Cruise report 64PE410

NIOZ Baltic 2016

Texel-Nynäshamn (Sweden)

The 64PE410 NIOZ Baltic 2016 team

May 16th-May 28th

Baltic Sea

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1. Introduction

1.1 Aim and background

This cruise to the Baltic Sea is carried out by scientist from both the Marine Microbiology and Biogeochemistry and the Ocean System Science departments from the NIOZ.

The Baltic Sea is the world's largest brackish body of water with an area of about 377,000 km2 that is partitioned into multiple sub-basins. The Baltic is almost entirely encircled by land with a large freshwater contribution (including precipitation) of 660 km3/yr from a drainage basin that is 1.6 million km2. An inflow of 475 km3/yr of saltwater pours in through the only connection to the North Sea, the narrow Straits of Denmark. The Baltic Sea is a fairly shallow basin and on average only about 54 m deep. The salinity varies greatly in the Baltic Sea ranging from a salinity of ~3.5 in the north to ~8 in the Baltic proper and ~30 in the region where the Baltic connects to the North Sea. A permanent separation between a relatively fresh surface water layer and more saline bottom water (a halocline) exists at about 13-15 m water depth.

The large salinity gradient, especially on the western side of the Baltic though the narrow straits of Denmark is very well suited for calibrating indirect methods to estimate paleo salinity, so called paleo salinity proxies. Especially core top calibrations for various organic and inorganic proxies and linking surface water biological signals to sedimentary information. In order to do these paleo salinity proxy calibrations we will take water samples from various depths, focusing on the sea surface, the photic zone, but including much deeper samples at a few stations for nutrient analysis and to study the biology in these water masses by various methods. Suspended particulate organic matter including Algae, bacteria and archaea are sampled using in situ pumps and sediments will be sampled using a multi-corer.

Since the last deglaciation the Baltic Sea transformed from the freshwater Baltic Ice Lake (± 12600 to10300 years ago) to the slightly brackish Yoldia Sea (± 10300 to 9500 years ago) into the freshwater Ancylus Lake (± 9500-8000 years ago) and then into the brackish Littorina Sea (± 8000 to 3000 years ago). The present Baltic Sea is a continuation of the Littorina Sea, but with a salinity of almost half (a salinity of 7 to 8 in the Baltic proper) that of the Littorina Sea. In the deeper basins of the Baltic Sea, the Arkona, Bornholm and Gotland basins we will take long piston cores that span this entire history or at least a large part of it. These long sediments records will then be used to validate and test the proxies developed based on the core tops from the Denmark Strait.

The separation between the surface and bottom water layers results in reduced mixing and anoxic bottom waters, which is becoming more and more of problem in the Baltic Sea. The relatively limited inflow of saline water through the strait of Denmark results in reduced venting of the bottom waters (mixing due to saline water sinking to the bottom). While the run off of nutrients results in more extensive blooms, especially of cyanobacteria in the Baltic Sea, organic matter of which sinks after death and organic matter remineralization consumes the oxygen in the sediment and bottom water resulting in anoxic conditions. Organic matter remineralization (oxidation) under anoxic conditions results in sulfide and methane production amongst others. Sulfide is highly toxic for higher organisms and methane is a strong greenhouse gas. Studying redox gradients in the water column and especially the sediments, and the microorganisms involved in these different processes, such as methane oxidation for instance, is

also part of this cruise and will take place mainly in the deeper basins. The saltwater intrusions from the North Sea resulting in bottom water venting could a link between the “paleo-proxy” development and application part and the anoxic conditions in the Baltic part of the cruise.

1.2 Team members

1.2.1 Scientific

Marcel van der Meer, MMB, NIOZ	Chief scientist
Alice Webb, OCS, NIOZ	titrations/VINTA/testing new equipment, piston core
Darci Rush, MMB, NIOZ	multicore slicing; aerobic methanotrophy incubations
Fatimah Sulu-Gambari, OCS, NIOZ	porewater/coordination, Oxygen measurements
Gabriella Weiss, MMB, NIOZ	Multi-core, core slicing, pore water alkalinity, piston core
Saara Suominen, MMB, NIOZ	In situ pumps, anaerobic water sampling + help with CTD sampling
Margriet Lantink, OCS, NIOZ	porewater sampling
Rick Hennekam, OCS, NIOZ	porewater sampling
Sigrid van Grinsven, MMB, NIOZ	POC/PON/POP, δD, water-incubation experiments, pore water alkalinity, anaerobic water sampling + help with CTD sampling
Sergio Balzano, MMB, NIOZ	Phytoplankton/bacteria collection & chlorophyll
Judith van Bleijswijk, MMB, NIOZ	POC/PON/POP, δD water, own experiments
Sharyn Ossebaar, OCS, NIOZ	NUTS
Yvo Witte, NMF, NIOZ	Technical support
Jan Dirk de Visser, NMF, NIOZ	Technical support

1.2.2 Crew

Pieter Kuijt	Master
Ewout Adriaans	Able seaman
Len Bliemer	Chief Officer
Wim Jan Boon	Able seaman

Iwan den Breejen	Cook
Roel van der Heide	Able seaman
Roald van der Heide	Electrician
Olga Koster	2nd Officer
Vitali Maksimovs	Steward
Inno Meijer	2nd Engineer
Jaap Seepma	Chief Engineer
Hein de Vries	Able seaman

2. NIOZ Baltic 2016 cruise

Transit

16-05-2016: We left the NIOZ harbor Monday morning at approximately 10:30 for a two day transit to station 1. During transit we organized the lab and tried to get over our seasickness (those that got sick). We arrived at station 1 at 01:00 on Wednesday 18th of May 2016 (local time). During the transits water from the aquaflo system was sampled for water isotope analysis back at the NIOZ, every hour starting on Tuesday 17th of May in the afternoon (section 15).

2.1 Station 1

58°29.76' N 09°35.91' E

Water depth 550m

Multibeam

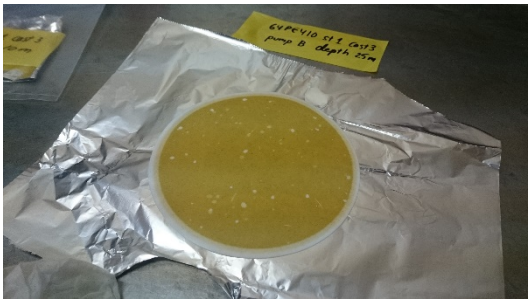
18-01-2016: At 1 am the seafloor was mapped using the multi beam from the bridge. Based on this mapping it was decided the original station coordinates were the best for Station 1.

CTD

At 06:00 we started a CTD cast (St. 1, cast 2) and we profiled the entire water column to 550 meters depth and sampled water from 12 depths, 2 bottles per depth (see CTD sample list, appendix 1), for various nutrients, the carbonate system, chlorophyll, algae and bacteria abundances, hydrogen isotopes etc.

In situ pumps

This shallow in situ pump cast (3) started around 08:00, pumps were deployed at 55, 25 and 10 meters water depth and pumped for 1 hour using 0.7µm GFF filters. Deployment ended around 09:30.



In situ pump filter from 25 meter.

The serial port USB converts we brought did not function, again, possibly because software for multiple of these converters are installed for the same com port resulting in all kinds of issues. We are using a converter and laptop from the Pelagia for programming the in situ pumps.

Multi-core

12 cores were retrieved (cast 4), 8 sliceable and 4 archive cores of approximately 40 centimeters. 4 cores were sliced, 3 for lipid and DNA analysis to 10 centimeter depth, slices of which were stored in the -80 freezer and 1 to 10 centimeter depth the slices of which were stored in Bengal rose in the fridge (4ºC). 1 Archive core was stored at 4 ºC, left over cores were disposed of.

Transit

18-05-2016: At 10 am transit from Station 1 to Station 2 started. During transits sampling for water isotopes continued. Station 2 had to be moved to a slightly different position because the original coordinates fell right in a zone for which it was advised not to anchor, fish or otherwise disturb the bottom. The second problem was that somewhere in our permission from Sweden the 16th of May had turned into the 19th of May, we were granted permission to work in the Swedish EEZ before the 19th, but not their territorial waters. See below for the actual coordinates decided up on and to be confirmed by multi beam mapping.

2.2 Station 2

57º 45.9’ N, 11° 7.0’ E

Water depth 44m

Multi-beam

To get an idea of the seafloor a multibeam map (cast 1) was made from approximately 1.5 miles before to 1.5 miles after Station 2 at approximately 17:00. Due to the limited depth and therefore limited beam width multiple lines were mapped to get a good idea of seafloor topography. Based on the multi beam map we determined the chosen location was good.

CTD

At 18:30 a CTD cast was taken (St. 2, cast 2) and we sampled 6 depths and closed 3 bottles at each depth for nutrients, carbonate chemistry and microscopy. We sampled the tree in situ pump depths also for chlorophyll, hydrogen isotopes, POC, PON, POP, algae and bacterial counts etc.

In situ pumps

Three pumps (0.7 μm filters) were deployed at 30, 15 and 5 meters using the payout of the winch to determine depth (there was an issue with “nullen” of the winch that was resolve afterwards).

Multi-core

12 cores were retrieved (cast 4), 8 sliceable and 4archive cores of approximately 30 centimeters. 4 cores were sliced, 3 for lipid and DNA analysis slices of which were stored in the -80 freezer and 1 the slices of which were stored in Bengal rose in the fridge (4ºC). 1 Archive core was stored for further analysis at NIOZ. The cores looked very nice with extremely fluffy material at the top and lots of larger animals living in the sediment, including sea potato’s.

Multi core.

During the overnight transit to station 3 hourly samples were taken for water isotope analysis at the NIOZ.

2.3 Station 3

56° 36.158'N 11° 46.522'E

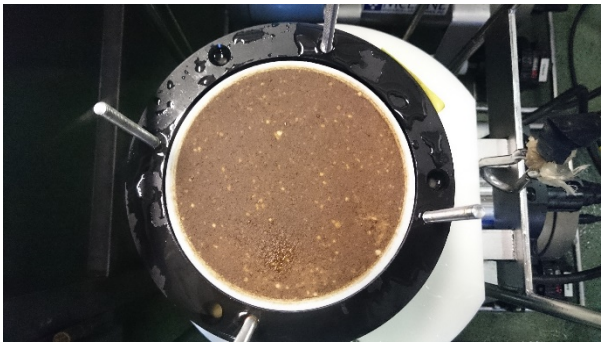
Water depth 38m

Multi-beam

To get an idea of the seafloor a multibeam map (cast 1) was made from approximately 1.5 miles before to 1.5 miles after Station 3. Again, due to the limited depth and therefore limited beam width multiple lines were mapped to get a good idea of seafloor topography.

CTD

At 07:00 a CTD cast was taken (St. 3, cast 2) and we profiled the water column to 31,4 meters depth at a safe distance from the seafloor, 3 bottles for 31.4, 25, 20, 15, 10 and 5 meters water depth (see CTD sample list, appendix 1). 25, 20 and 5 meter depths were also the in situ pump depths for the 0.7 µm filter. The in situ pumps were also deployed with 0.3 µm filters at all depths (5,10, 15, 20, 25 and 30m). There was a large fluorescence peak at 20 meters, microscopy indicated that there was a large number of dinoflagellates, Pyridinium and Protoperidinium.



In situ pump filter from 20 meter.

In situ pumps

Cast 3, at 25, 20 and 5 meters using 0.7 µm filters. Unfortunately Antje (in situ pump A) did not pump, the start date for operation had somehow reset to 1-1-70 even though the actual time and date the pump used was correct.

Cast 4, at 15, 10 and 5 meters using 0.3 µm filters.

Cast 5, at 15, 10 and 5 meters using 0.3 µm filters.

Multi-core (cast 6)

Beautiful multicores, even better than at station 2, slightly longer (± 40 cm). 4 Cores will be sliced up to 10 cm, 3 for DNA and lipid analysis stored in the -80 freezer and 1 stored in Bengal rose at 4 ºC (reefer). 1 Archive core is stored at 4 ºC for further analysis at the NIOZ.

Transit

Transit from Station 3 to Station 4 started at 13:30 and during transit water from the aquaflo was sampled every hour for water isotope analysis.

2.4 Station 4

56° 17.025' N 12° 16.835' E

Water depth 30.3m

Multi-beam

To get an idea of the seafloor a multibeam map (cast 1) was made from approximately 1.5 miles before to 1.5 miles after Station 3. Again, due to the limited depth and therefore limited beam width multiple lines were mapped to get a good idea of seafloor topography. The seafloor seemed relatively flat except for a known shipwreck.

CTD

20-01-2016, 1 am, a CTD cast was taken (St. 4, cast 2) and we profiled the water column to 23 meters depth and sampled water from 5 depths, 3 bottles for 23, 20, 15, 10 and 5 meters water depth (see CTD sample list, appendix 1). 20, 15 and 5 meter depths were also the in situ pump depths.

