

# Minutes from the BALTIC GAS kick-off workshop at the Max Planck Institute for Marine Microbiology, Bremen, Germany, February 4 – 6, 2009

Rapporteur: Henrik Fossing

Enclosed documents (comprising PowerPoint files (i.e. ppt) and handouts (pdf-files)) are snail-mailed to you together with the photo of the kick-off workshop participants.

## BALTIC GAS – a research programme in BONUS – overview

### Major research challenges and scope of BALTIC GAS

...was presented by Bo Barker Jørgensen, who summarized the general goals of the project and outlined its structure and strategy.

- 01. BALTIC GAS overview (BBJ).ppt
- 01. BALTIC GAS Full Research Plan.pdf
- 02. Best et al. EOS vol 87 213-220.pdf

Information about BONUS EEIG data policy, reporting guideline, Ph.D courses and Consortium Agreement was presented by Henrik Fossing

- 02. BONUS EEIG (HFO).ppt
- 03. BONUS+ scientific reporting guidelines.pdf
- 04. Call for joint training proposals.pdf
- 05. BONUS EEIG data policy.pdf

## BALTIC GAS science plan in detail

### Integrating institutional research into BALTIC GAS

Henrik Fossing gave a short overview of two "related" BONUS programs: HYPER and INFLOW as also presented at the BONUS Portal homepage: [http://www.bonusportal.org/research\\_projects](http://www.bonusportal.org/research_projects) and [http://www.bonusportal.org/research\\_projects](http://www.bonusportal.org/research_projects), respectively.

The PIs presented their institutional research plans with special emphasis on the research obligations and deliverables. The presentation pointed to areas in the Baltic Sea of particular interest.

Bo Barker Jørgensen/ Henrik Fossing, Center for Geomicrobiology/ National Environmental Research Institute, Aarhus University

- 03. Cfg and NERI research (BBJ).ppt

Tim Ferdelman, Max Planck Institute for Marine Microbiology

- 04. MPI research (TF).ppt

Volker Brüchert, Department of Geology and Geochemistry, Stockholm University

- 05. IGG research (VB).ppt

Daniel Conley, Department of Geology, Lund University

- 06. LU research (DC).ppt

Nikolay Pimenov, Winogradsky Institute of Microbiology, Russian Academy of Sciences

- 07. INMI RAS research (NP).ppt

Zygmunt Klusek, Institute of Oceanology, Polish Academy of Science

- 08. IOPAS research (ZK).ppt

Gregor Rehder, Baltic Sea Research Institute Warnemünde

- 09. IOW research (GR).ppt

Volkhard Spieß, Department of Geology, University of Bremen

- 10. GeoB research (VS).ppt

Jørn Bo Jensen / Ziad Al-Hamdani, Geological Survey of Denmark and Greenland  
11a.GEUS research (ZAH).pptx  
11b.GEUS research (JBj).ppt

Michael Schlüter, Alfred Wegener Institute for Polar and Marine Research  
12.AWI research (MS).ppt

Pierre Regnier / Andy Dale, Department of Earth Sciences, Utrecht University  
13. DESUU research (PR).ppt

## **BALTIC GAS administration**

**The BALTIC GAS Steering group** was presented by Bo Barker Jørgensen. The steering group comprises the lead partners of the five work packages.

- Bo B. Jørgensen ( CfG) and Henrik Fossing (NERI)  
WP1: Project management, coordination and dissemination
- Jørn Bo Jensen (GEUS)  
WP2: Data mining and GIS mapping
- Gregor Rehder (IOW)  
WP3: Gas and seismo-acoustic mapping
- Tim Ferdelman (MPI)  
WP4: Biogeochemistry
- Pierre Regnier (DESUU)  
WP5: Modelling and data integration

### **Day to day coordination of BALTIC GAS**

Bo Barker Jørgensen expressed his enthusiasm about the cooperation to the PIs during the application process and encouraged to a continued constructive dialogue between the coordinators PIs, WP leaders and scientific team. This is of major importance to secure the success of BALTIC GAS.

A BALTIC GAS Webpage [www.biology.au.dk/BALTICGAS](http://www.biology.au.dk/BALTICGAS) was 'presented' (i.e. discussed). The construction will be comparable to the METROL webpage (see [www.metrol.org](http://www.metrol.org)) and administration will be done under Department of Biological Sciences, Aarhus University – Web manager: Irene Harder Tarpgaard, Center for Geomicrobiology, Aarhus University (DK).

