

Leibniz Institute for Baltic Sea Research Warnemünde

Cruise Report

r/v "Elisabeth Mann Borgese"

Cruise - No.: EMB 046

This report is based on preliminary data

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1. **Cruise No.:** EMB 046
2. **Dates of the cruise:** from 18. May to 31. May 2013
3. **Particulars of the research vessel:**
 Name: "Elisabeth Mann Borgese"
 Nationality: Germany
 Operating Authority: Baltic Sea Research Institute (BSRI) Warnemünde
4. **Geographical area in which ship has operated:**
 Skagerrak, North Sea
5. **Dates and names of ports of call**
 22.-23. May 2013; Bergen; Norway
6. **Purpose of the cruise**
 Pre-site acoustic survey, water column profiling and sediment sampling at sites suitable for reconstructing mid-to late Holocene paleo-environmental changes in the Skagerrak region
7. **Crew:**
 Name of master: Uwe Scholz
 Number of crew: 11
8. **Research staff:**
 Chief scientist: Dr. Thomas Leipe (IOW)

Scientists:	7	Students:
	2	
Engineers:	1	
Technicians:	1	
9. **Co-operating institutions:**
 Bjerknæs Centre for Climate Research; Bergen, Norway
 University of Szczecin, Poland
10. **Scientific equipment**
 CTD-device for hydrographical profiling; Sediment echosounder; Gravity coring devices.
11. **General remarks and preliminary results (including maps and station list)**

The main purpose of the cruise was to take water and sediment samples in three areas in the Skagerrak and Norwegian Trench region which will form the basis of a Polish-Norwegian-German collaboration project "*Climlink*" to be starting in January 2014. This project will focus, amongst others, on the reconstruction of mid-to late Holocene paleo-environmental changes in the Skagerrak/ Norwegian Trench region.

The cruise focussed on three selected areas in the Skagerrak – Norwegian Trench region (A, B, C see figure 1). All hydrographical measurements (CTD profiling), sediment acoustic profiling and water and sediment sampling were performed inside these three areas. The selection of these areas is based on former research cruises, published scientific results

on the marine geology of this area and on previous work conducted by the Norwegian partners.

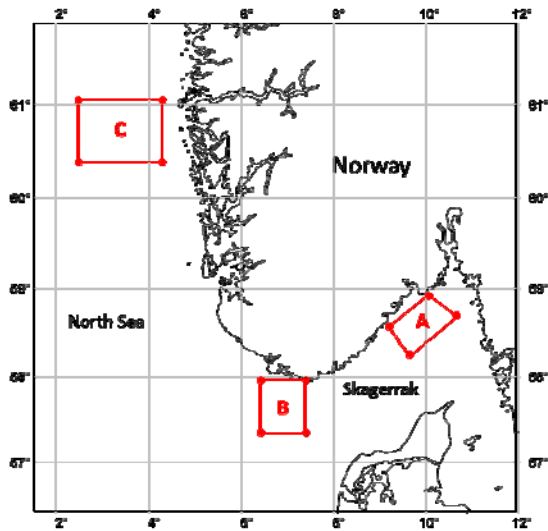


Fig. 1 Work areas A-C during EMB 046 cruise. These areas were notified from IOW for scientific work and approved by the Norwegian authorities.

During the cruise the work schedule in the respective areas was as follows: i.) seismoacoustic profiling to identify key-sites for water and sediment sampling, at key-sites ii.) CTD profiling and water sampling, and iii.) short core and long gravity core sampling.

i.) Sea-bottom sediment acoustic profiling

Sediment acoustic profiling was performed using high resolution parametric echo sounder device SES 2000 from INNOMAR Technology Company. The locations of the profiles in work areas A), B), and C), are shown in Fig. 2.