In situ pumps

At approximately 20:00 a shallow in situ pump (0.7 µm filters) cast was made (cast 3), the pumps were pumping for 1 hour. There seemed to be a communication issue between pump C and the computer, the connection on the pump was cleaned. Later there was a connection error with pump B (St. 5) suggesting it might be the cable not the connection on the pump that was the problem!

Multi core

At 20:30 the multi-core was deployed (cast 4) the cores here were about 30 cm but slanted and a bit “messy”, the second deployment (cast 5) was much better.

Transit

Transit to Station 5 started at ±21:30, samples for water isotopes were taken roughly every hour.

2.5 Station 5

55° 55.510' N 12° 42.770' E

Water depth 45m

Multibeam

In between Sweden and Denmark, the area around the station coordinates was mapped using multi beam (cast 1) and indicated that the station was in the middle of a deep relatively flat area in between the two countries.

CTD

At 06:30 we started a CTD cast (St. 5, cast 2) and we profiled the water column to 38 meters depth and sampled water from 7 depths, 3 bottles per depth (see CTD sample list, appendix 1). The in situ pump depths were 25, 20 and 10 meters, the fluorescence peak was at 20 meter. Nutrients and the carbonate system were analyzed for all depths, chlorophyll, algae and bacterial counts etc. only for the in situ pump depths.

In situ pumps

There was one in situ pump deployment (cast 3) with pumps at 3 depths 25, 20 and 10 meters.

Multi-core

12 cores were retrieved (cast 5), 8 sliceable and 4 archive cores of approximately 30 centimeters. 4 cores were sliced, 3 for lipid and DNA analysis to 10 centimeter depth, slices of which were stored in the -80 freezer and 1 for which the slices were stored in Bengal rose in the fridge (4ºC).

Transit

Transit to station 6 was only one hour during which one sample for water isotope analysis was taken.

2.6 Station 6

55° 49.340' N 12° 45.420' E

Water depth 27m

Multi beam

The sea floor was mapped using multi beam to make sure sampling would take place in a suitable location. We decided to sample slightly north of the original coordinates because the water column was slightly deeper, 27 instead of just over 20 meter and the close by location of a (electricity)cable. The very limited depth makes mapping difficult.

CTD

The first CTD cast, just before lunch was aborted because essential material for sampling was still in use for the previous CTD cast just a few hours before. The first CTD cast after lunch (cast 3) failed due to a connection issue between the software and hardware which turned out to be the CTD deck unit, fortunately there is a spare. The third CTD cast (6-4) was successful and we collected water from 20, 15, 10 and 5 meter water depth. Be aware that file names and samples names might still refer to cast 6-3!

In situ pumps

The in situ pumps were deployed (cast 5) using 0.7 µm filters for one hour at 20, 15 and 5 meter depth.

Multi core

The first multi core deployment was discarded due to very turbulent water potentially due to a little shock leaving the sediment. A second cast (6) looked the same suggesting that the surface sediment was extremely fluffy and easily disturbed. 4 positions in the multi corer did not trigger, but enough cores were retrieved for the planned work.

Transit

Transit to station 7 in the Arkona Basin started at approximately 4:30 and during transit hourly samples were taken for water isotope analysis.

2.7 Station 7 Arkona Basin

Water depth 45 meter

Piston coring

21-05-2016 Matthias Moros [The Leibniz Institute for Baltic Sea Research (IOW), Department of Marine Geology, Warnemünde, Germany] advised us two site for piston coring in the Arkona Basin, 54° 50.910'N 13° 21.412'E (7A) and 54° 50.995'N 13° 24.818'E (7B), together with our original Station 7 (C; 54° 53.500'N 13° 24.624'E) we now have three location for station 7 very close together. At station 7 we did an extensive multi beam cast (7-1) to map the sea floor after which we took two piston cores of, respectively 12.48 and 12.22 m (7-2 and 7-3) for analysis back at NIOZ and IOW. After a transit of approximately 15 minutes, station 7B where the seafloor was mapped by multi beam (7-4) and the piston the cores were of 12.66 and 11.84 m (7-5 and 7-6) were taken also for analysis back at NIOZ and IOW. The transit to station 7C was about 20 minutes and this was the main water work and sediment station.

Pore water sampling of piston core sections using rhizons

Also at station 7 the seafloor was mapped using multi beam (7-7) after which we took a piston core (7-8) of 12.40 m with predrilled holes for pore water and methane sampling. After the sampling with rhizons, pore water, and cut-off syringes, methane, the

sections were split and subsampled for DNA, lipids and test samples for laser ablation ICP-MS.

Piston core sampled for DNA and lipids.

CTD

After moving a little upstream to avoid sediment in the surface waters, we did a CTD cast using the 3 goflo bottles in case we would see anoxic bottom water and to test the bottles. The water depths for water sampling were 5, 15, 25, 30, 35 and 40 meter, with a fluorescence peak at approximately 25 meter.

The goflo bottles were not a success, a lot of time had to be invested to make the bottle function and even than the don't actually close after triggering. The main reason for bringing goflo bottles was that these can be tapped under N_2 pressure however, but then the taps for connecting the N_2 have to be available otherwise this will not work. As a back-up system for the clean CTD frame these bottles are useless, for us they are dramatic. With a lot of work Roald van der Heide managed to re-wire and remake some taps for 3 bottles that now, at least in theory, could work. They don't, at least not yet. Again these bottles should be thrown away and not used for anything, not even as back-up. This should have been tested and tried at the NIOZ before dumping them on the Pelagia. Fortunately the staff on the Pelagia sees this as a challenge.

In situ pumps

After the CTD cast we did three in situ pump casts at one with 0.7 µm filters at 5, 25 and 30 meters depth and two with 0.3 µm filters at all CTD depths.

Overnight we already started looking for methane bubbling using multi beam in the area just North of station 7, close to know sites of methane in the water column (like station TF0113; Gülzow et al., 2013, Biogeosciences). The idea was that this might safe time the next day, unfortunately no methane bubbles were observed.

On the 22-05-2016 we did several multi core casts for slicing, pore water sampling both by rhizons as well as slicing and centrifuging, methane sampling, an archive core. The first cast (7-13) failed, with the second (7-14) we retrieved many of the required cores, but not all. We needed 12 archive cores for experiments back at NIOZ and this took another 2 casts (7-15 and 7-16).

After retrieving all the necessary multi cores and everyone was busy sampling them, an additional CTD cast (7-17) was taken to specifically sample the fluorescence peak for microscopy etc.

2.8 Station 8 Arkona Basin (methane)

After the last CTD cast at station 7 we continued our search for methane gas emissions from the sediment by multi beam and fish finder (cast 8.1), again just a little north of station 7 at locations known for methane in the water

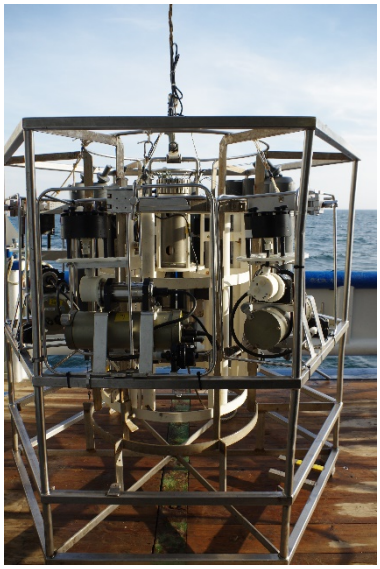
column. Unfortunately we were not able to actually find methane bubble, possibly due to the lack of emissions from the sediment massive enough to be detected this way. The fail save plan was to sample at TF0113 (Gülzow et al., 2013), a known methane site (54º 55.2' N, 13º 30.0' E, max depth 53 meter).

CTD

Another try with the goflo bottles (8-2), still not really successful and they need to be, at least on station 10. We sampled 6 depths, 43, 30, 25, 18 (fluorescence peak), 10 and 5m. At 43 meters depth the oxygen concentrations declined, suggesting, based on literature from this site, that this might also be the depth methane starts to increase, oxygenic methane consumption zone, potentially.

In situ pumps

In situ pumps with 0.7 µm filters were deployed to CTD depths 25, 18 and 5 meter (8-3). To sample the potential aerobic methane consumption zone with 0.3 µm filters for (incubation) experiments back at the NIOZ some Niskin bottles were removed from the CTD frame and all three in situ pumps were mounted in the CTD frame. The CTD was lowered to 43 meter depth twice, casts 8-4 and 8-5. Some extra water from 43 meter was also collected during cast 8-5.



Three in situ pumps in the CTD frame.

There remained a communication error/failure between especially in situ pump B and the computer, but also sometimes pump C and the computer. After trying to exclude multiple option we replace the actual connecting cable with one here on the ship, it seems the original connecting cable for pump C has lost its "grip" and has to be replaced! Replacing the connectors on the pumps with the pump A types might also be a good investment!

2.9 Station 9 Bornholm Basin

55° 28.080'N 15° 28.620'E

Water depth 93 meter

Multi beam

23-05-2016, the sea floor was mapped using the multi beam (9-1), if we want to use the multi beam data, for all stations so far, the data has to be recalculated based on the local velocity profiles.

CTD

At approximately 77 meter water depth the oxygen concertation was approximately 36 µmol kg^{-1} and we tried again to use the goflo bottle(s) to sample low oxygen water for “anaerobic” nutrients. One goflo bottle closed and this one was sampled, we did not expect free sulfide. The other depths sampled were 5, 23 (fluorescence maximum), 35, 45 and 60 (cast 9-2). We closed 4 bottles at 23 m to make sure we would have enough water from the fluorescence maximum.

Multi core

Since we wanted to sample the multi cores for methane and pore water besides slicing for more paleo applications we decide to take the cores relatively early in the morning since especially the pore water sample work-up takes most of the rest of the day. Rather than sampling pore water with both rhizons and slicing/centrifugation, only rhizons were used. The first cast (9-3) overfilled some core tubes and the others almost. For the second cast (9-4) 10 top weights were removed, although the cores looked very nice the amount of water on top was too little for further processing. For cast 9-5 another 6 top weights and 2 middle weights were removed and the cores looked great.

Very nice multi core from very fluffy sediments.

Piston core

One piston core was taken for further analysis at NIOZ from station 9 (cast 6), we used an 18 meter set-up and retrieved approximately 14.40 m core. The first few meters were very rich in gas which made the core run out of the liner. There are some small piece of core from in between sections due to this (2-3, ±3cm and 4-5, ±6cm), after a few meters sectioning the core got better. The top 30, or so, cm was collected in a geochemical bag.

In situ pumps

Three casts, one with 0.7 µm filters at 5, 22 and 35 m (9-7) and two casts with 0.3 µm filters (9-8 and 9-9) at all CTD depths.

24-05-2016

Predrilled piston core (18m set up, core length 14 m 60 cm), a piston core predrilled for methane analysis was deployed early in the morning and sampled for methane through the drilled holes (cast 9-10). Afterwards the sections were split and subsampled for DNA, lipids and pore water. Pore water sampling of piston cores using rhizons is not a success, there for the choice has been made for sampling for pore water after splitting the core followed by centrifugations. This can of course affect things like sulfide

concentrations, but is better than rhizon sampling. It is better to try to do something the right way, than knowing you're doing it wrong.

Transit

After leaving station 9, the piston core was cut, sampled for methane and split for further subsampling. In the meantime the crew found out the side winch had slowly unreeled and had to be partly taken of the winch and rolled tight again. Material from yesterday was cleaned and during our 20 hour transit samples will be taken every hour on the hour for the LGR.

2.10 Station 10 Gotland Basin

57° 12.702'N 19° 57.000'E

Water depth 220m

Multi beam

On the 25th of May 2016 we started with mapping the seafloor using the multi beam (cast 10-1).

CTD

After the mapping we deployed the CTD to profile the water column and take water samples. There was a strong oxycline between 60 and 75 meters water depth below which oxygen was almost completely gone. We decided to sample water from 200, 150, 100, 72 (at the bottom of the oxycline), 60 (at the top), 50, 25, 15 (fluorescence maximum) and 5m (10-2). Since only 2 of the 3 goflo bottles closed a second cast was needed (10-3) in which only one bottle closed, not the depth we missed in the first cast, so a third cast was needed (10-4) focused on sampling 100 m water depth.

Multi core

Since we wanted to sample the multi cores for methane and pore water besides slicing for more paleo applications we decide to take the cores relatively early in the morning since especially the pore water sample work-up takes most of the rest of the day. Rather than sampling pore water with both rhizons and slicing/centrifugation, only centrifugation was used. For the first time the new multi core sub frame was used, which resulted in absolutely beautiful cores (cast 10-4). Although borderline to short, we managed to get the required 30 cm core depth for nearly all cores (1 core was 1 cm to short). A second cast (10-5) was done to retrieve archive cores for further experiments back at NIOZ, a total of 12 cores were taken.

Multi corer with sub frame.

Piston core

One piston core was taken for further analysis at NIOZ from station 10 (cast 6), we used an 21 meter set-up and retrieved approximately 16 m and 77 cm core.