### **Scheduling meetings and workshops during BALTIC GAS**

Six meetings/ workshops are planned to be organized in shifting partner countries and hosted by the PI. Following BALTIC GAS meetings and workshops are planned

2009 spring	Bremen (Germany): kick-off meeting
2009 fall	Warnemünde (Germany): cruise planning - Poseidon/ Oceania 2009 in particular
2010 spring	Askö (Sweden)
2010 fall	Kaliningrad (Russia)
2011 summer	8th Baltic Sea Science Congress 2009 (unknown location): BALTIC GAS special session will be applied for
2011 (late fall)	Aarhus (Denmark), round-up, stakeholders, managers and end-users to be invited

#### OTHER MEETINGS

The seismic group plans a 1½ days meeting in Copenhagen (organized by Jørn Bo Jensen) early June 2009 to discuss (old) data from working areas in Bornholm and Arkona Basin.

BALTIC GAS scientists are also encouraged to participate in the 10<sup>th</sup> International Conference on Gas in Marine Sediments, August 2010, in Irkutsk (Russia).

Please note that participation in all meetings and workshops are on the participants own expense. However, the hosting PI is encouraged to apply for external money to organize the meeting (if possible).

**Communication to stakeholders, managers and end-users** is of importance to the scope of BONUS. BALTIC GAS PIs were asked to consider active partners from their countries and how to address the non-participating states: Finland, Estonia, Latvia, and Lithuania. Ziad Al-Hamdani (GEUS) and Daniel Conley (LU) will assist in the communication process to the stakeholders. The BALTIC GAS scientists agreed that communication to stakeholder etc. will benefit from coordination with other BONUS projects.

## Research cruises and field work

### Discussion and priorities of research areas in the Baltic Sea

The discussion of research interest pointed to

- ... deep basins, river fans and pock mark areas (as also outlined in the application)
- ... a salinity gradient from Skagen to the Bothnian Bay was of particular interest to all BALTIC GAS institutions
- ... a transect from shallower Holocene mud (with no gas) to thicker mud layers with CH<sub>4</sub> deposits in both high and low salinity regimes (e.g. Arcona Basin and Bothnian Bay, respectively). Study should be coupled to measure of orgC and age (<sup>14</sup>C- dating). An alternative to Bothnian Bay is Bothnia Sea with at much higher sedimentation rate.
- ... Himmerfjärden - eutrophication gradient from bottom of fjord towards the Baltic Sea
- ... budget and process studies should be performed in already known geographical areas – if possible along the Skagen/ Bothnian Bay transect. If necessary the transect should be split up between more cruises
- ... the gas seepage area in northern Gdansk basin where pock marks are also present. Note that all data on pock mark areas are not necessarily mapped – e.g. data obtained by RV PROFESSOR SHTOKMAN. Also Zygmunt Klusek has information about pock marks in Gdansk Bay
- ... intercalibration and testing of geophysical equipment in different sediment types
- ... Bornholm Basin, Arcona Basin, and Mecklenburger Bay as interesting because of large areas with gas accumulation that will be studied during student courses and thus add further to the physical information of Holocene sediment

Based on the discussion the following **geographical areas** will be **covered during BALTIC GAS**:

Mecklenburg Bay, Arkona Basin, Bornholm Basin, Stolpe Channel, Gdansk Bay, Gulf of Finland (with Vyborg Bay), Gulf of Bothnia (i.e. Bothnian Bay in particular), Himmerfjärden, Aarhus Bay (i.e. METROL station M5), an approx. 1100 nautical mile long transect from Kattegat to the Bothnian Bay (i.e. Baltic Sea Grand tour).

See also map (in two sizes): 06a.BALTIC GAS (Baltic Sea map A4).pdf or 06b.BALTIC GAS (Baltic Sea map A3).pdf

### Presentation of research vessels

An overview of available research vessels and their performance in BALTIC GAS research was given. The presentations focused on ship size, deck space, lab capacity (i.e. size), equipment (e.g. coring device and seismic equipment), suitability for seismic and sediment gear, strength of cranes and cables (length and thickness) to pull out 4-6 m gravity cores etc.