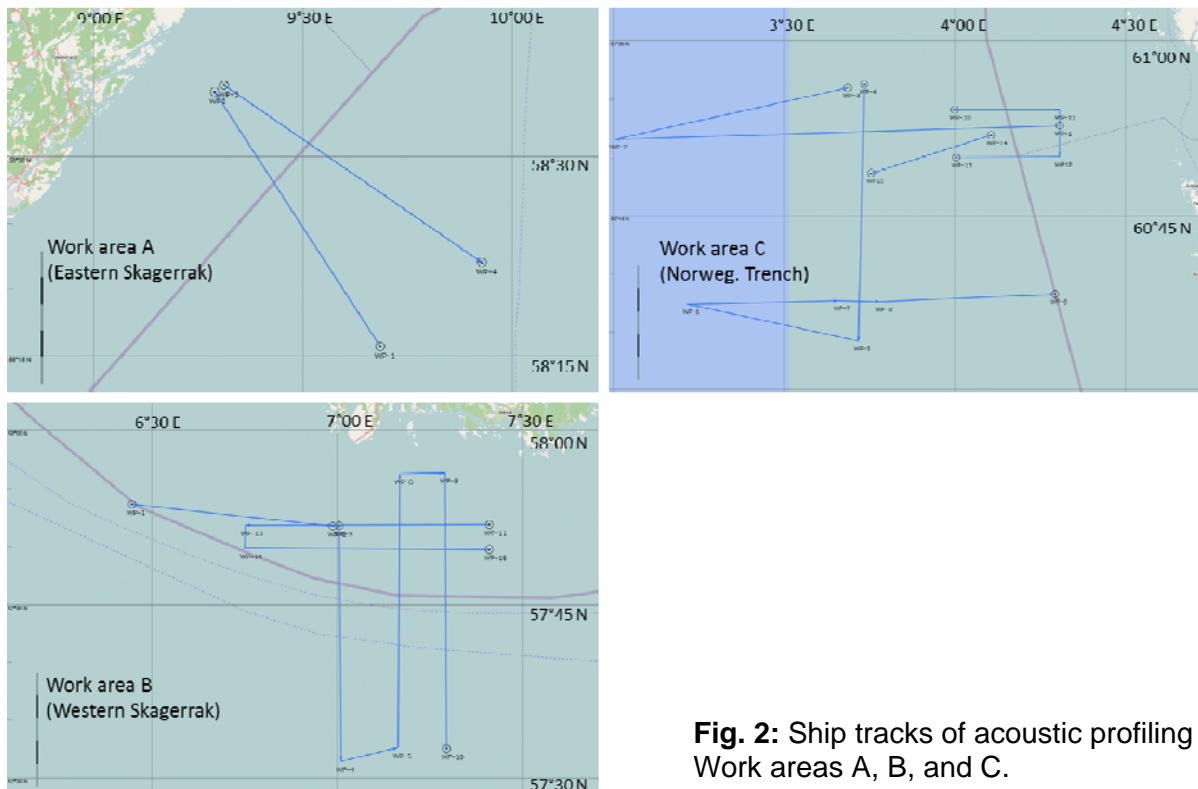


Fig. 2: Ship tracks of acoustic profiling in Work areas A, B, and C.

The aim was to obtain the water and sediment samples at sites with undisturbed mid- to late Holocene sequences for high resolution investigations of paleo-oceanographic changes. From earlier studies we know that the homogenous Holocene silty-mud sediments, our target, overlay the well-stratified late-Glacial (varved clay) / Deglacial sediments. This structural situation is exemplified in Fig. 3 and 4.