In situ pumps

Cast 10-7 the three upper depths (5, 15, 25m) including the fluorescence maximum were sampled using 0.7 µm filters (1h). In the next cast (10-8) the same depths were sampled using 0.3 µm filters (1h). In the third cast (10-9) 50, 60 and 72 m water depth were sampled using 0.3 µm filters for 1.5 hours. Pump B seems to use way more batteries than the other two?

Piston core section.

26-05-2016

Predrilled piston core (21 m set up, core length 15 m 93 cm), a piston core predrilled for methane analysis was deployed early in the morning and sampled for methane through the drilled holes (cast 10-10). Afterwards the sections were split and subsampled for DNA, lipids and pore water.

In situ pumps

The deeper water depths, 100, 150 and 200 were sampled using using 0.3 µm filters for 2 hours (cast 11). Pump A, 200 meter failed, the cast will be repeated with 200, 175 and 125 meter sampling depths (cast 10-12). A and B pumps where switched.

To sample the potential aerobic methane consumption zone with 0.3 µm filters for (incubation) experiments back at the NIOZ some Niskin bottles were removed from the CTD frame and all three in situ pumps were mounted in the CTD frame. The CTD was lowered to 68 meter depth (cast 10-13). Also 120l water was collected from this depth for laboratory filtration.

After 1279 miles we arrived in Nynäshamn.

3. NUTRIENTS – NIOZ Baltic Sea 2016 Cruise 64PE410 on R.V. Pelagia

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3.1 Summary

Nutrients were analysed in a thermostated lab containers equipped with a QuAAtro Gas Segmented Continuous Flow Analyser, measuring approximately 600 samples during the cruise for the different parameters. Measurements were made simultaneously on four channels for Phosphate, Ammonium, Nitrite, and Nitrate with Nitrite together. Samples for Silicate, Dissolved Inorganic Carbon (DIC) and Sulphide were also taken and will be stored in a refrigerator until further analysis either in another thermostated lab container also on board or back at the NIOZ, The Netherlands. All measurements were calibrated with standards diluted in low nutrient seawater (LNSW) in the salinity range of the stations of the Baltic Sea ranging from 33 - 7 $^{o}/_{oo}$ to ensure that analysis remained within the same ionic strength.

3.2 Equipment and Methods

3.2.1 Sample Handling

The seawater samples were collected in 60ml high-density polyethylene syringes with a three way valve from the Niskin bottles of the CTD Rosette. The syringes with a three way valve were first rinsed three times with a small amount of the sample taken directly from the CTD-rosette bottles before being completely filled. After sampling on deck, the samples were processed immediately in the lab container; samples were filtered over 0.2µm and instantly sub-sampled into two vials made out of high density polyethylene, also known as 'pony-vials. The PO4, NH4 and NO3 plus NO2 samples were simultaneously measured in the lab container within 12 hours of sub sampling. Only samples taken from the evening CTD were refrigerated and analysed the following day. Samples were stored in a refrigerator at 4^{o}C and prior to analysis, all samples were brought to lab temperature in about one to two hours. To avoid gas exchange and evaporation during the runs with NH4 analysis, all vials including the calibration standards were covered with 'parafilm' under tension before being placed into the auto-sampler, so that the sharpened sample needle easily penetrated through the film leaving only a small hole. The QuAAtro uses an LED instead of a lamp as a light source as it is not affected by the movement of the ship giving a stable reading and a sampler rate of 60 samples per hour was used. Calibration standards were diluted from stock solutions of the different nutrients in 0.2µm filtered LNSW diluted with de-ionised water to obtain approximately the same salinity as the samples and were freshly prepared every day. This diluted LNSW was also used as the baseline water for the analysis in between the samples. The LNSW is

surface seawater depleted of most nutrients. Each run of the system had a correlation coefficient of at least 0.9999 for 10 calibration points, but typical 1.0000 for linear chemistry. The samples were measured from the lowest to the highest concentration in order to keep carry-over effects as small as possible, i.e. from surface to deep waters. Concentrations were recorded in 'µmol per liter' (µM/L) at an average container temperature of 21.8°C. During the cruise, a freshly diluted mixed nutrient standard, containing silicate, phosphate and nitrate (a so-called nutrient cocktail), was measured in every run. The cocktail sample was used as a guide to monitor the performance of the standards.

Pore-water from sediment cores was collected under anoxic conditions in glove bags under nitrogen atmosphere and sub sampled for H2S, DIC, N, PO4 and Si. For the PO4 pore-water samples, an extra addition of 5µl 5N HCl per 1ml of sample was added to compensate for high DIC background levels, expected up to 25mM DIC, to keep the pH in between 1 and 2 to prevent any form of iron-phosphate precipitates. Sulfide samples were diluted using a dilution factor of 4 made with anoxic demineralised water containing 8ml 1N NaOH/L. DIC samples were also diluted using a dilution factor of 10 with anoxic demineralised water containing 17g NaCl/L, this ensuring that the samples remained with the same ionic strength as deep water of the Baltic Sea.

3.2.2 Analytical Methods

The colorimetric methods used are as follows:

Ortho-Phosphate (PO_4) reacts with ammonium molybdate at pH 1.0, and potassium antimonyltartrate is used as a catalyst. The yellow phosphate-molybdenum complex is reduced by ascorbic acid and forms a blue reduced molybdophosphate-complex which is measured at 880nm (Murphy & Riley, 1962).

Ammonium (NH_4) reacts with phenol and sodiumhypochlorite at pH 10.5 to form an indo-phenolblue complex. Citrate is used as a buffer and complexant for calcium and magnesium at this pH. The blue color is measured at 630nm (Koroleff, 1969 and optimized by W. Helder and R. de Vries, 1979).

Nitrate plus Nitrite (NO_3+NO_2) is mixed with an imidazol buffer at pH 7.5 and reduced by a copperized cadmium column to Nitrite. The Nitrite is diazotated with sulphanylamide and naphtylethylene-diamine to a pink colored complex and measured at 550nm. Nitrate is calculated by subtracting the Nitrite value of the Nitrite channel from the 'NO3+NO2' value. (Grasshoff et al, 1983).

Nitrite (NO_2) is diazotated with sulphanylamide and naphtylethylene-diamine to form a pink colored complex and measured at 550nm. (Grasshoff et al, 1983).

Another thermostated lab container on board or back at the NIOZ, The Netherlands;

Silicate (Si) reacts with ammonium molybdate to a yellow complex and after reduction with ascorbic acid, the obtained blue silica-molybdenum complex is measured at 820nm. Oxalic acid is added to prevent formation of the blue phosphate-molybdenum complex (Strickland & Parsons, 1968).

Dissolved Inorganic Carbon (DIC):

Samples are acidified online after being oxidised by H_2O_2 to prevent H_2S being released before entering the silicon dialyser whereby the formed CO_2 is dialysed to a secondary flow. This secondary flow contains a slightly alkaline phenolphthalein solution giving a pink colour. The more CO_2 that is dialysed, the lower the pH and therefore some discolouration of the pink reagent is observed. This decolouring is measured at 520nm and is an inverse chemistry spectrophotometer method described by Stoll, Bakker, Nobbe and Haesse, 2001.

H_2S:

To keep the samples in the S_2^- form under alkaline conditions, a small aliquot of NaOH is added. The Hydrogen Sulfide in the sample reacts with para-aminodimethylaniline and ferric chloride to yield methylene blue which is measured at 660nm as described by Grasshof, K., 1969.

3.2.3 Calibration and Standards

Nutrient primary stock standards were prepared at the NIOZ as follows;

Phosphate (PO_4): by weighing Potassium dihydrogen phosphate in a calibrated volumetric PP flask to make 1mM PO_4 stock solution.

Ammonium (NH_4): by weighing Ammonium Chloride in a calibrated volumetric PP flask to make 1mM NH_4 stock solution.

Nitrate (NO_3): by weighing Potassium nitrate in a calibrated volumetric PP flask set to make a 10mM NO_3 stock solution.

Nitrite (NO_2): by weighing Sodium nitrite in a calibrated volumetric PP flask set to make a 0.5mM NO_2 stock solution.

Silicate: by weighing Na_2SiF_6 in a calibrated volumetric PP flask to 19.84mM Si stock solution.

DIC: by weighing Na_2CO_3 stock in a calibrated volumetric PP flask set to make a 200mM stock solution.

S_2^- : by weighing Na_2S in 0.5N NaOH set to make a 50mM Sulphide stock solution.

All standards were stored at room temperature in a 100% humidified box. The calibration standards were prepared daily by diluting the separate stock standards, using three electronic pipettes, into four 100ml PMP volumetric flasks (calibrated at the NIOZ) filled with diluted LNSW. The blank values of the diluted LNSW were measured onboard and added to the calibration values to get the absolute nutrient values.

3.3 Statistics

3.3.1 Quality Control

Our standards have already been proven by inter-calibration exercises from ICES and Quasimeme, and over the past years the RMNS exercise organised by MRI, Japan, concluded them to be within the best obtainable limits to the mean of the better laboratories.

To gain some accuracy, the Cocktail standard which contains PO4, NO3 and Si has been monitored since 1997, showing between run reproducibility better than 1.5% , but typically 0.7% of its average value. The following values were obtained from the cocktail which was diluted 100 times in a calibrated PP volumetric flask, being measured in every run onboard.

	Average value	S.D.	N	Dilution Factor
PO4	0.899 uM	0.009uM	42	250
NO3	13.701 uM	0.285uM	42	250

Although our cocktail standard is measured in every run and its value remained stable for all nutrient measurements during the cruise, it is vitally important to get a certified nutrient reference material, like the standard seawater for salinity that is directly for use, in order to obtain real accuracy to give better comparison between labs and cruises.

3.3.2 Mean Detection Limits

The method detection limit was calculated during the cruise using the standard deviation of ten samples containing 2% of the highest standard used for the calibration curve and multiplied with the student's value for n=10, thus being 2.82. (M.D.L = Std Dev of 10 samples x 2.82)

µM/l	Used measuring ranges µM/l:	
PO4	0.011	2.0
NH4	0.007	5.0
NO3+NO2	0.005	15.5
NO2	0.002	0.5

3.3.3 Further Remarks

It is suggested that through diluting the samples by means of electronic pipettes, one for the sample and one for the dilution water, a small error of maximum 1.0% could be introduced.

The reported pore-water results took into account the dilution steps that were made in the glovebag prior to analysis for HS- and DIC.

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4. Long chain alkyl diols

Sergio Balzano

Several freshwater and marine microalgal species from the eukaryotic supergroup Heterokontophyta (Rampen et al., 2014; Rampen et al., 2011; Sinninghe Damste et al., 2003) can synthesize, among other lipids, long chain alkyl diols (LCD). LCDs can vary in chain length and in the position of the second alcohol functional groups, they are usually taxon specific. LCDs are widespread in marine and freshwater sediment and their distribution can also reflect ancient temperature and nutrient conditions (Rampen et al., 2012). The biological sources of LCDs are not fully clear since LCDs are usually more abundant than LCD-producers in the water column. To investigate this discrepancy I'm currently coupling 18S rRNA gene high throughput amplicon sequencing (Balzano et al., 2015) with lipid analyses to infer relationships between LCDs and LCD-producers in the water column.
The Baltic Sea is affected by latitudinal and vertical salinity gradients and is inhabited by both freshwater and seawater microalgae (Hällfors, 2004). The Baltic Sea is thus likely to contain LCDs of both marine and freshwater origin and the analyses of lipids and microbial eukaryotes in the Suspended Particulate Matter (SPM) can provide a diverse dataset and improve the current knowledge about the biological sources of LCDs.

4.1 Suspended Particulate Matter (SPM)

During the 64PE410 cruise we sampled SPM from different stations along a decreasing salinity gradient. SPM was sampled using an *in situ* pump (information by Saara Suominen) from 3 depths (surface, fluorescence maximum, and bottom of the photic zone). Additional sampling depths were occasionally selected in correspondence of secondary fluorescence peaks or sharp changes in temperature and/or salinity. 50 to 100 L seawater were filtered through 0.7 µm pore-size, 120 mm diameter glass fiber (GF/F) filters which were immediately stored at -80 °C after filtration.

4.2 Seawater collection for chlorophyll and flow cytometry

To complement the investigation of the microbial eukaryotes in the Baltic Sea useful information can be provided by analyzing the concentration of chlorophyll as well as by enumerating cells from different microbial classes in the water column. 2L seawater were collected using Niskin bottles mounted on a Conductivity-Temperature-Depth (CTD) frame from the same depths at which SPM has been sampled.

4.2.1 Flow cytometry

Seawater was processed immediately for future flow cytometry analyses which will allow the enumeration of small (< 5µm) phytoplankton, heterotrophic

bacteria, and viruses. For heterotrophic bacteria and viruses 1 mL seawater was added, in triplicate, in 2 mL cryovials pre-filled with 20 µL gluteraldehyde. For small phytoplankton, mostly consisting in cyanobacteria from the genera *Prochlorococcus* and *Synechococcus* as well as photosynthetic nano and picoeukaryotes, 3.5 mL seawater were added in triplicate in 5 mL cryovials pre-filled with 100 µL formaldehyde (18%)-hexamine (10%) solution. Cryovials were then incubated at 4 °C for 30 minutes, and flash frozen in liquid nitrogen where they were stored for 1-2 hours. Cryovials were then transferred at -80 °C for future analyses in flow cytometry.
Samples are labeled by the station number and a sample code as shown in the Table below.