RV GUNNAR THORSON (Henrik Fossing)  
Rental prize: 3.000-14.000 € per day (lessee dependant)  
Gunnar Thorson.ppt  
Gunnar Thorson.pdf

RV PROFESSOR SHTOKMAN (Nikolay Pimenov)  
Rental prize: 10.000 € per day  
Professor Shtokman.ppt  
Professor Shtokman.pdf

RV OCEANIA (Zygmunt Klusek)  
Rental prize: 3.000 € per day  
Note: limited GC length of up to 3 m  
Oceania.ppt

RV POSEIDON and RV PROFESSOR ALBRECHT PENCK (Gregor Rehder)  
Rental prize – Poseidon: 10.000 € per day, Penck: 3.000 – 6.000 € per day  
Poseidon and Penck.ppt

RV HEINCKE/ ALKOR (Volkard Spiess)  
Rental prize: 3.000 € per day?  
Heincke and Alkor.ppt

**Workgroups on sediment survey (i.e. seismic measurement)** headed by Gregor Rehder (WP 3 leader) and **biogeochemistry (i.e. sediment sampling and analyzing)** headed by Tim Ferdelman (WP 4 leader)

The two groups discussed the research to be done at the selected research areas. This also comprised how the survey/ sediment sampling should be performed, the equipment needed, time frame for the in field research, participating scientists, analyses of data and sediment, data handling and transfer to database.

**Biogeochemistry** (Tim Ferdelman)

Measurements to be performed at the **air-water interface** (IOW + IGG):

- fluxes of CH<sub>4</sub> (flux chamber opportunistic)
- water column CH<sub>4</sub> concentration ( $\delta^{13}\text{C-CH}_4$ ,  $\delta\text{D-CH}_4$ )
- salinity, temperature and wind data (i.e. direction and strength)
- ferrybox
- Niskin-CTD (use of continuous pump-CTD requires 2-3 people onboard)

Water samples should be taken on all sampling sites (IOW-IGG provide bottles + protocol for sampling (Jens Schneider von Deimling))

Measurements to be performed in **bottom water** (AWI):

- Water is sampled by use of AWI's bottom water sampler and/ or from the water phase in MUC-core liner. Routine measurements of O<sub>2</sub>, SO<sub>4</sub><sup>2-</sup>, CH<sub>4</sub>, H<sub>2</sub>S,  $\delta^{13}\text{C-DIC}$

Measurements to be performed in the **sediment** (CfG, NERI, MPI, INMI RAS, IGG, LU):

**Routinely** measured parameters in top 30 cm of MUC sampled sediment (4 cores necessary):

- temperature, pH
- pore water: CH<sub>4</sub>, SO<sub>4</sub><sup>2-</sup>, H<sub>2</sub>S, DIC/ total alkalinity and Cl
- solid phase: porosity/density, org.C, Fe, Mn and <sup>210</sup>Pb.
- One (backup/ archive) sediment core should be sliced and frozen.

A sediment sampling protocol (with reference to METROL) to be written by IGG and MPI comprising parameter measured routinely in MUC and GC-cores (reg. the latter see below: Routinely measured parameters in GC-cores). The sampling protocol is to be used on each BALTIC GAS cruise as one group should be responsible for the routine measurements.

Question to be answered:

- Which institutions have access to a MUC?
- HYPER: Is H<sub>2</sub>S exchange measured in anoxic waters. PW profiles measured in HYPER must be checked with Caroline Slomp (Utrecht University) who does PW and solid state sediment sampling (coordination necessary)

Non-routine measurements performed on MUC sampled sediment (to be discussed prior to cruises):

- O<sub>2</sub>-uptake (as measure/ proxy for total C-flux)
- process rates: SRR, AOM, and methanogenesis (<sup>14</sup>C-Acetate and <sup>14</sup>CO<sub>2</sub> labelling)
- $\delta^{13}\text{C-DIC}$ ,  $\delta^{13}\text{C-CH}_4$
- orgC
- in situ pore water sampling by AWI
- major ions and if possible H<sub>2</sub>
- <sup>14</sup>C dating and <sup>14</sup>C-CH<sub>4</sub> age determination

Routinely measured parameters in GC-cores (2 cores necessary):

- temperature, pH
- pore water: CH<sub>4</sub>, SO<sub>4</sub><sup>2-</sup>, H<sub>2</sub>S, DIC/ total alkalinity and Cl
- solid phase: porosity/density, org.C, Fe, Mn and <sup>210</sup>Pb, <sup>14</sup>C dating
- backup/ archive sediment should be sampled and frozen