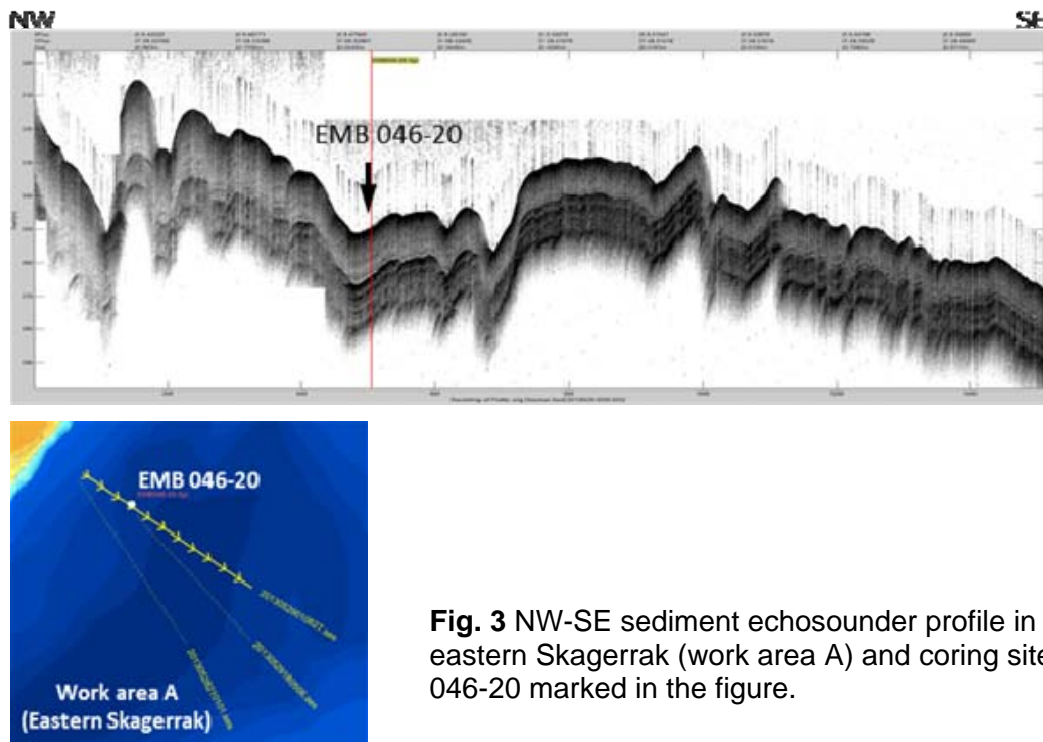


Fig. 3 NW-SE sediment echosounder profile in the eastern Skagerrak (work area A) and coring site EMB 046-20 marked in the figure.

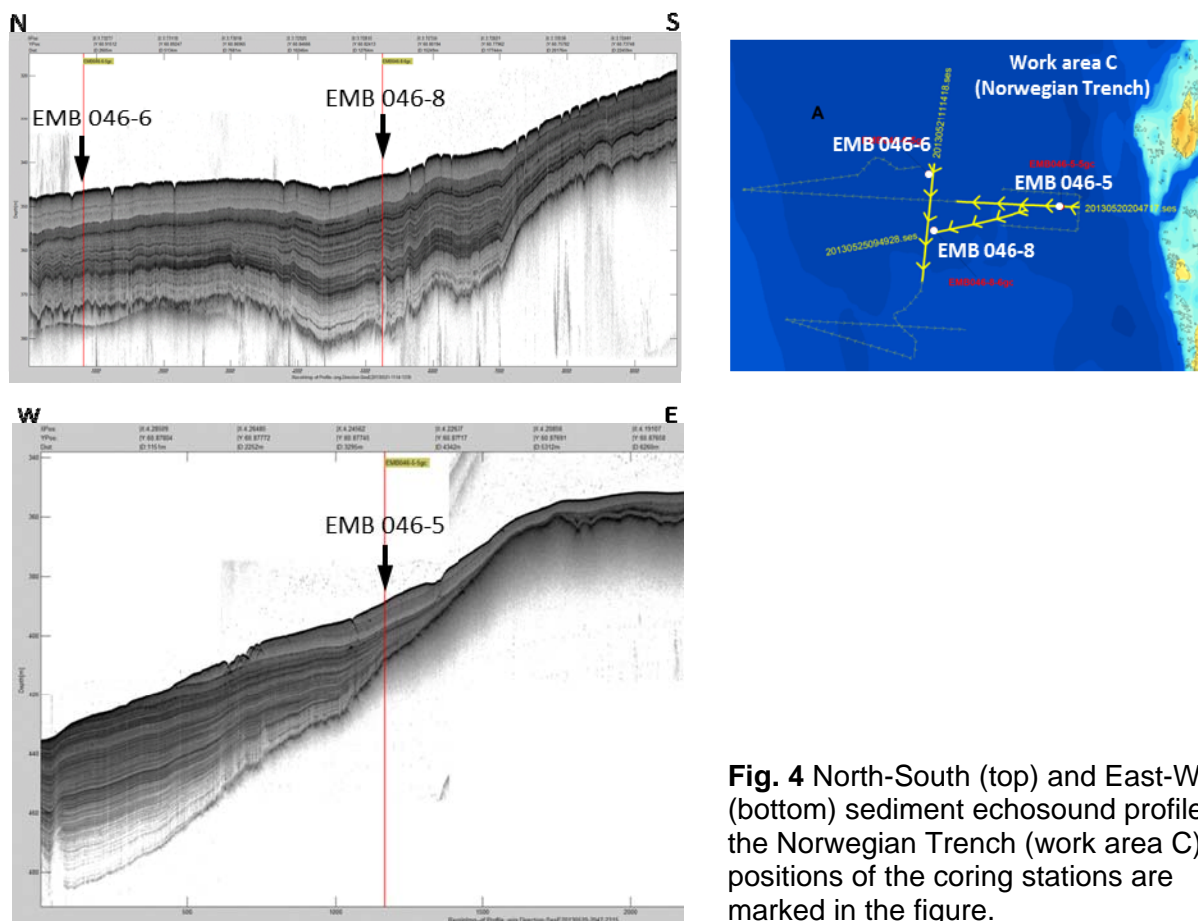


Fig. 4 North-South (top) and East-West (bottom) sediment echosounder profiles in the Norwegian Trench (work area C). The positions of the coring stations are marked in the figure.