4.3 Chlorophyll

Seawater collected from the Niskin bottles (see above) was stored at 4 °C for 1 hour maximum until being processed for future chlorophyll measurements. 300 to 800 mL seawater were filtered in triplicate though 0.7 µm pore-size, 25 mm diameter, pre-combusted glass fiber (GF/F) filters using glassware filtration units connected to a vacuum pump. After filtration filters were stored at -20 °C in pre-labelled 1.5 mL eppendorf tubes. Tubes are labeled by the station number and a sample code as shown below.

Table 1: samples

Station	Cast	CTD bottle #	Temperature	Salinity	Sample code[1]	Depth (m)	Volume filtered for chlorophyll (mL)
1	2	23	10.7	30	Surface	10	630
1	2	21	8.1	32	DCM	24.5	570
1	2	17	7.1	35	Bottom	55	500
2	2	16	11.1	26	Surface	5	600
2	2	10	8.7	32.7	DCM	15	600
2	2	4	7.9	34	Bottom	30	600
3	2	18	11.5	16.1	1	5	600
3	2	15	11.2	17.8	2	10	600
3	2	12	7.4	25.4	3	15	600
3	2	9	5.7	32.7	4	20.5	500
3	2	6	5.8	33.4	5	25	600
3	2	3	5.5	33.6	6	31.5	600
4	2	15	10.7	17.5	Surface	5	600
4	2	9	6.5	28.4	DCM	15	600
4	2	6	5.6	33.7	Bottom	20	600
5	2	18	9.6	19.5	Surface	10	700
5	2	12	6.2	32.6	Middle	20	500

5	2	9	6	33.1	Bottom	25	500
6	3	13	11.7	4.6	Surface	4.5	500
6	3	7	9.1	14.6	Middle	14.5	600
6	3	4	6	20.6	Bottom	20.5	600
7	9	21	11.8	8.1	1	4.5	600
7	9	18	10	8.3	2	14	500
7	9	15	5.9	9.6	3	24.5	500
7	9	12	5.9	11	4	29.5	600
7	9	9	5.9	14.3	5	24.5	600
7	9	6	6	17.4	6	35.6	600
7	17	7				19	400
7	17	9				21	300
8	2	23	11.1	8.1	1	5	500
8	2	20	10.9	8.1	2	9	400
8	2	17	6.4	8.3	3	18	300
8	2	14	6.1	10	4	24	600
8	2	11	6	11.7	5	30	600
8	2	8	5.6	17.1	6	43	600
9	2	22	10.6	7.8	1	5	500
9	2	19	8.5	8	2	22.5	400
9	2	15	5.9	8.5	3	35	600
9	2	12	5.8	10.6	4	45.5	700
9	2	9	5.6	13.4	5	59.2	600
9	2	6	7	18.4	6	77.4	600
10	2	17	11.1	6.95	1	4	500
10	2	15	6.9	6.95	2	13	300
10	2	13	5.1	7.1	3	24	700
10	2	11	4.7	7.2	4	49.5	700
10	2	9	4	7.3	5	59.8	800
10	2	7	5.2	9.1	6	71.9	800
10	3	3	6	11.1	7	99.4	0[2]
10	2	3	6.8	12.8	8	149.7	0[2]
10	2	2	7.1	13.5	9	199.8	0[2]

[1] Code as written on the sampling tubes for both flow cytometry cryovials and chlorophyll eppendorf tubes.

[2] Seawater was not filtered for chlorophyll at these 3 depth because of the very low fluorescence values previously observed on the CTD profile. Samples were instead processed for flow cytometry and are labeled station 10-7, station 10-8 and station 10-9.

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5. Marine fungi

Judith van Bleijswijk

There is increasing evidence that marine fungi might play a significant role in remineralization of organic matter in anoxic sediments. However, data on the presence and activity of marine fungi is still very scarce. During this cruise in the Baltic my aim was to find more evidence for the potential importance of marine fungi by analyzing fungal DNA in multicores and piston cores that have been taken at various stations. Focus will be on core slices with known pore water chemistry. More specifically, anoxic layers with high DIC and average alkalinity (indicative for mineralization and not calcium carbonate dissolution) will be extracted. Using primers specific for marine fungi, the presence of marine fungi can be quantified with quantitative PCR. In addition, the community composition of marine fungi can be analyzed using 454 FLX sequencing.

6. Particulate organic matter

Judith van Bleijswijk

Particles for POC and PON, POP were collected from Niskin bottles mounted on a CTD at 3-9 depths per station. Chlorophyll and subsampels for flow cytometry and microscopy were taken from the same Niskin bottle. Nutrients and gasses were measured from different Niskin bottles that were closed at the same depth. A volume of 2-3L of water was filtered using the HPLC filtration set up of the plankton lab (plastic cups of 300 ml, vacuum filtration) over ashed pre-weighted 47 mm GFF filters. Per station, per depth, two filters were stored at -20 degrees. An overview of all sa*mples is given below in Table 1.*

Filter	*Volume (L)*	*Station, cast, depth (m)*	*Filter*	*Volume (L)*	*Station, depth (m)*	*Filter*	*Volume (L)*	*Station, depth (m)*
1-2	2.0-2.0	St1, c2, 10.1	37-38	2.0-2.0	St6, c3, 4.6	70-71	2.0-2.0	St9, c2, 5.1
3-4	2.0-2.0	St1, c2, 24.4	39-40	2.0-2.0	St6, c3, 14.6	72-73	2.0-2.0	St9, c2, 22.5
5-6	2.0-2.0	St1, c2, 55.1	41-42	2.0-2.0	St6, c3, 20.6	74-75	2.0-2.0	St9, c2, 34.8
7-8	2.0-2.0	St2, c2, 5.2	43-44	2.0-2.0	St7, c?, 4.6	76-77	2.0-2.0	St9, c2, 45.4
9-10	2.0-2.0	St2, c2, 14.9	45-46	2.0-2.0	St7, c?, 14.8	78-79	2.0-2.0	St9, c2, 59.2
11-12	2.0-2.0	St2, c2, 30.0	49-50	2.0-2.0	St7, c?, 24.3	80-81	2.0-2.0	St9, c2, 77.4
13-14	2.0-2.0	St3, c2, 4.7	52-55	2.0-2.0	St7, c?, 29.7	82-83	2.0-2.0	St10, c2, 4.2
15-16	2.0-2.0	St3, c2, 10.2	53-54	2.0-2.0	St7, c?, 35.6	84-85	2.0-2.0	St10, c2, 13.9
17-18	2.0-2.0	St3, c2, 14.9	56-57	2.0-2.0	St7, c?, 40.1	86-87	2.0-2.0	St10, c2, 24.2

19-20	2.0-2.0	St3, c2, 20.3	58-59	2.0-2.0	St8, c2, 4.9	88-89	3.0-3.0	St10, c2, 49.3
21-22	2.0-2.0	St3, c2, 24.8	60-61	2.0-2.0	St8, c2, 9.3	90-91	2.0-2.0	St10, c2, 59.8
23-24	2.0-2.0	St3, c2, 31.4	62-63	2.0-2.0	St8, c2, 18.0	92-93	2.0-2.0	St10, c2, 71.9
25-26	2.0-2.0	St4, c2, 4.8	64-65	2.0-2.0	St8, c2, 24.1	94-95	2.5-2.5	St10, c2, 99.4
27-28	2.0-2.0	St4, c2, 14.5	66-67	2.0-2.0	St8, c2,30.1	96-97	2.4-2.4	St10, c2, 149.8
29-30	2.0-2.0	St4, c2, 19.8	68-69	2.0-2.0	St8, c2, 43.4	98-99	2.0-2.0	St10, c2, 199.6
31-32	2.0-2.0	St5, c2, 9.8						
33-34	2.0-2.0	St5, c2, 20.1						
35-36	2.0-2.0	St5, c2, 24.9		2.0-2.0				

7. Microscopy

Judith van Bleijswijk

From the same Niskin bottles that were sampled for POC,PON, POP, Chlorophyll and flow cytometry, a subsample of 0.5 or 1 L was prepared for microscopic analyses of the plankton at the Deep Chlorophyll Maximum. An overview is given below.

Station 1, cast 2, DCM at 24.4 m, 1L >10um *and Station 2, cast 2, 1L* >10um

Chain forming diatoms are dominant (many small diameter chains, and less large Guinardia-like chains, Rhizosolenia). Some dinoflagellates (Ceratium sp.). Adult copepods and nauplii

Station 3, cast 2, 1L >10um

Chain forming diatoms blooming (>100 chains per field 10x10; small, and larger Guinardia-like species, Rhizosolenia) with Coscinodiscus also present. Large dinoflagelates (Protoperidinium, Dinophysis) appear. Adult copepods and nauplii, also tintinnids present.

Station 4, cast 2 , *1L* >10um

Similar to station 3 but less intensive chain forming diatom bloom (20 chains per field 10x10). In addition non-chain forming Chaetoceros densus 10 per field. And apparent silicoflagelate presence (Dyctyocha speculum) 20 per field. Also, large dinoflagellate variation. Also many small phototroph swimmers (gymnodinium-like).

Station 5, cast 2 , *1L* >10um

Remarkebly large diameter chain-forming diatoms, Guinardia-like, Chaetoceros sp. Also small dinoflagellate swimmers (Gymnodinium, Glenodinium-like), many tintinnids,copepod faecal pellets and debris.

Station 6 cast 3 , *1L* >10um

At 4.6 m depth mainly small swimmers and only few diatoms. At 14.6 m bloom of silicoflagelate Dictyocha speculum 60 per field 10x10!. Also variation of large diatoms (20 per field). At 20.6 m no dinoflagellates, no silicoflagelates, still diatoms (20/field).

Station 7 cast? , *1L* >10um

Poor station with sharp chlorophyll maximum at 25 m. No large plankton present. Only small flagellated swimming cells (Scriptiella, Peridinella, Gymnodinium-like).

Station 7, cast 17, 1L >10 um and 1L >0.45um

Small dinoflagelates (>30 per field), plus smaller swimmers, plus filamentous cyanobacteria and small cyanobacteria.

Station 8, cast 2, 0.5L > 0.22 um

Small cyanobacteria, small diatoms (Scriptiella), a lot of debris, and filaments (cyanobacteria?).

Station 9, cast 2, 0.5L >0.22um

Small diatoms Thallassiosira (1/2 per field) no large diatoms, small dinoflagellate (Scriptiella-like 10 per field), many pollen grains. Large dinoflagellate Dinophysis and many (cyanobacteria) filaments.

Station 10 cast ?, 0.5L > 0.22 um

At DCM a bloom of dinoflagelates: Dinophysis (>12 per field), Protoperidinium, prorocentrum, Gyrodinium, Katodinium, Scriptiella-like as in earlier stations. Many rotifers. At 200m no living plankton visible, only dark-brown small globules with extending filaments (iron-phosphate? crystels?)

8. Piston Core for DNA and pore water sampling

Judith van Bleijswijk

Three piston cores were predrilled for porewater sampling and DNA analyses.

DNA Piston 1: Information by Sigrid van Grinsven

DNA Piston 2 and 3: Cores were split in sections of 1 m, sliced and opened. The two exposed sides of the core were photographed. Subsequently pore water was sampled from one side and DNA samples were taken from the other side on the same core depth. The sample list is given below.

DNA Piston Core 2, Station .. cast …

section	Label#	cm from **bottom**	remark
4	40, 39, 38, 37	20, 40, 60, 80	
5	36, 35, 34, 33	20, 40, 60, 80	A hole of 10 cm at 90 cm
6	32, 31, 30, 29	20, 40, 64, 84	
7	28, 27, 26, 25	20, 40, 60, 80	two holes: one at 66-70; one at 90-95
8	24, 23, 22, 21	20, 40, 60, 80	cracks
9	20, 19, 18, 17	20, 40, 60, 80	
10	16, 15, 14, 13	20, 40, 60, 80	Wet sediment, bivalves (~1 cm) visible
11	12, 11, 10, 9	20, 40, 60, 80	Wet sediment, bivalves visible
12	8, 7, 6, 5	20, 40, 60, 80	dry
13	4, 3, 2, 1	20, 40, 60, 80	dry
14	0, -1, -2, -3	20, 40, 60, 80	wet
15	-4, -5, -6, -7	20, 40, 60, 80	wet

DNA piston core 3, Station 10

section	Label#	cm from **top**	remark
4		10, 35, 60, 85	
5		10, 35, 60, 85	
6		10, 35, 60, 85	
7	37, 38, 39, 40	10, 35, 60, 85	
8	33, 34, 35, 36	10, 35, 60, 85	
9	29, 30, 31, 32	10, 35, 60, 85	
10	25, 26, 27, 28	10, 35, 60, 85	
11	21, 22, 23, 24	10, 35, 60, 82.5	82.5 cm including white line, in stead of 85 cm
12	17, 18, 19, 20	10, 35, 60, 85	
13		10, 35, 60, 85	
14		10, 35, 60, 85	
15		10, 35, 60, 85	

9. In-situ pumping

Saara Suominen

McLane Large Volume Water Transfer System Sampler (WTS-LV) in-situ pumps (McLane Research Laboratories Inc., East Falmouth, MA, USA) were deployed at each station at the same depths as the CTD cast. Between the Norths Sea and the Baltic Sea (stations 1-6), during a large salinity gradient, pumps were deployed at only at the three upper depths, except for station 3 were three additional deeper depths were used. Depths were chosen according to the CTD profiles and especially fluorescence maximums to access the bloom populations. In the Baltic Sea (stations 7-10) pumps were deployed also to deeper depths. In addition at stations 8 and 10 pumps were mounted on to the CTD frame to collect several filters at the same depth for an incubation project of Darci Rush (Figure 1).

