseen, April 7th to October 1st 2006 (scientific coordinator Monika Bright)
- **Extreme 4 kids:** An Austrian-wide, multidisciplinary, integrative, education program for children 6 to 16 years during the cruise to the East Pacific Rise 9N in October/November 2006 by Monika Bright (www.hydrothermalvent.com)
- **JAMSTEC:** have conducted an ROV cruise for primary and middle school students at a whale fall site. 13 students, who were prize winners of drawings of "Your Dream of the Ocean," and their parents were invited to the vessel and experienced the ROV operations, ship controlling, and scientific research using ROV. Same event will be held in 2007. (Fujiwara)
- **Filming of ALVIN/Atlantis Cruise:** July 2006 by Modzilla/Marco Polo Films for a documentary on marine biodiversity (Levin). Working Title: The Deep Sea – Between Myth and Reality. Film to include studies of methane seeps, gas hydrates, OMZ's.
- **CIMV 3000** – Centre of Virtual Interpretation of the Ecosystems of the Azores: This Centre is based in Faial in an old Whale Factory and aims the outreach and education on marine biodiversity and ecosystems of the Mid Atlantic Ridge at the Azores Region. CIMV 3000 is also a DVD. Hydrothermal vents are the primary ecosystems being considered. Inauguration of the Centre and issue of the DVD is planned for October 2006. All the material (DVD, posters, leaflets, etc) have the CoML and ChEss logos incorporated.

5. GEOGRAPHIC EXPANSION

- The **ChEss Scientific Steering Committee** (SSC) now has 25 members from 11 different nations worldwide engaged in research spanning all chemosynthetic environments and including a wide range of faunal groups and expertise. In 2006 the SSC benefited from the incorporation of 2 new members: Dr Loka Bharathi in representation of the Indian research community and Dr Monika Bright in representation of Austria and for meiofauna research.
- The **ChEss field programme** has also expanded. The *ChEss* SSC met in Scripps in September 05 and decided that, with the Atlantic Equatorial Belt and NZ field programmes well underway and the submission for the INSPIRE project (SE Pacific), it was timely to expand the **ChEss priority areas** to new regions. Two major regions were chosen, in relation with the *ChEss* original objectives as well as developing international activities. The first new key area is the **Polar region**, including the Antarctic and the Arctic. A 5 year UK programme, *ChEsSo* (PI: Paul Tyler, NOCS) has been funded by NERC (2008-2011) to work on the Scotia Arc and Bransfield Straight. Other proposals have also been submitted (e.g. Tim Shank) to work in the Antarctic and Arctic regions. The second new region is the **Indian Ocean Ridge system**, where the Indian research community has an exploratory and investigation programme and in which the *ChEss* PI Chris German has been acting as advisor.
- Plans for future years include the development of research programmes in the Brazilian margin, in collaboration with COMARGE.

6. PARTNERSHIPS & COLLABORATION

a. Partnerships

Organization Name	Point-of-Contact (Name)	Nature of Relationship
European Science Foundation	Eva Ramirez-Llodra	EuroDEEP programme (2007-2010)
InterRidge	Colin Devey (IFM-Geomar, DE)	Collaboration in workshops, databases and O&E (Ongoing programme)
Ridge 2000 (NSF, USA)	Donna Blackman (SIO, USA)	Collaboration in workshops, databases and O&E (2004 - onwards)
NOAA – Ocean Exploration Programme (USA)	Steve Hammond (NOAA, USA)	Research funding: NZ & AEB programmes (2006-2007), submission for INSPIRE project (2006)
NERC (UK)	Paul Tyler (NOC, UK)	<i>ChEsSo</i> programme (2007-2011)

DFG - German programme SPP1144. Coordinator C. Devey and biology rep. Nicole Dubilier	Christopher German (WHOI, USA) Nicole Dubilier (MPI, Germany)	Collaborations in South and North MAR research
MoMAR (EC, ESF) MomarNet (EC)	Ricardo Serrão Santos (Univ. Azores, PT) Nicole Dubilier (MPI, Germany)	Collaboration on MAR observatories (2004 – onwards). Co-chair of the InterRidge WG on Monitoring and Observatories. Research training network on hydrothermal vent sin Momar region
OSPAR - MASH	Ricardo Serrão Santos (Univ. Azores, PT)	Member of the Portuguese to MASH WG. Contact point for OSPAR on the monitoring and assessment of the priority habitats “Oceanic Ridges with Hydrothermal Vents” and “Seamounts”
WG on Deep Sea Research (Ministry of Science, Portugal)	Ricardo Serrão Santos (Univ. Azores, PT)	Chair
International Seabed Authority	Adam Cook (ISA, Jamaica)	Developing collaborations on deep-sea management issues
HERMES (FP 6, EC)	Myriam Sibuet (Ifremer, FR) and Antje Boetius (MPI, DE)	Research on cold seeps and anoxic microbial systems (2005-2009)
DEEPSETS – MARBEF (FP 6, EC)	David Billett & Paul Tyler (NOC, UK)	Links on data gathering and PhD project (2005-2009)
Biological Response to Catastrophic Disturbance on the Aleutian Margin (WC NURC, USA)	L. Levin (SIO, USA)	Biological and biochemical information on cold seep ecosystems (2004-2006)
Metazoan life at extreme sulphide concentrations: ecology and evolution of Dorvilleidae at methane seeps (NSF & WC NURC, USA)	L Levin (SIO, USA)	Biological and biochemical information on cold seep ecosystems (2004-2007)
Biogeography and community structure in mussel beds at Pacific vents (NSF, USA)	CL Van Dover (College of William and Mary, USA)	SEPR study links with INSPIRE. Lau-Fiji study links with NZ region (2005-2006)
Submarine Ring of Fire Exp. Mariana Fore arc. NOAA-OE (USA) & NSERC (CA).	A. Metaxas (Dalhousie Uni., CA) B. Embley (USA), Tunnicliffe, Juniper & Dower (CA) Co-PIs	Study of hydrothermal active seamounts (April 2004 & May 2006)