- second core for sediment description, stratigraphy, XRF-scanning (Stockholm), magnetic scanning

GC to be provided by MPI and/ or CfG

*Non-routine measurements performed on sediment from gravity corer (GC), Niemistö corer or Rumohr corer, vibro corer, and autoclave piston corer:*

- process rates: SRR, AOM, and methanogenesis ( $^{14}\text{C}$ -Acetate and  $^{14}\text{CO}_2$  labelling)
- orgC
- major ions and if possible  $\text{H}_2$
- $^{14}\text{C}$  dating and  $^{14}\text{C}$ - $\text{CH}_4$  age determination
- $\text{CH}_4$ :Ar: $\text{N}_2$ -ratio
- stable isotopes of carbon compounds (i.e.  $\delta^{13}\text{C}$ -DIC,  $\delta^{13}\text{C}$  $\text{CH}_4$ , and  $\delta^{13}\text{C}$ Org) and sulfur compounds (i.e.  $\delta^{34}\text{S}$  $\text{SO}_4^{2-}$ ,  $\delta^{34}\text{S}$ - $\text{H}_2\text{S}$ ,  $\delta^{34}\text{S}$ -AVS and  $\delta^{34}\text{S}$ -CRS).
- accurate  $\text{CH}_4$ -concentration, gas bubble size and distribution in sediment by use of autoclave corer and CT scanning (take up larger space on ship)
- In addition HYPER-scientists have expressed interest in C/N-ratios.

Niemistö or Rumohr corer to be provided by whom? (CfG has a Rumohr corer)

Vibro corer to be provided by IOW and/ or GEUS

Autoclave piston corer and CT-scanner to be borrowed/ chartered from G. Bohrmann by CfG.

### **Seismic measurements** (Gregor Rehder)

(see also 14.Seismic measurements (work group).ppt)

Themes discussed by the work group

- Data mining
  - typical areas versus hot spots
  - good system overarching data for both
  - possible to agree on "specific lines" where all different seismic methods are used
  - use existing data to define "representative" as well as "hot spot lines"
- Defining scientific questions
- Important parameters
  - bubble size distribution and concentration as a function of
    - Lithology
    - sedimentation rate
    - Etc.
- Logistic constraints – some comments made by participants
  - use of thermal measurements (Uni Bremen) only in Mecklenburger Bight
  - or bring to areas were felt essential
  - CT on autoclaved cores to get gas size and distribution ....
  - instrumentation partly overlapping, but often complementary
  - THIS PROJECT CAN NOT BE ABOUT DATA COVERAGE
  - Data compilation to be done early
  - Arkona Basin and Bornholm Basin could gain from joined forces
  - Bubble size distribution measurements
- Additional work to be included in already scheduled cruises comprising
  - Alkor in October 2009
  - Oceania Nov
  - Poseidon Dec
    - "nearly overlap" of Oceania and Poseidon cruises, but potential to define one or two areas of "repeated" and complimentary work
    - ARKONA Basin
      - ◇ agree on „characteristic line“ for the Arkona Basin
      - ◇ Agree on „ hot spot line“ for the Basin
    - Same duty for Bornholm Basin

In all areas – need for good bathymetry and interpretation of backscatter data

- Workshops on key areas and data mining
  - Arkona Status and Data meeting (early June see Scheduling meetings and workshops during BALTIC GAS above)
    - Arkona and Bornholm Basin - data base as far as possible
    - method comparison, outcome, and theoretical understanding

## Cruise planning

### **BALTIC GAS 2009 cruises in overview**

<i>Date</i>	<i>research vessel</i>	<i>Locality</i>	<i>chief scientist</i>
Feb. 20-26	RV OCEANIA	<ul style="list-style-type: none"> <li>Gdansk Basin - Polish EZ (seismic measurements)</li> </ul>	Zygmunt Klusek (IOPAS)
May/ June	"local ship"	<ul style="list-style-type: none"> <li>Himmerfjärden (Sweden) (eutrophication gradient)</li> </ul>	Volker Brüchert (IGG)
Summer	RV PROFESSOR STOCKMAN	<ul style="list-style-type: none"> <li>Russian EZ</li> </ul>	Nikolay Pimenov (INMI RAS)
Oct. 9-18	RV ALKOR	<ul style="list-style-type: none"> <li>Arcona Basin (seismic course)</li> </ul>	Volkard Spiess (GeoB)
Nov. 5-16	RV OCEANIA	<ul style="list-style-type: none"> <li>Gdansk Basin + Stolpe Channel (both in Polish EZ)</li> <li>Bornholm Basin (seismic measurements)</li> </ul> <p><b>4-5 berths for BALTIC GAS</b></p>	Zygmunt Klusek (IOPAS)
Nov. 27- Dec. 21	RV POSEIDON	<ul style="list-style-type: none"> <li>Stolpe Channel (Swedish EZ)</li> <li>Bornholm Basin</li> <li>Arcona Basin</li> <li>Mecklenburg Bay (seismic measurements)</li> </ul> <p><b>3-4 berths for BALTIC GAS</b></p>	Rodolf Endler