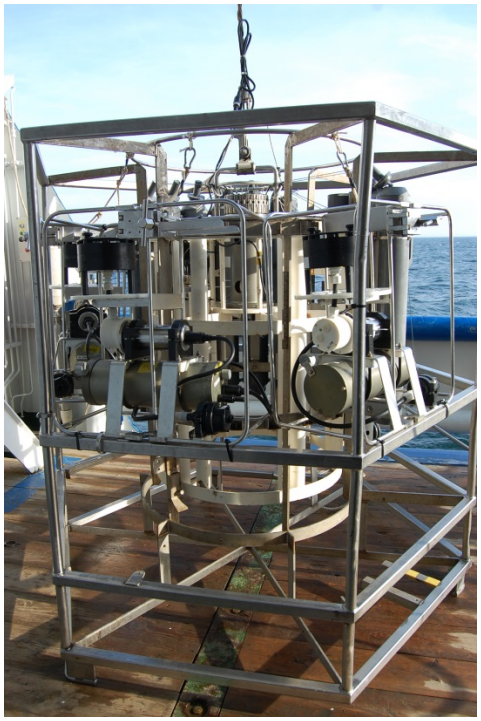


Figure 1, Pumps mounted on the CTD frame

The three shallow depths were filtered on pre-ashed 142 mm 0,7 um glass fibre filters, while at stations with more depths the whole water column (including shallow depths) was additionally pumped through pre-ashed 0.3 um glass fibre filters. Most deployments ended in clogged filters and the time limit determined for pumping was not reached.

Filters were collected immediately after pumps were brought up, photographed if possible, folded once, wrapped in two layers of aluminium foil and taken to the -80 °C freezer. Filters from each cast were collected in one geochemical bag and labelled with station and cast number, depth and filter size. An example of the program used for each pump is shown in table 1.

Table 1. An example of programmed parameters for pump deployment. All pumps were programmed similarly except for time limit (60-120 minutes) and scheduled start.

Cruise	64PE410	
	Station 6 cast 7	
Sample volume	10000	[liters]
Initial flow rate	6000	[ml/min]
Minimum flow rate	4000	[ml/min]
Time limit	60	[minutes]
Pump data period	1	[minutes]
Scheduled start	05/21/2016	16:55:00

There were connection problems with the pumps C and B and the computer, which were resolved by changing the connection cable. The computer provided by NIOZ was not functioning, because of a missing driver for the USB connection, and a computer was borrowed from the Pelagia (Roald) to access the CrossCut software. The pump B was running out of battery power faster than the other two pumps. Some changes to the connections in the electronics were made during the last cruise, which could be the issue, or alternatively there was something hindering the flow more than normal. In two occasions pump A did not pump due to unknown software problems.

After the cruise all pumps were rinsed outside, and the filter holders were washed thoroughly with fresh water. Filters will be used for molecular and organic geochemical analysis at the NIOZ. Table 2 shows the conditions and pumped volume for each deployment and photographs of filters are in fig 1-5.

Table 2. In situ pump deployments, depths and liters filtered during cruise 64PE406. Deviations marked in red color explained in text

Date	Station	Pump	Depth (m)	Time deployment (UTC)	Pumping time	Computer (L)	Read before (L)	Read after (L)	calculated liters	min flow at (sec)
18/05/2016	Station 1, cast 3	Pump C	10	6.15-7.15	1 hour	66.31	69091	69152	61.0	939.0
0.7 µm		Pump B	25			221.61	87065	87241	176.0	3202.0
		Pump A	55			154.07	60919	61078	159.0	2125.0
	Station 2, cast 3	Pump C	5	17.55-18.55	1 hour	79.03	69152	69221.0	69.0	1172.0
0.7 µm		Pump B	15			70.87	87241	87295	54.0	1033.0
		Pump A	30			55.33	61078.0	61134	56.0	791.0
19/05/2016	Station 3 cast 3	Pump C	5	06.15-07.15	1 hour	71.76	69222	69285	63.0	1024.0
0.7 µm		Pump B	20			201.45	87295.0	87441	146.0	3122.0
		Pump A	25			0.00	61134	61134	0.0	FROM ISSUES WITH PR(
	Station 3, cast 4	Pump C	5	08.15-09.15	1 hour	50.02	69285	69329	44.0	725.0
0.3 µm		Pump B	10			61.76	87441	87498	57.0	906.0
		Pump A	15			32.5	61134	61165	31.0	507.0
	Station 3, cast 5	Pump C	20	09.55-10.55	1 hour	78.64	69329	69402	73.0	1243.0
0.3 µm		Pump B	25			84.34	87498	87576	78.0	1185.0
		Pump A	30			35.31	61165	61202	37.0	487.0
ALL BATTERIES CHANGED										
	Station 4, cast 3	Pump C	5	17.30-18.30	1 hour	223.25	69403	69565	162.0	time limit reached
0.7 µm		Pump B	15			189.78	87578	87702	124.0	2818.0
		Pump A	20			35.34	61204	61239	35.0	474.0
20/05/2016	Station 5, cast 3	Pump C	10	05.50-06.50	1 hour	92.81	69565	69605	40.0	1319.0
0.7 µm		Pump B	20			133.5	87702	87794	92.0	1997.0
		Pump A	25			48.59	61246.0	61289.0	43.0	678.0
	Station 6, cast 5	Pump C	5	12.50-13.50	1 hour	48.86	69651	69689	38.0	732.0
0.7 µm		Pump B	15			138.56	87794.0	87898	104.0	2003.0
		Pump A	20			48.68	61289	61339	50.0	661.0
21/05/2016	Station 7, cast 10	Pump C	5	18.10-19.10	1 hour	72.8	69690	69749	59.0	1093.0
0.7 µm		Pump B	15			140.38	87898.0	87976	78.0	2163.0
		Pump A	25			143.4	61339	61443	104.0	2110.0
	Station 7, cast 11	Pump C	5	20.00-21.00	1 hour	35.57	69749	69780	31.0	580.0
0.3 µm		Pump B	15			64.11	87976	88013	37.0	1010.0
		Pump A	25			58.13	61443	61541	98.0	859.0
		Pump C	30	21.45-22.45	1 hour	107.42	69780	69879	99.0	1686.0
0.3 µm		Pump B	35			242.85	88013	88194	181.0	time limit reached
		Pump A	40			61.03	61541	61602	61.0	910.0
22/05/2016	Station 8, cast 3	Pump C	5	15.00-16.00	1 hour	63.55	69879	69928	49.0	964.0
0.7 µm		Pump B	18			114.21	88196	88255	59.0	1803.0
		Pump A	25			95.18	61603	61699	96.0	1314.0
For Darci	Station 8, cast 4	Pump C	40	17.15-18.15	1 hour	55.63	69928	69980	52.0	786.0
0.3 µm		Pump B	40			89.19	88255.0	88317	62.0	1303.0
		Pump A	40			37.53	61699	61736	37.0	520.0
	Station 8, cast 5	Pump C	40	18.50-19.50	1 hour	51.08	69980	70029	49.0	721.0
0.3 µm		Pump B	40			72.55	88317	88370	53.0	1045.0
		Pump A	40			291.74	61736	62061	325.0	time limit reached

23/05/2016	Station 9, cast 7	Pump C	5	11.30-12.30	1 hour	49.62	70030	70068	38.0	778.0
0.7 µm		Pump B	23			161.52	88377.0	88453	76.0	2607.0
		Pump A	35			129.52	62064	62194	130.0	1954.0
	Station 9, cast 8	Pump C	5	13.15-14.15	1 hour	48.6	70068	70100	32.0	775.0
0.3 µm		Pump B	23			241.84	88453	88622	169.0	time limit reached
		Pump A	35			53.95	62194	62249	55.0	835.0
	Station 9, cast 9	Pump C	45	15.30-16.30	1 hour	241.44	70100	70306	206.0	time limit reached
0.3 µm		Pump B	59			268.49	88622.0	88832	210.0	time limit reached
		Pump A	77			66.26	62249	62315	66.0	933.0
25/05/2016	Station 10, cast 8	Pump C	5	11.25-12.25	1 hour	111.52	70309	70399	90.0	1657.0
0.7 µm		Pump B	15			211.02	88846	88972	126.0	3380.0
		Pump A	25			115.22	62316	62429	113.0	1691.0
	Station 10, cast 9	Pump C	5	13.20-14.20	1 hour	64.18	70399	70452	53.0	977.0
0.3 µm		Pump B	15			193.04	88972.0	89084	112.0	3040.0
		Pump A	25			65.01	62429	62494	65.0	1002.0
	Station 10, cast 10	Pump C	50	15.15-16.45	1,5 hours	208.9	70452	70622	170.0	3207.0
0.3 µm		Pump B	60			298.45	89084	89330	246.0	4567.0
		Pump A	72			58.91	62494	62557	63.0	904.0
26/05/2016	Station 10, cast 12	Pump C	100	07.45-09.45	2 hours	355.65	70623	70921	298.0	5142.0
0.3 µm		Pump B	150			371.32	89331.0	89591	260.0	time limit reached
		Pump A	200				62557	62561	4.0	failed, low battery
	Station 10, cast 13	Pump C	125	12.00-15.00	2 hours	78.15	70922	70986	64.0	1095.0
0.3 µm		Pump B	200			522.65	89599	89977	378.0	time limit reached
		Pump A	175			113.34	62561	62672	111.0	1657.0
For Darci	Station 10, cast 14	Pump C	68.4	15.00-16.00	1 hour	163.13	70986	71120	134.0	2443.0
0.3 µm		Pump B	68.4			266.27	89977.0	90167	190.0	time limit reached
		Pump A	68.4			87.98	62672	62760	88.0	1396.0

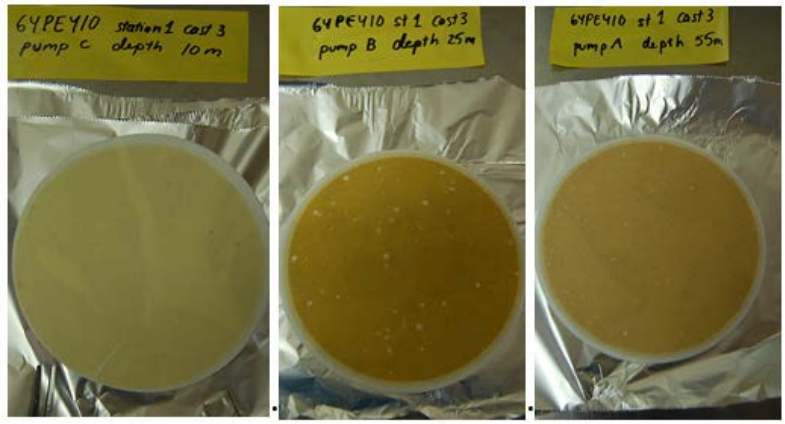


Figure 2. Pictures of filters from station one reading from left to right: 10 m, 25 m, 55 m

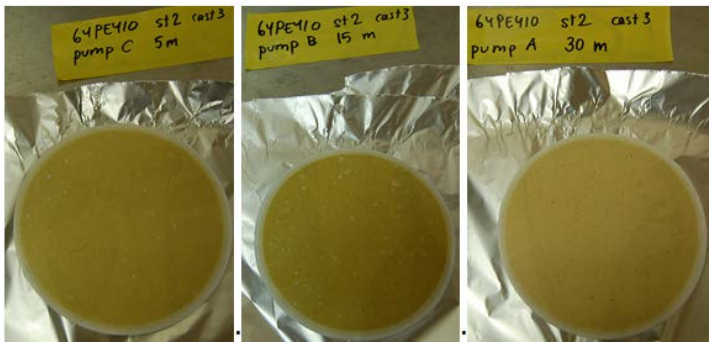


Figure 3, Pictures of filters from station 2, depths 5 m, 15 m and 30 m

Figure 4, Pictures of filters from station 3, depths 5 m and 20 m with 0.7 um filters and depths, 5 m, 10 m, 15 m, 20 m, 25 m and 30 m with 0.3 um filters. The first deployment to 25 m with pump A failed.