ii.) CTD-Profilung (water column)

Hydrographic water column profiling was done at each of the stations during the cruise. The measured parameters are temperature, salinity, oxygen, chlorophyll, and backscatter turbidity. These measurements allow an assessment of different water masses (e.g. near surface outflow of lower saline water from the Baltic Sea) and the occurrence of living phytoplankton in the euphotic zone (e.g. coccolithophorides). Coccoliths are producing organic substances (lipids, alkenone biomarker) which composition depends on the surrounding temperature and salinity. The alkenone biomarker can be used for Holocene paleo-temperature and relative paleo-salinity reconstructions measured on sediment core samples.

CTD profiling examples of two sites (Fig. 5 Eastern Skagerrak – Work area A, Fig. 6 Norwegian Trench – work area C) displaying the typical water column structure in the respective area observed during the cruise are shown here:

Filename:	0014F01
StationsNr.:	0020
StationsBez.:	X_0013 aus .DRIFT.
EinsatzNr.:	0014 01 Operator= Leipe
Zeit (UTC):	13:26:00 29-Mai-13
Position:	GPS: 58 31.5903N 009 29.0907E

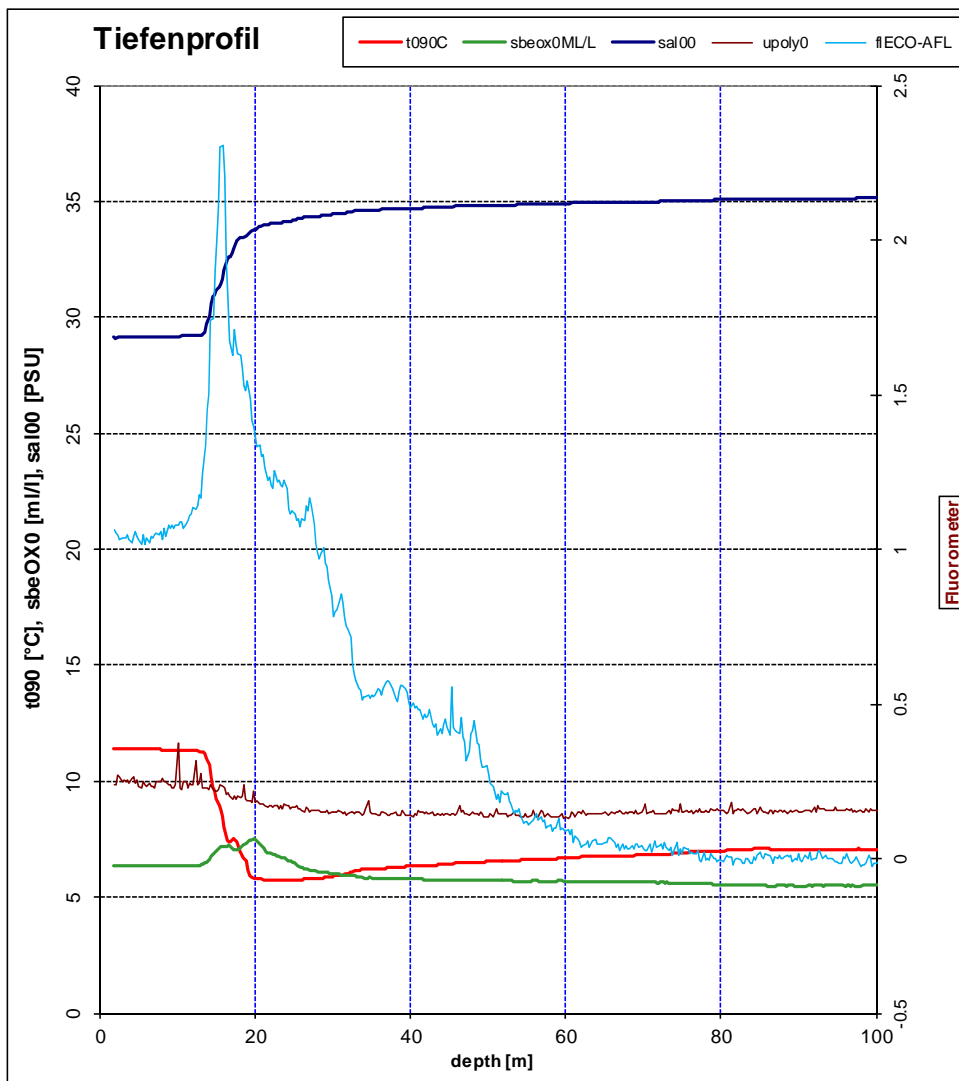


Fig. 5 CTD-profile at site EMB 046- 20 in eastern Skagerrak. The outflowing surface water from Baltic Sea is characterized by lower salinity (dark blue) and higher temperature (red) and overlays marine waters. Maximum chlorophyll (light blue) is observed at the halo-thermocline at about 20 m.

Filename:	0006F01
StationsNr.:	0005
StationsBez.:	X_0005 aus .DRIFT.
EinsatzNr.:	0006 01 Operator= Leipe
Zeit (UTC):	11:24:02 24-Mai-13
Position:	GPS: 60 52.6867N 004 14.1135E