### **Planned and tentative cruises**

**Mecklenburg Bay, Arkona Basin and Bornholm Basin** – Western Baltic Sea with thick layers of Holocene mud with CH<sub>4</sub> diffusive and gassy sediments.

Expression of interest to participate in cruises to this area: Cfg, NERI, MPI, IGG, IOPAS, IOW, GeoB, GEUS

Study of

- water column chemistry
- sediment-water fluxes
- sediment biogeochemistry (long cores)

Oct. 9-18 2009	RV ALKOR	Arcona Basin (seismic course)
Nov. 5-16 2009	RV OCEANIA	Bornholm Basin (seismic measurements) 4-5 berths available for BALTIC GAS Participation: to be determined
Nov. 27- Dec. 21 2009	RV POSEIDON	Bornholm Basin, Arcona Basin, Mecklenburg Bay (seismic measurements) 3-4 berths available for BALTIC GAS Utrecht will propose sampling sites! Participation: MPI, Cfg, IGG
Sept./Oct. 2010	RV ALKOR	Arcona Basin (seismic course)

Spring 2011	RV GUNNAR THORSON	Bornholm Basin, Arcona Basin, Mecklenburg Bay (biogeochemistry) 12-14 berths available for BALTIC GAS Participation: MPI, CfG, NERI, IGG
<u>other cruises</u>		
July 2009	RV PROFESSOR ALBRECHT PENCK	HYPER (Caroline Slomp, Utrecht University)
May 2010	RV HEINCKE	HYPER (Caroline Slomp, Utrecht University)
	"unknown"	IOW monitoring cruises (mainly CTD)
	RV GUNNAR THORSON	Arcona Basin (NERI monitoring cruises)
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<b><u>Stolpe Channel and Gdansk Bay</u></b> – seep sites and pockmark area.		
Expression of interest to participate in cruises to this area: INMI RAS, IOPAS, IOW, AWI		
Feb. 20-26 2009	RV OCEANIA	pockmark area NW of Gdansk Bay (CTD and seismic measurements)
summer 2009	RV PROFESSOR STOCKMAN	Russian EZ
Nov. 5-16 2009	RV OCEANIA	4-5 berths available for BALTIC GAS Participation: to be determined
Nov. 27- Dec. 21 2009	RV POSEIDON	(seismic measurements) 3-4 berths available for BALTIC GAS Participation: MPI, CfG, IGG
<hr/>		
<b><u>Gulf of Finland and Vyborg Bay</u></b> – Russian EZ		
Participate in cruises to this area: INMI RAS		
summer 2009	RV PROFESSOR STOCKMAN	Russian EZ
<hr/>		
<b><u>Gulf of Bothnia</u></b> – with 2 - 4‰ salinity in Bothnian Bay		
Expression of interest to participate in cruises to this area: Cfg, NERI, MPI, IGG		
2010	Umeå Marine Station (coastguard vessel*)	Bothnian Bay
<u>other cruises</u>		
June 2009	RV ARANDA	HYPER (Maren Voss) 1 berth available
July 2009	RV PROFESSOR ALBRECHT PENCK	HYPER
May 2010	RV HEINCKE	HYPER
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*Rental price: 3.000 SEK per day		

**Himmerfjärden** – Salinity and eutrophication gradient with anoxic bottom water during summer – gassy sediments<sup>W</sup>/bubble ebullition - see also: [www2.ecology.su.se/dbHFJ/index.htm](http://www2.ecology.su.se/dbHFJ/index.htm)

Expression of interest to participate in cruises to this area: Cfg, MPI, IGG, AWI

May/ June      “local ship”  
2010

2010            “local ship”

**Aarhus Bay** (i.e. METROL station M5) - a shallow CH<sub>4</sub> zone; <30 cm below sediment surface

AWI has expressed interest to participate in cruises to this area and deploy in situ instruments to check seasonal variation in methane depth.