Chilean margin cold seeps (Chilean Govt. & SIO, USA)	Javier Sellanes (COPAS, Chile), Lisa Levin (SIO, USA)	Biology of Chilean cold seeps – description of new bivalve species
BOA O/DiWOOD: sunken wood and associated organisms (CNRS/ INSU / IRD, FR/ MPI)	F. Gaill (CNRS, FR) A. Boetius, N. Dubilier (MPI, Germany)	Chemosynthetic fauna on sunken wood (2003-2006) DiWood 2006-2009
FWF Austrian Science Foundation	M. Bright (University of Vienna, Austria)	Community study of hydrothermal vent meiobenthos from 9°50'N EPR.

b. Links to Other CoML Ocean Realm Projects

Project Name	Cross-Over Person(s)	Nature of Relationship
MAR-ECO	R. Santos (Uni. Azores, PT), A. Gebruk (P.P. Shirshov Inst. Oceanology, RU)	Research on Mid-Atlantic Ridge Ecosystems DESEO group (O&E)
COMARGE	C. Smith (Uni. Hawaii, USA)	Research on cold seep and other reducing ecosystems on margins DESEO group (O&E)
CeDAMar	P. Martinez (contact) (DZMB, DE)	DESEO group (O&E)
CenSeam	A. Rowden (NIWA, NZ)	Research on hydrothermal active seamounts DESEO group (O&E)
CAML	Lucia S Campos (Federal University of Rio Janeiro, BR)	Research on Antarctic chemosynthetic ecosystems through SEASOAM and MABIREH*
ICoMM	A. Boetius (MPI, DE)	Research on chemoautotrophic and other vent/seep microorganisms

*MABIREH (*Marine Antarctic Biodiversity in Relation to Environmental Heterogeneity at Admiralty Bay, King George Island, and adjacent areas at the Bransfield Strait*) is a project proposal submitted to CNPq in June 2006. This project involves most biological components that will complement the SEASOAM project.

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

NRIC	Liaison or Cross-over personnel	Nature of Relationship
Australia		
Canada	Anna Metaxas	Links with Canadian CoML
Caribbean		

China		
Europe	Eva Ramirez-Llodra (CSIC); Bhavani Narayanaswamy' Nicole Dubilier (SSC)	Link with EuroCoML for EuroDEEP and DESEO O&E activities
Indian Ocean	Loka Bharathi (NIO, Goa)	Link with Indian Ocean <i>ChEss</i> field programme
Japan	Yoshihiro Fujiwara (JAMSTEC)	Representation for chemosynthetic research on NW Pacific
South America	Luiz A P Gamboa and Lúcia S Campos	Brazil Margin chemosynthetic investigation & Brazilian Antarctic Programme*
Sub-Saharan Africa		
USA		

d. Liaisons to CoML Cross-Cutting Groups

Project Name	Liaison Name & Institution	Nature of the Relationship
OBIS	Eva Ramirez-Llodra (ICM-CSIC)	Database manager
HMAP		
FMAP	Maria Baker (NOCS)	Liaison – started discussions with D. Tittensor
SCOR Tech Panel		
E&O	Maria Baker (NOCS)	E&O liaison
Barcoding	Cindy Van Dover (Duke)	Barcoding PI for <i>ChEss</i>

e. Effectiveness of the Partnerships and collaborations

- **Cross-Cutting Groups:** The links with OBIS have allowed *ChEss* to develop ChEssBase and to integrate it with OBIS. This work is ongoing and we believe that close links with OBIS are essential for further developing and updating of ChEssBase capabilities.

The links with the E&O group have been extremely beneficial to *ChEss* since the project started in 2002, providing help and guidance with the E&O activities and proposals that *ChEss* has developed.

The links with the Barcoding group have just been initiated and *ChEss* had a Barcoding meeting during the 11th Deep-Sea Biology Symposium in Southampton in July 2006. Cindy Van Dover took the lead in this component of *ChEss* and will link closely with the Barcoding Group for future developments.

- **NRICs:** The relationships established between *ChEss* and EuroCoML have been very beneficial in terms of developing and establishing the EuroDEEP programme, which published a Call for Proposals in March 2006 and will start running in spring 2007 for 3

years. EuroCoML also played an active role during the foundation of DESEO, and indeed funded our first meeting in Southampton, January 2007.

- **Ocean Realm Projects:** The E&O liaisons with the deep-sea CoML projects (MAR-ECO, COMARGE & CeDAMar) have been excellent and resulted in the creation of the DESEO group in early 2006. The joint efforts developed by this group in term of outreach and education activities will maximise our efforts and we believe it will result in better and more efficient public activities. It will also help to increase awareness about the deep-sea ecosystem as a whole.

In terms of research, *ChEss* and COMARGE are in the process of developing common efforts in the Atlantic Equatorial Belt region in relation with the Fondation Total – CoML funding agreement (2006-2009).