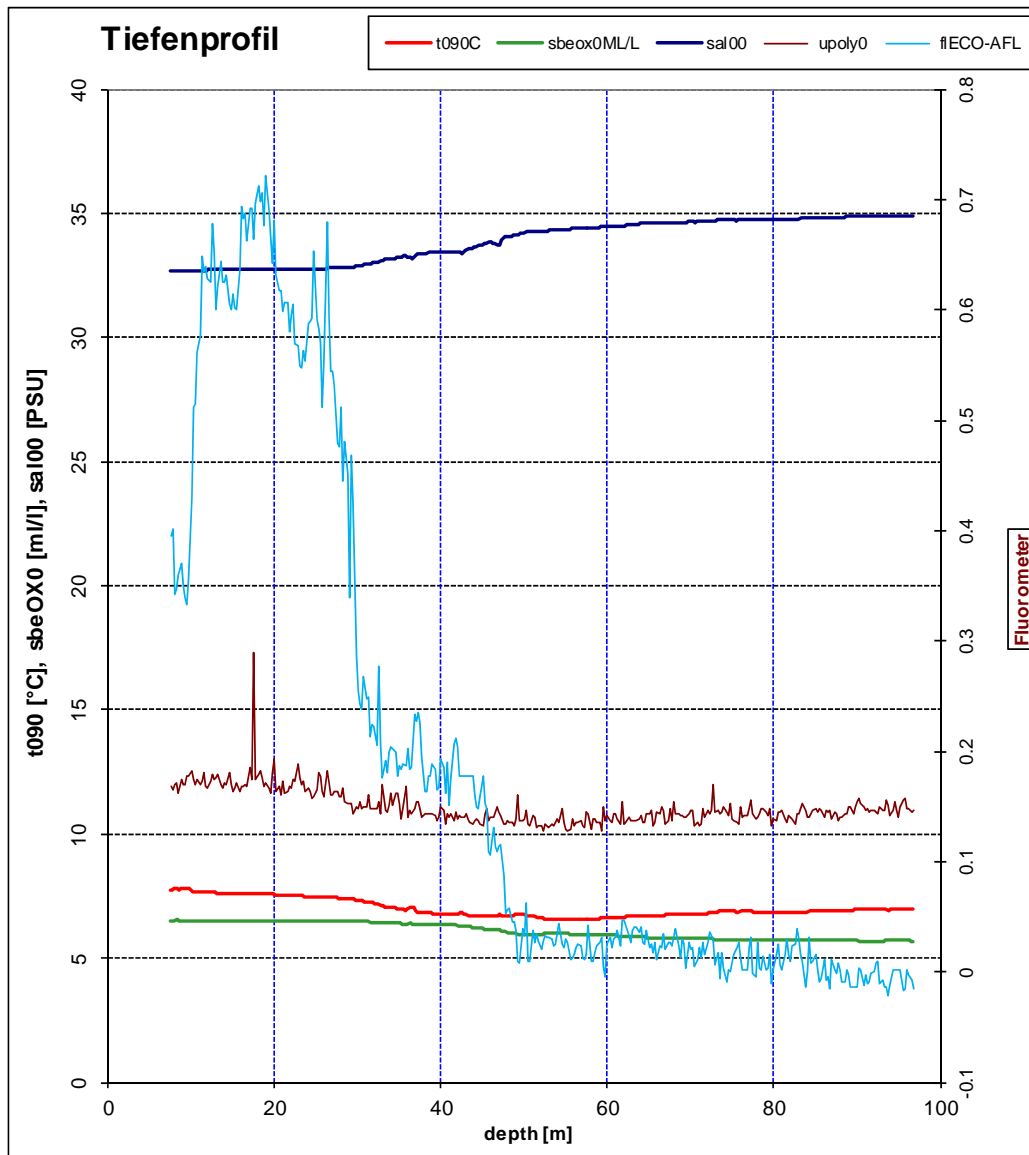


Fig. 6 CTD-profile at Station EMB 046-5 in Work area C (Norwegian Trench). The surface water layer (down to about 50 m) only slightly differs in temperature and salinity from the underlying waters. Only a very weak halo-/thermocline is developed. However, the surface waters are characterized by enhanced plankton activity (chlorophyll A).

Seston filtered from seawater samples taken with the CTD from the euphotic zones will be analysed for plankton community and alkenone biomarker chemistry in our laboratories from January 2014.

iii) Short and long coring (sediment)

The coring sites were selected based on the seismoacoustic profiling results. Suitable coring were sampled using surface sediment multi-corer (MUC) and 6 meter long gravity corer (GC). The acoustically rather homogenous upper unit (up to 10 m thickness) overlaying a section with many reflectors (late Glacial and Deglacial clayey sediments) represents the mid-to late Holocene sequence of interest for our paleo-environmental reconstructions.

The table 1 (list below) provides an overview of all coring stations (long cores and short cores) during the cruise.

In the IOW laboratory, the following measurements are ongoing or will be performed for key-site selection: XRF core-scanning (photographs, radiographs, major elements intensity), magnetic susceptibility measurements and supported by AMS¹⁴C dating key-sites will be selected for the time-consuming geochemical, biomarker (e.g. alkenone temperatures) and micropaleontological proxy analyses to be performed within the international project *Climlink*.