Cruises with RV Genetica or SF Henry planned 1-3 times per year

**Baltic Sea Grand tour** – an approx. 1100 nautical mile long transect (salinity gradient) from Kattegat to the Bothnian Bay

Expression of interest to participate in cruises to this area: Cfg, NERI, MPI, IGG, LU, INMI RAS, IOPAS, IOW, GeoB, GEUS, AWI, DESUU

September    RV GUNNAR THORSON  
2010

2011            RV MERIAN

#### PLEASE NOTE

- an INFLOW, HYPER and BALTIC GAS cruise coordination meeting was organized in Helsinki, February 10 2009 (i.e. immediately after the BALTIC GAS kick-off meeting). Jørn Bo Jensen participated on behalf of BALTIC GAS. The minutes from this meeting (listing additional cruises) is attached (07.Bonus Cruise coordination.pdf)
- a BONUS CRUISE CALENDAR comprising planned BONUS Projects cruises has been initiated at the BONUS Portal homepage [www.bonusportal.org/for\\_researchers/cruise\\_calendar](http://www.bonusportal.org/for_researchers/cruise_calendar) – the calendar will be currently updated. If you wish to participate in one of these cruises, please send a message to the mentioned contact person. Updates and additions to this data can be sent to Tiina Tembe, [tiina.tembe@bonuseeig.fi](mailto:tiina.tembe@bonuseeig.fi).

## Data, GIS-mapping and modelling

### Data mining (Jørn Bo Jensen)

An introduction to data mining was given by Jørn Bo Jensen, who also chaired the discussion. There was consensus that data of relevance to BALTIC GAS should all be included in a common data base (e.g. PANGAEA). The BALTIC GAS data base to be constructed should include both new data, existing GIS-data, data from other BONUS projects (HYPER and INFLOW in particular), as well as mined data. Content of the data base should include, but not necessary be limited to

- methane data comprising concentration, production (i.e. methanogenesis), and anerobic oxidation of methane (i.e. AOM)
- biogeochemical data (e.g. organic content, sedimentation rate, degradation rates like sulfate reduction rates, etc.)
- sediment/ mud texture (i.e. grain size, thickness of e.g. Holocene layer)
- seismic lines/ profiles
- location of pock marks and other gas escape structures

Regarding data mining, the BALTIC GAS data base will primarily be based on data searched and compiled from national data-bases as it is considered difficult to get access to and obtain seismic data from the scientific community not participating in BALTIC GAS. Also sediment data obtained

during marine construction projects (i.e. pipe line, wind mill farms, bridges etc.) are considered difficult to include in a BALTIC GAS data base as these data most probably are in the possession of the entrepreneur and thus kept confidential. However, addressing potential development companies should be attempted.

There was general agreement that the exorbitant 'number of data points' sampled during seismic measurements will be difficult to encompass in the data base. Thus, an alternative presentation of such data must be considered, e.g. by presentation on maps (see discussion below).

Jørn Bo Jensen presented a list of national representatives to be contacted (see 15a. Data mining(JBJ).ppt). These institutions are expected to be able to contribute with data to the BALTIC GAS database. The PIs were encouraged to take the lead in this contact to their national representative(s) to secure the delivery of the requested data.

Bo Barker Jørgensen showed an example of sediment data presentation from the SMaRP Database (i.e. Sulfate, Methane and Related Parameters) as constructed by Natascha Riedinger (MPI) using FileMaker (see 15b. Data mining(BBJ).ppt).

Jørn Bo Jensen (in cooperation with Michael Schlüter) agreed to write a manual how to organize the data mining – both seismic and geochemical. The manual should state the parameters to include in the data base and how to approach the data holders/ owners (in particular in Finland, Estonia, Latvia, and Lithuania). Further the manual must define how to format and transfer data to the data base PANGAEA (see discussion below) and currently how to present data by GIS-mapping. The manual should be send to BALTIC GAS PIs for their action.

#### **Use of database PANGAEA for geochemical data** (Michael Schlüter)

Several examples of data presented on GIS-maps were given (see 15c. Data mining (MS).ppt). However, some of these maps appear quite complex and hence there was general agreement that maps should be kept simple to the public. More advanced GIS-maps (to the used by BALTIC GAS scientists) will be constructed upon request by Michael Schlüter.