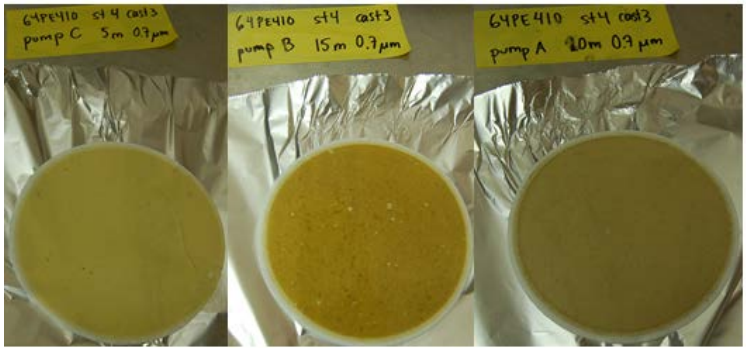


Figure 5, Pictures of filters from station 4, depths 5 m, 15 m and 20 m

Figure 6, Pictures of filters from station 5, depths 10 m, 20 m and 25 m

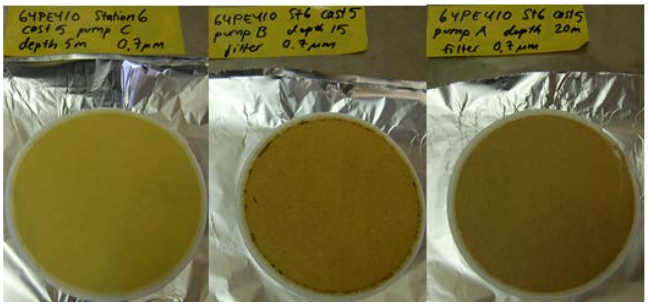


Figure 7, Pictures of filters from station 6, depths 5 m, 15 m and 20 m

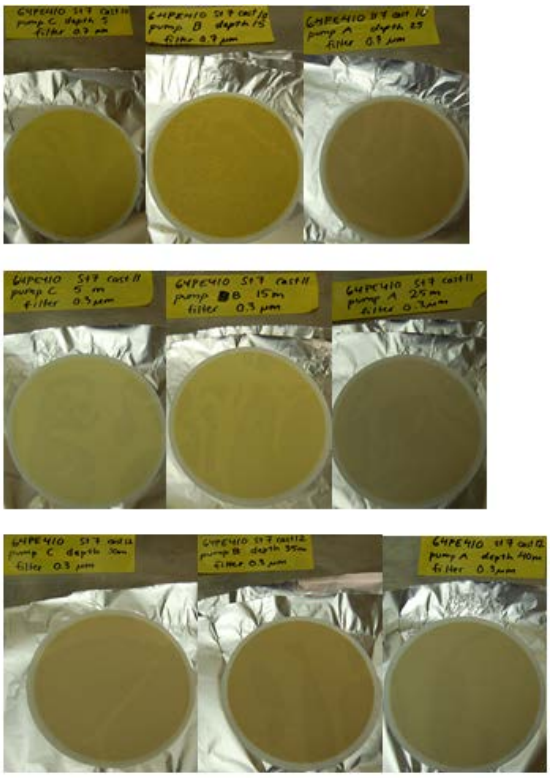


Figure 8, Pictures of filters from station 7, depths 5 m, 15 m and 25 m with 0.7 um filters. Depths 5 m, 15 m, 25 m, 30 m, 35 m and 40 m with 0.3 um filters.

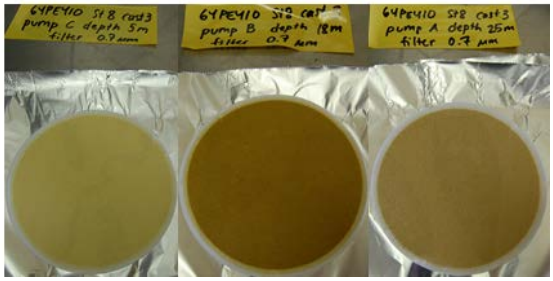


Figure 9, Pictures of filters from station 8, depths 5 m, 18 m and 25 m. In addition 40 m filtered 6 times for Darci Rush (not shown).

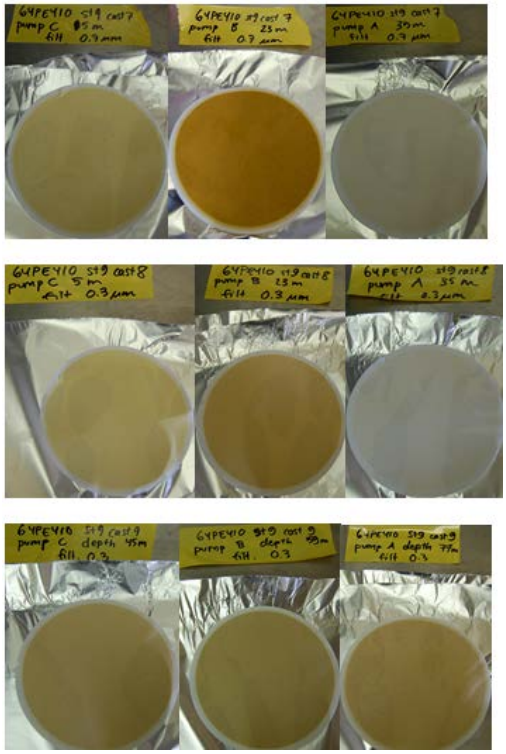


Figure 10, Pictures of filters from station 9, depths 5m, 23 m and 39 m with 0.7 um filters. Depths 5 m, 23 m, 39 m, 45 m, 59 m and 77 m with 0.3 um filters

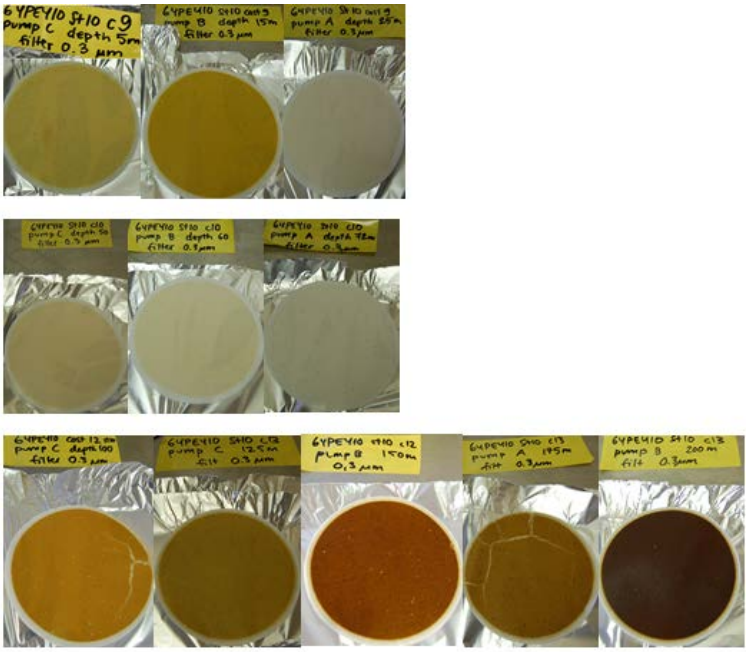


Figure 11, Pictures of filters from station 10, depths 5 m 15 m and 25 m with 0.7 um filters. Depths 5 m, 15 m, 25 m, 50 m, 60 m, 70 m, 100 m, 125 m, 150 m, 175 m and 200 m with 0.3 um filters

10. MULTICORES

Gabriella Weiss & Darci Rush

Station	Water Depth	Core Length (cm)	Sliced Cores Lipids/DNA (-80°C)	Sliced Cores (Bengal Rose - 4°C)	Cores for Pore water	Cores for methane	Porosity/Carbonate 5mL (-20°C)	Archived Cores (4°C)
1	550	40	3 (10cm)	1 (10cm)	0	0	0	1
2	44	40	3 (2 to 10cm, 1 to 8cm)	1 (10cm)	0	0	0	1
3	37.5	45	3 (10cm)	1 (10cm)	0	0	0	1
4	30	35	3 (10cm)	1 (10cm)	0	0	0	1
5	45	35	3 (10cm)	1 (10cm)	0	0	0	1
6	27	45	3 (10cm)	1 (10cm)	0	0	0	1
7	50	55	3 (30cm)	1 (10cm)	2	1	1 (30cm)	13
8	NO SEDIMENT WORK							
9	90	55	3 (30cm)	1 (10cm)	1	1	1 (30cm)	1
10	246	30	3 (2 to 30cm, 1 to 29cm)	1 (10cm)	1	1	1 (30cm)	13

10.1 Part 1 – Stations 1-6:

For all stations, four cores were sliced at half cm resolution for the first two cm and every one cm thereafter until 10cm and labeled cores A, B, C and D. Slices from three cores (A, B, C) were stored in geochemical bags at -80°C for lipid/DNA analyses. Slices from one core (D) were stored in pots with Bengal rose for foraminiferal analyses and kept in the reefer at 4°C. At least one archive core was taken at each station and also stored at 4°C.

10.1.1 Station 1:

First deployment of the multicorer was successful, with cores measuring approximately 42cm in length. Sediment was relatively homogenous dark brown with roots throughout. The top 2-3cm were soupy, but the sediment became more condensed further down the core, with no significant changes throughout the top 10cm.

10.1.2 Station 2:

The multicorer was deployed once successfully. Upon initial inspection, sediment appeared to be quite fluffy with many holes and worms throughout. However, only the first cm was watery, and the subsequent depths were quite thick and sticky grey to brown clay with some black layers mixed in. Each core had a lot of

bioturbation, with many of the perpetrators still at work burrowing through the sediment. Core C had a “zee-klit” (Echinocardium cordatum) around 3-4cm and core D had a cluster of worms at 5-6cm making these slices a bit smaller than normal. The outside ring on the coring tube of core C broke, therefore slicing stopped after 8cm.

10.1.3 Station 3:

Multicores measured approximately 45cm in length and were again heavily bioturbated with a number of brittle stars and small worms throughout. Core B contained a large Echinocardium cordatum between 4 and 8cm. Sediment was quite soupy in the top few cm and the first cm had to be removed with a syringe.

10.1.4 Station 4:

Multicores were approximately 35cm in length. Cores were very similar to station 3, with many brittle stars, but less obvious bioturbation. Another Echinocardium cordatum was found in core B and another large one was found on the multicore frame, along with a number of brittle stars.

10.1.5 Station 5:

Cores measured around 35cm and the top layer was populated with a number of brittle stars, which continued to be present throughout, but strong bioturbation was less clear than in previous cores. At 5-6cm, a shell layer was present.

10.1.6 Station 6:

Multicoring was done twice because it was brought to the surface a bit too quickly the first time and the top layers of the cores were slanted and sediment was suspended into the bottom water. The second time, the top layer was less disturbed, but still very fluffly. Approximately 0.5-1cm of bottom water was included in the first half cm slice to included suspended top sediment. The top few cm was a grey-brown color, but switched to a dark grey-black color around 6-7cm with a strong sulfide smell. Cores measured around 45cm in length.

10.2 Part Two – Stations 7, 9 & 10:

For all three stations, four cores were sliced at half cm resolution for the first two cm and every one cm thereafter until 30cm and labeled cores A, B, C and D. Slices from three cores (A, B, C) were stored in geochemical bags at -80°C for lipid/DNA analyses. Slices from 0-10cm from core D were stored in pots with Bengal rose for foraminiferal analyses and kept in the reefer at 4°C. ~5mL wet sediment was sampled at 1cm resolution up to 30cm from core D for future porosity/carbonate measurements and stored at -20°C. At least one archive core was taken at each station and also stored at 4°C. Cores were also taken for methane measurements and pore water analyses, see sections 11 & 12.

10.2.1 Station 7:

Multicorer was deployed twice. The first time the cores were too full. The second deployment yielded cores approximately 55cm in length with slightly uneven tops. The top cm of the cores was very fluffy brown. After the first cm, the sediment was a mix between rich brown and dark grey – black and became completely dark grey – black after 3cm, but did not smell of sulfides until around 7-8cm. Core B contained more water throughout than the others and core C was more dry and sticky than the others. There was no clear bioturbation but some bubbling of gases was present at the very bottom depths.

10.2.2 Station 9:

Multicorer was deployed three times before cores were suitable. After the first deployment, ten weights were removed from the top. Again, the cores were too full and six weights were removed from the top and two from the middle. The top layer was brown, fluffy material. Below the first two cm the sediment was a mix of grey and brown. Core C remained brown for a majority of the 30cm. In core B there were a couple of fragmented shells around 27-28cm.

10.2.3 Station 10:

Multicores from station 10 were slightly over 30cm in length. The top half cm was very fluffy brown material followed by a Fe rich layer also half a cm thick. Laminations of carbonate material were present until around 6cm. After 6cm, the sediment became a greyish brown color, but still had nice laminations.