Table 1.: Cruise EMB 046 station-list.						
Date	UTC	Station	North	East	Water Depth	Gear
19.05.2013	09:10	EMB 046-1	58°14.48	09°39.32	540	CTD
19.05.2013	21:45	EMB 046-2	57°20.15	06°26.46	80	CTD
20.05.2013	20:00	EMB 046-3	60°52.73	04°18.40	432	CTD
21.05.2013	08:00	EMB 046-4	60°55.86	03°41.22	342	CTD, MUC
24.05.2013	11:30	EMB 046-5	60°52.69	04°14.11	380	CTD, MUC, GC
24.05.2013	16:29	EMB 046-6	60°54.92	03°43.93	342	CTD, MUC, GC
25.05.2013	06:30	EMB 046-7	60°53.17	04°13.52	380	CTD, MUC
25.05.2013	11:00	EMB 046-8	60°48.68	03°45.19	338	CTD, MUC, GC
26.05.2013	12:48	EMB 046-9	57°51.82	07°00.22	422	CTD
27.05.2013	06:05	EMB 046-10	57°49.75	07°17.62	457	MUC, GC
27.05.2013	11:09	EMB 046-11	57°54.66	07°17.62	297	MUC
27.05.2013	12:20	EMB 046-12	57°53.67	07°17.63	348	MUC
27.05.2013	13:53	EMB 046-13	57°45.10	07°17.63	390	MUC
27.05.2013	14:48	EMB 046-14	57°42.61	07°17.65	353	MUC
27.05.2013	15:49	EMB 046-15	57°38.10	07°17.96	301	CTD, MUC
27.05.2013	17:30	EMB 046-16	57°33.40	07°17.76	259	MUC
28.05.2013	06:04	EMB 046-17	57°49.73	07°23.79	460	CTD, MUC, GC
29.05.2013	06:30	EMB 046-18	58°24.73	09°48.07	534	MUC
29.05.2013	11:00	EMB 046-19	58°27.10	09°41.42	588	CTD, MUC
29.05.2013	13:26	EMB 046-20	58°31.59	09°29.09	532	CTD, MUC, GC

Attached to this cruise report all CTD-profiles (xls format) and sediment acoustic profiles (SEG-Y format) are stored on a separate DVD-CD-rom disc.

Dr. Thomas Leipe (IOW)

Chief Scientist