Maps will be constructed based on data from the common data base (e.g. PANGAEA). Ziad Al-Hamdani and Michael are encouraged to discuss the map projection format and agree on a common platform for the map layers and software to use (i.e. ARC/GIS or MAPINFO). The format of (sediment) data to be obtained in PANGAEA is defined by PANGAE. These data should be send to Henrik Fossing who checks data (i.e. format and data quality) and forward data to PANGAEA.

Information to PIs how to export BALTIC GAS data to both maps and PANGAEA should be included in the manual written by Jørn Bo Jensen and Michael Schlüter.

#### **Modelling and presentation of model tools** (Pierre Regnier/ Andy Dale).

Sediment models (i.e. transport-reaction models and predictive models) and modelling scenarios (i.e. hind casts and fore casts) were Presented. With respect to fore cast modelling there was agreement to cooperate with HYPER to use the same prerequisites.

An important "take home" message was that the excellence of modelling depends very much on the quality of parameters sampled. Thus the BALTIC GAS biogeochemists and geologists are encouraged prior to sediment sampling to discuss the sampling strategy with the modellers (i.e. parameters, depth resolution and sampling sites). In this context Andy Dale expressed particular interest to do sediment sampling at a specific station in Bornholm Basin. Also Pierre Regnier presented a prioritized list of parameters to be sampled to support sediment modelling (see next page).

16. Modelling (PR).ppt

Promised, desired or required data to meet modeling objectives <sup>†</sup>	
Step	Comment
CH <sub>4</sub> concentration	Diffusive CH <sub>4</sub> fluxes to the SMTZ
SO <sub>4</sub> <sup>2-</sup> concentration	Diffusive SO <sub>4</sub> <sup>2-</sup> fluxes to the SMTZ / constraint on bioirrigation
H <sub>2</sub> S concentration	Constraint on SR rate and H <sub>2</sub> S losses
? H <sub>2</sub> S flux (benthic chamber)	Direct emission by non-local transport
Fell concentration	Constraint on H <sub>2</sub> S buffering
FellI concentration/flux	Constraint on H <sub>2</sub> S buffering
sedimentary S	net sulfate reduction
DIC concentration	Total carbon oxidation rates / constraint on methanogenesis
ALKALINITY	POM degradation
NH <sub>4</sub> concentration	POM degradation
Chloride	Presence of externally-impressed fluid advection
SO <sub>4</sub> <sup>2-</sup> , H <sub>2</sub> S, O <sub>2</sub> etc bottom water	Required for model boundary condition
O <sub>2</sub> microprofiles	Reactivity of labile POM / DBL thickness
? O <sub>2</sub> flux (benthic chamber)	Bioirrigation, ΣPOC mineralization
N <sub>2</sub> flux (benthic chamber)	Relative importance of denitrification
pH	AB speciation / Correction to carbon oxidation rates by CaCO <sub>3</sub>
Microbial cell numbers	Calculation of maximum turnover rates (for SR and AOM)
C:N:P of POM flux	N, P recycling back to water column
<sup>14</sup> CH <sub>4</sub> incubation	Direct determination of AOM rate
? <sup>35</sup> SO <sub>4</sub> <sup>2-</sup> incubation	Direct determination of SR rate / constraint on POC reactivity
<sup>14</sup> Acetate and H <sub>2</sub> +CO <sub>2</sub> incubation	Direct determination of methanogenesis
<sup>13</sup> DIC and <sup>13</sup> CH <sub>4</sub> concentration	Constraint on methanogenesis and AOM
<sup>14</sup> C dating for POC	Age of gas and transport of gas(?)
? <sup>14</sup> C dating for CH <sub>4(aq)</sub> , CH <sub>4(g)</sub>	Age of gas and origin
<sup>210</sup> Pb <sub>XS</sub>	Sediment accumulation velocity / depth of mixed layer
<sup>137</sup> Cs	Sediment accumulation velocity / depth of mixed layer
Free gas depth and gas volume	Constraint on gas fluxes and predictive algorithms
Acoustic profiles	Depth of free gas and/or hydrate layer
<sup>†</sup> Note that for Holocene reconstruction additional data are required ( <i>link to</i> Task 4.4)	
Will be done (according to proposal and yesterday's discussion)	
Not promised - but desirable	
Not promised - but high necessity	