Station 1

Station 2

Station 3

Station 4

Station 5

Station 6

Station 7

Station 10

Station 9 - top

Station 9 - bottom

11. Methane sampling

Sigrid van Grinsven

Methane samples were taken from both multicores and piston cores of stations 7, 9 and 10.

Methane samples	
Station 7, multicore A	
Sample ID number	Depth in core (cm)
5	1
6	3.5
7	6
8	8.5
9	11
10	13.5
11	16
12	18.5
13	21
14	23.5
15	26
16	28.5
17	31
18	33.5
19	36
20	38.5
21	41
22	43.5

Methane samples	
Station 7, multicore B	
Sample ID number	Depth in core (cm)
7	0.5

8	3
9	5.5
10	8
11	10.5
12	13
13	15.5
14	18
15	20.5
16	23
17	25.5
18	28
19	30.5
20	33
21	35.5
22	38

Methane samples	
Station 7, piston core	
Sample ID number	Depth in core (cm)
7	112
8	137
9	162
10	187
11	212
12	237
13	262
14	287
15	312

16	337
17	362
18	387
19	412
20	437
21	462
22	487
23	512
24	537
25	562
26	587
27	612
28	637
29	662
30	687
31	712
32	737
33	762
34	787
35	812
36	837
37	862
38	887
39	912
40	937
4	962

5	987
6	1012

Methane samples	
Station 9, multicore	
Sample ID number	Depth in core (cm)
4	0.5
5	3
6	5.5
7	8
8	10.5
9	13
10	15.5
11	18
12	20.5
13	23
14	25.5
15	28
16	30.5
17	33
18	35.5
19	38
20	40.5
21	43

Methane samples	
Station 10, multicore	
Sample ID number	Depth in core (cm)
3	0.5

4	3
5	5.5
6	8
7	10.5
8	13
9	15.5
10	18
11	20.5
12	23
13	25.5
14	28
15	30.5
16	33
17	35.5

Methane samples	
Station 9, piston core	
Sample ID number	Depth in core (cm)
-4	20
-3	45
-2	70
-1	95
0	120
1	145
2	170
3	195
4	220
5	245

6	270
7	295
8	320
9	345
10	370
11	395
12	420
13	445
14	470
15	495
16	520
17	545
18	570
19	595
20	620
21	645
22	670
23	695
24	720
25	745
26	770
27	795
28	820
29	845
30	870
31	895

32	920
33	945
34	970
35	995
36	1020
37	1045
38	1070
39	1095
40	1120

Methane samples	
Station 10, piston core	
Sample ID number	Depth in core (cm)
2	18
3	43
4	68
5	93
6	118
7	143
8	168
9	193
10	218
11	243
12	268
13	293
14	318
15	343
16	368

17	393
18	418
19	443
20	468
21	493
22	518
23	543
24	568
25	593
26	618
27	643
28	668
29	693
30	718
31	743
32	768
33	793
34	818
35	843
36	868
37	893
38	918
39	943
40	968

12. Pore water sampling and sub-sampling

Fatimah Sulu-Gambari, Rick Hennekam, Margriet Lantink, Sigrid van Grinsven

During the Baltic expedition (64PE410) 3 stations were sampled for pore water analyses. Both a piston core and a multicore were sampled for pore waters at Stations 7, 9, and 10. Either an approach using (1) Rhizons and/or (2) slicing in an anoxic glove bag with subsequent centrifugation were used for pore water extraction (see Sampling section below for further details per core). Pore water extraction was done directly after core recovery. Slicing and subsequent sub-sampling were performed at ±8 °C, both in N-flushed glove bags. Bottom waters (i.e. water on top of the sediments) were also sampled from the multi cores (labeled sample depth 0).

12.1 Methods

12.1.1 Glove bag sampling and centrifuge

From multicores at Stations 7, 9, and 10, pore water samples were taken by slicing them inside a glove bag. The cores where pushed up vertically into the glovebox using a core pusher. Subsequently the core was sampled with the desired resolution of 1-cm for the top 30 cm's. Caution was taken to avoid sampling sediment from the outer rim as this potentially contains relatively wet sediment from the surface that had been dragged along while the core is pushed into the sediment. The retrieved sediment was put into a Greiner tube and centrifuged at 3000 RPM for 15-30 minutes (depending on the amount of pore water recovered). After centrifugation the (pore) water from the Greiner tubes was decanted in a syringe and then filtered into a container, awaiting subsequent sub-sampling (see details below, done within 6 hours after pore water retrieval).

12.1.2 Rhizons

Rhizons are made of a hydrophilic porous polymer tube, with a typical pore diameter of 0.1 µm, extended with a polyvinyl chloride tube. The outer diameter of a Rhizon is 2.4 mm, and the filter section has a length of 5 cm. To support the polymer, a wire is fixed to one end of the porous polymer. The fluid sampled from the sediment flows into the tiny space between the porous tube and the supporting wire. The pore size ensures the extraction of microbial- and colloidal-free, ready-to-analyze solutions (Seeberg-Elverfeldt et al., 2005). The Rhizons are distributed by Rhizosphere Research Products (Wageningen, NL). The Rhizon tube is pushed into the sediment and samples are obtained at the extraction points by weak negative pressure.

During the cruise the Rhizons were pushed into the sediment via predrilled holes in the multi and piston core tubes. A negative pressure was obtained by a connection of the Rhizon, via a 3-way valve, to a pulled syringe, hold in position

with a wooden stick. The Rhizons were left with negative pressure for around 60 minutes. After the pore water extraction the 3-way valves were closed and the syringes were brought into a glove bag for subsampling done at 8°C.

12.1.3 Sub-sampling of pore waters

After pore water recovery the samples were sub-sampled in an N-flushed glove bag. The amounts of pore water collected varied and therefore sub-sampling was done using (generally) the following priority of the several treatments: SO_4 > HS > Metals > N species > PO_4 + Si > DIC > Alkalinity. Only for the piston core of Station 10 this priority list was altered (first N Species then Metals) because of a limited amount of glass vials left. The general scheme for the sub-sampling of the porewater samples can be seen in Table PW-1.

Table PW-1. Scheme of pore water treatment

Analysis	ml sampled	Vial	Treatment	Code	Method	Storage
SO_4	0.5	Glass	None	IC	NIOZ	-20°C
HS	0.5	Glass	1.5 ml 8 mmol/L NaOH	HS	Onboard Sharyn	4°C
Metals (trace to major elements)	1	15 ml Greiner	10 µl Suprapur 30% HCl	ME	NIOZ	-20°C
N Species (NH_4, NO_3, NO_2)	0.5	Pony	None	NSPEC	Onboard Sharyn	-20°C
PO_4, Silica	1	Pony	5 µl 5 M HCl	PO_4, Si	Onboard Sharyn	4°C
DIC	0.5	Glass	First sampe, then added 4,5 ml saturated NaCl solution	DIC	Onboard Sharyn	4°C
Alkalinity	>1	50 ml Greiner (left over)	None	ALK/BULK	Onboard Titration	4°C

12.2 Sampling of pore waters

The multi and piston cores of Stations 7, 9, and 10 were sampled for pore waters. Station 7 Cast 13 Multi Core has been done by both Rhizon sampling and slicing+centrifuge sampling. For all other cores one of the two pore water extraction methods were used. On the following pages per core a table is given for the samples taken and the sub-sampling performed on these samples.

Station 7 Cast 8 Piston Core

Core Section	Sample	Depth in Section (cm)	Depth in Core (cm)	Method	SO_4	HS	Metals	N species	PO_4 + Si	DIC	Alk
12	1	9.5	49.5	Rhizon	X	X	X	X	-	-	-
12	2	34.5	74.5	Rhizon	X	X	X	X	-	-	-
12	3	59.5	99.5	Rhizon	X	X	X	X	-	-	-
12	4	84.5	124.5	Rhizon	X	X	X	X	-	-	-
11	5	9.5	149.5	Rhizon	X	X	X	-	-	-	-
11	6	34.5	174.5	Rhizon	X	X	X	X	-	-	-
11	7	59.5	199.5	Rhizon	X	X	X	-	-	-	-
11	8	84.5	224.5	Rhizon	X	X	X	X	-	-	-
10	9	9.5	249.5	Rhizon	X	X	X	X	-	-	-
10	10	34.5	274.5	Rhizon	X	X	X	-	-	-	-
10	11	59.5	299.5	Rhizon	X	X	X	X	-	-	-
10	12	84.5	324.5	Rhizon	X	X	X	X	-	-	-
9	13	9.5	349.5	Rhizon	X	-	-	-	-	-	-
9	14	34.5	374.5	Rhizon	X	-	-	-	-	-	-
9	15	59.5	399.5	Rhizon	X	X	X	-	-	-	-
9	16	84.5	424.5	Rhizon	X	X	X	-	-	-	-
8	17	9.5	449.5	Rhizon	X	X	X	X	-	-	-
8	18	34.5	474.5	Rhizon	X	X	X	-	-	-	-
8	19	59.5	499.5	Rhizon	X	-	-	-	-	-	-
8	20	84.5	524.5	Rhizon	X	-	-	-	-	-	-
7	21	9.5	549.5	Rhizon	X	X	X	X	-	-	-
7	22	34.5	574.5	Rhizon	X	X	X	X	-	-	-
7	23	59.5	599.5	Rhizon	X	X	X	X	-	-	-
7	24	84.5	624.5	Rhizon	X	X	X	-	-	-	-
6	25	9.5	649.5	Rhizon	X	-	-	-	-	-	-
6	26	34.5	674.5	Rhizon	X	X	X	-	-	-	-
6	27	59.5	699.5	Rhizon	X	X	X	-	-	-	-
6	28	84.5	724.5	Rhizon	X	-	-	-	-	-	-
5	29	9.5	749.5	Rhizon	X	-	-	-	-	-	-
5	30	34.5	774.5	Rhizon	X	-	-	-	-	-	-
5	31	59.5	799.5	Rhizon	X	X	X	-	-	-	-
5	32	84.5	824.5	Rhizon	X	X	X	-	-	-	-
4	33	9.5	849.5	Rhizon	X	-	-	-	-	-	-
4	34	34.5	874.5	Rhizon	X	X	X	-	-	-	-
4	35	59.5	899.5	Rhizon	X	X	X	X	-	-	-
4	36	84.5	924.5	Rhizon	X	X	X	-	-	-	-

Station 7 Cast 13 Multi Core (Rhizon Sampling)

Sample	Depth from sediment-water interface (cm)	Method	SO_4	HS	Metals	N species	PO_4 + Si	DIC	Alk
0	-0.8	Rhizon	X	X	X	X	X	X	X
1	1.2	Rhizon	X	X	X	X	X	X	X
2	3.2	Rhizon	-	-	-	-	-	-	-
3	5.2	Rhizon	X	X	X	X	X	X	X
4	7.2	Rhizon	X	X	X	X	-	-	-
5	9.2	Rhizon	X	X	X	X	X	X	X
6	11.2	Rhizon	X	X	X	X	X	X	X
7	13.2	Rhizon	X	X	X	X	X	X	X
8	15.2	Rhizon	X	X	X	X	X	X	-
9	17.2	Rhizon	X	X	X	X	-	-	-
10	18.2	Rhizon	X	X	X	X	X	X	-
11	19.2	Rhizon	X	X	X	X	X	-	-
12	20.2	Rhizon	X	X	-	-	-	-	-
13	21.2	Rhizon	X	X	-	X	-	-	-
14	22.2	Rhizon	X	X	X	X	X	X	-
15	26.2	Rhizon	X	X	X	X	-	-	X
16	27.2	Rhizon	X	X	X	X	-	-	-
17	28.2	Rhizon	X	X	X	-	-	-	-
18	29.2	Rhizon	X	X	-	X	-	-	-
19	31.2	Rhizon	X	X	X	-	-	-	-
20	33.2	Rhizon	X	X	-	X	-	-	-
21	34.2	Rhizon	X	X	X	-	-	-	-
22	37.2	Rhizon	X	X	-	X	-	-	-
23	39.2	Rhizon	X	X	-	X	-	-	-
24	41.2	Rhizon	X	X	-	X	-	-	-
25	43.2	Rhizon	X	-	-	-	-	-	-
26	45.2	Rhizon	X	X	-	X	-	-	-
27	47.2	Rhizon	X	-	-	X	-	-	-
28	49.2	Rhizon	X	X	-	X	-	-	-

Station 7 Cast 13 Multi Core (Slicing+Centrifuge Sampling)

Sample	Depth from sediment-water interface (cm)	Method	SO_4	HS	metals	N species	PO_4 + Si	DIC	Alk
0	-1	Centrif.	X	X	X	X	X	X	X
1	1	Centrif.	X	X	X	X	X	X	X
2	2	Centrif.	X	X	X	X	X	X	X
3	3	Centrif.	X	X	X	X	X	X	X
4	4	Centrif.	X	X	X	X	X	X	X
5	5	Centrif.	X	X	X	X	X	X	X
6	6	Centrif.	X	X	X	X	X	X	X
7	7	Centrif.	X	X	X	X	X	X	X
8	8	Centrif.	X	X	X	X	X	X	X
9	9	Centrif.	X	X	X	X	X	X	X
10	10	Centrif.	X	X	X	X	X	X	X
11	11	Centrif.	X	X	X	X	X	X	-
12	12	Centrif.	X	X	X	X	X	X	X
13	13	Centrif.	X	X	X	X	X	X	X
14	14	Centrif.	X	X	X	X	X	X	X
15	15	Centrif.	X	X	X	X	X	X	X
16	16	Centrif.	X	X	X	X	X	X	X
17	17	Centrif.	X	X	X	X	X	X	X
18	18	Centrif.	X	X	X	X	X	X	X
19	19	Centrif.	X	X	X	X	X	X	X
20	20	Centrif.	X	X	X	X	X	X	X
21	21	Centrif.	X	X	X	X	X	X	X
22	22	Centrif.	X	X	X	X	X	X	X
23	23	Centrif.	X	X	X	X	X	X	X
24	24	Centrif.	X	X	X	X	X	X	X
25	25	Centrif.	X	X	X	X	X	X	X
26	26	Centrif.	X	X	X	X	X	X	-
27	27	Centrif.	X	X	X	X	X	X	X

Station 9 Cast 5 Multi Core

Sample	Depth from sediment-water interface (cm)	Method	SO_4	HS	metals	N species	PO_4 + Si	DIC	Alk
0	-1	Rhizon	X	X	X	X	X	X	X
1	1	Rhizon	X	X	X	X	X	X	X
2	3	Rhizon	X	X	X	X	X	X	X
3	5	Rhizon	X	X	X	X	X	X	X
4	7	Rhizon	X	X	X	X	X	X	X
5	9	Rhizon	X	X	X	X	X	X	X
6	11	Rhizon	X	X	X	X	X	X	X
7	13	Rhizon	X	X	X	X	X	X	X
8	15	Rhizon	X	X	X	X	X	X	X
9	17	Rhizon	X	X	X	X	X	X	X
10	19	Rhizon	X	X	X	X	X	X	X
11	21	Rhizon	X	X	X	X	X	X	-
12	27	Rhizon	X	X	X	X	X	X	-
13	29	Rhizon	X	X	X	X	X	X	-
14	31	Rhizon	X	X	X	X	X	X	-
15	33	Rhizon	X	X	X	X	X	X	-
16	35	Rhizon	X	X	X	X	-	X	-
17	37	Rhizon	X	X	X	X	X	-	-
18	39	Rhizon	X	X	X	X	X	-	-
19	41	Rhizon	X	X	X	X	X	X	-
20	43	Rhizon	X	X	X	X	X	X	-
21	45	Rhizon	X	X	X	X	X	X	-
22	47	Rhizon	X	X	X	-	-	-	-
23	49	Rhizon	X	X	X	X	X	X	-

Station 9 Cast 8 Piston Core

Core Section	Sample	Depth in Section (cm)	Depth in Core (cm)	Method	SO_4	HS	metals	N species	PO_4 + Si	DIC	Alk
15	1	5	5	Centrif.	X	X	X	X	X	X	X
15	2	20	20	Centrif.	X	X	X	X	X	X	X
14	3	20	60	Centrif.	X	X	X	X	X	-	-
14	4	40	80	Centrif.	X	X	X	X	X	-	-
14	5	60	100	Centrif.	X	X	X	X	X	-	-
14	6	80	120	Centrif.	-	-	-	-	-	-	-
13	7	20	160	Centrif.	-	-	-	-	-	-	-
13	8	40	180	Centrif.	-	-	-	-	-	-	-
13	9	60	200	Centrif.	-	-	-	-	-	-	-
13	10	80	220	Centrif.	-	-	-	-	-	-	-
12	11	20	260	Centrif.	-	-	-	-	-	-	-
12	12	40	280	Centrif.	-	-	-	-	-	-	-
12	13	60	300	Centrif.	-	-	-	-	-	-	-
12	14	80	320	Centrif.	-	-	-	-	-	-	-
11	15	20	360	Centrif.	-	-	-	-	-	-	-
11	16	40	380	Centrif.	-	-	-	-	-	-	-
11	17	60	400	Centrif.	-	-	-	-	-	-	-
11	18	80	420	Centrif.	-	-	-	-	-	-	-
10	19	20	460	Centrif.	-	-	-	-	-	-	-
10	20	40	480	Centrif.	-	-	-	-	-	-	-
10	21	60	500	Centrif.	-	-	-	-	-	-	-
10	22	80	520	Centrif.	-	-	-	-	-	-	-
9	23	20	560	Centrif.	-	-	-	-	-	-	-
9	24	40	580	Centrif.	-	-	-	-	-	-	-
9	25	60	600	Centrif.	-	-	-	-	-	-	-
9	26	80	620	Centrif.	-	-	-	-	-	-	-
8	27	20	660	Centrif.	-	-	-	-	-	-	-
8	28	40	680	Centrif.	-	-	-	-	-	-	-
8	29	60	700	Centrif.	-	-	-	-	-	-	-
8	30	80	720	Centrif.	-	-	-	-	-	-	-
7	31	20	760	Centrif.	-	-	-	-	-	-	-

7	32	40	780	Centrif.	-	-	-	-	-	-	-
7	33	60	800	Centrif.	-	-	-	-	-	-	-
7	34	80	820	Centrif.	-	-	-	-	-	-	-
6	35	20	860	Centrif.	-	-	-	-	-	-	-
6	36	40	880	Centrif.	-	-	-	-	-	-	-
6	37	60	900	Centrif.	-	-	-	-	-	-	-
6	38	80	920	Centrif.	-	-	-	-	-	-	-
5	39	20	960	Centrif.	-	-	-	-	-	-	-
5	40	40	980	Centrif.	-	-	-	-	-	-	-
5	41	60	1000	Centrif.	-	-	-	-	-	-	-
5	42	80	1020	Centrif.	-	-	-	-	-	-	-
4	43	20	1060	Centrif.	-	-	-	-	-	-	-
4	44	40	1080	Centrif.	-	-	-	-	-	-	-
4	45	60	1100	Centrif.	-	-	-	-	-	-	-
4	46	80	1120	Centrif.	-	-	-	-	-	-	-

Station 10 Cast 4 Multi Core

Sample	Depth from sediment-water interface (cm)	Method	SO_4	HS	metals	N species	PO_4 + Si	DIC	Alk
0	-1	Centrif.	X	X	X	X	X	X	X
1	1	Centrif.	X	X	X	X	X	X	X
2	2	Centrif.	X	X	X	X	X	X	X
3	3	Centrif.	X	X	X	X	X	X	X
4	4	Centrif.	X	X	X	X	X	X	X
5	5	Centrif.	X	X	X	X	X	X	X
6	6	Centrif.	X	X	X	X	X	X	X
7	7	Centrif.	X	X	X	X	-	-	-
8	8	Centrif.	X	X	X	X	X	X	X
9	9	Centrif.	X	X	X	X	X	X	X
10	10	Centrif.	X	X	X	X	X	X	X
11	11	Centrif.	X	X	X	X	X	X	X
12	12	Centrif.	X	X	X	X	X	X	X
13	13	Centrif.	X	X	X	X	X	X	X
14	14	Centrif.	X	X	X	X	X	X	X
15	15	Centrif.	X	X	X	X	X	X	X
16	16	Centrif.	X	X	X	X	X	X	X
17	17	Centrif.	X	X	X	X	X	X	X
18	18	Centrif.	X	X	X	X	X	X	X
19	19	Centrif.	X	X	X	X	X	X	X
20	20	Centrif.	X	X	X	X	X	X	X
21	21	Centrif.	X	X	X	X	X	X	X
22	22	Centrif.	-	-	-	-	-	-	-
23	23	Centrif.	X	X	X	X	X	X	X
24	24	Centrif.	X	X	X	X	X	X	X
25	25	Centrif.	X	X	X	X	X	X	X
26	26	Centrif.	X	X	X	X	X	X	X
27	27	Centrif.	X	X	X	X	X	X	X
28	28	Centrif.	X	X	X	X	X	X	X
29	29	Centrif.	X	X	X	X	X	X	-
30	30	Centrif.	X	X	X	X	-	-	-

Station 10 Cast 11 Piston Core

Core Section	Sample	Depth in Section (cm)	Depth in Core (cm)	Method	SO_4	HS	metals	N species	PO_4 + Si	DIC	Alk
16	1	10	8	Centrif.	X	X	X	X	X	X	X
16	2	35	33	Centrif.	X	X	X	X	X	-	X
16	3	60	58	Centrif.	X	X	X	X	X	X	-
16	4	85	83	Centrif.	X	X	-	-	-	-	-
15	5	10	108	Centrif.	X	X	-	-	-	X	-
15	6	35	133	Centrif.	X	X	-	-	-	X	-
15	7	60	158	Centrif.	X	X	-	-	-	-	-
15	8	85	183	Centrif.	X	-	-	-	-	-	-
14	9	10	208	Centrif.	-	-	-	-	-	-	-
14	10	35	233	Centrif.	X	-	-	-	-	-	-
14	11	60	258	Centrif.	X*	-	-	-	-	-	-
14	12	85	283	Centrif.	-	-	-	-	-	-	-
13	13	10	308	Centrif.	X*	-	-	-	-	-	-
13	14	35	333	Centrif.	X*	-	-	-	-	-	-
13	15	60	358	Centrif.	X*	-	-	-	-	-	-
13	16	85	383	Centrif.	-	-	-	-	-	-	-
12	17	10	408	Centrif.	X*	-	-	-	-	-	-
12	18	35	433	Centrif.	-	-	-	-	-	-	-
12	19	60	458	Centrif.	-	-	-	X	-	X	-
12	20	85	483	Centrif.	-	-	-	X*	-	X	-
11	21	10	508	Centrif.	-	-	-	X	-	X	-
11	22	35	533	Centrif.	-	-	-	X	-	-	-
11	23	60	558	Centrif.	-	-	-	X*	-	X	-
11	24	85	583	Centrif.	-	-	-	X*	-	-	-
10	25	10	608	Centrif.	-	-	-	X*	-	-	-
10	26	35	633	Centrif.	-	-	-	X*	-	-	-
10	27	60	658	Centrif.	-	-	-	X*	-	-	-
10	28	85	683	Centrif.	-	-	-	X*	-	-	-
9	29	10	708	Centrif.	-	-	-	X*	-	-	-
9	30	35	733	Centrif.	-	-	-	X*	-	-	-

9	31	60	758	Centrif.	-	-	-	X*	-	-	-
9	32	85	783	Centrif.	-	-	-	X*	-	-	-
8	33	10	808	Centrif.	-	-	-	X*	-	-	-
8	34	35	833	Centrif.	-	-	-	X*	-	-	-
8	35	60	858	Centrif.	-	-	-	X*	-	-	-
8	36	85	883	Centrif.	-	-	-	X*	-	-	-
7	37	10	908	Centrif.	-	-	-	X*	-	-	-
7	38	35	933	Centrif.	-	-	-	X*	-	-	-
7	39	60	958	Centrif.	-	-	-	X*	-	-	-
7	40	85	983	Centrif.	-	-	-	X*	-	-	-

* <0.5 ml but still sub-sampled

12.3 References

Seeberg-Elverfeldt, J., Schlüter, M., Feseker, T., Kölling, M., 2005. Rhizon sampling of porewaters near the sediment-water interface of aquatic systems. Limnology and Oceanography: Methods, 3, 361-371

13. In situ pump filter and water column collection from Arkona Basin and Gotland Deep for incubation of aerobic methane oxidisers (to be done at NIOZ)

Darci Rush

13.1 Research questions:

1) What microbes (specifically aerobic methane oxidising bacteria) are oxidizing the methane that diffuses/bubbles from the anoxic water/sediments into the oxic water column of Baltic Basins?
2) Do these bacteria produce specific biomarker lipids that we can use to trace past methane oxidation (e.g. bacteriohopanepolyol lipids)?
3) What effects do changes in environmental conditions have on the bacterial populations and their lipids?

To this end, we will analyse the bacteria population and lipid signatures of the oxic water column directly above methane influenced sediment (Arkona) and water (Gotland). Additionally, we will set up incubation experiments at NIOZ to determine effects changes in environmental conditions (e.g Temperature, pH, methane concentration) have on these bacteria.

13.2 Material retrieved:

22-05-2016:

13.2.1 Arkona Basin: 54º 55.208 N, 13º 29.992 E

Station 8, Cast 2, 4 and 5

The location of the site for Arkona Basin water and filter collection was decided based on a long-term monitoring site (TF0113) where active methane seepage into the water column had been reported (Gülzow et al., 2013). We did not detect methane in the water column using either real-time multibeam scanning or FishFinder. However, it is possible that methane was diffusing and not creating bubbles. We collected water and filters at the lowest possible depth that the CTD could get to the sediment water interface (43.4 m water depth, which was 10 m above the sediment at 53.4 m)

Collection:

6 filters (2 deployments of in situ pumps) were pumped for 1 hour at 43.4 m water depth VOLUME of water filtered from section 9

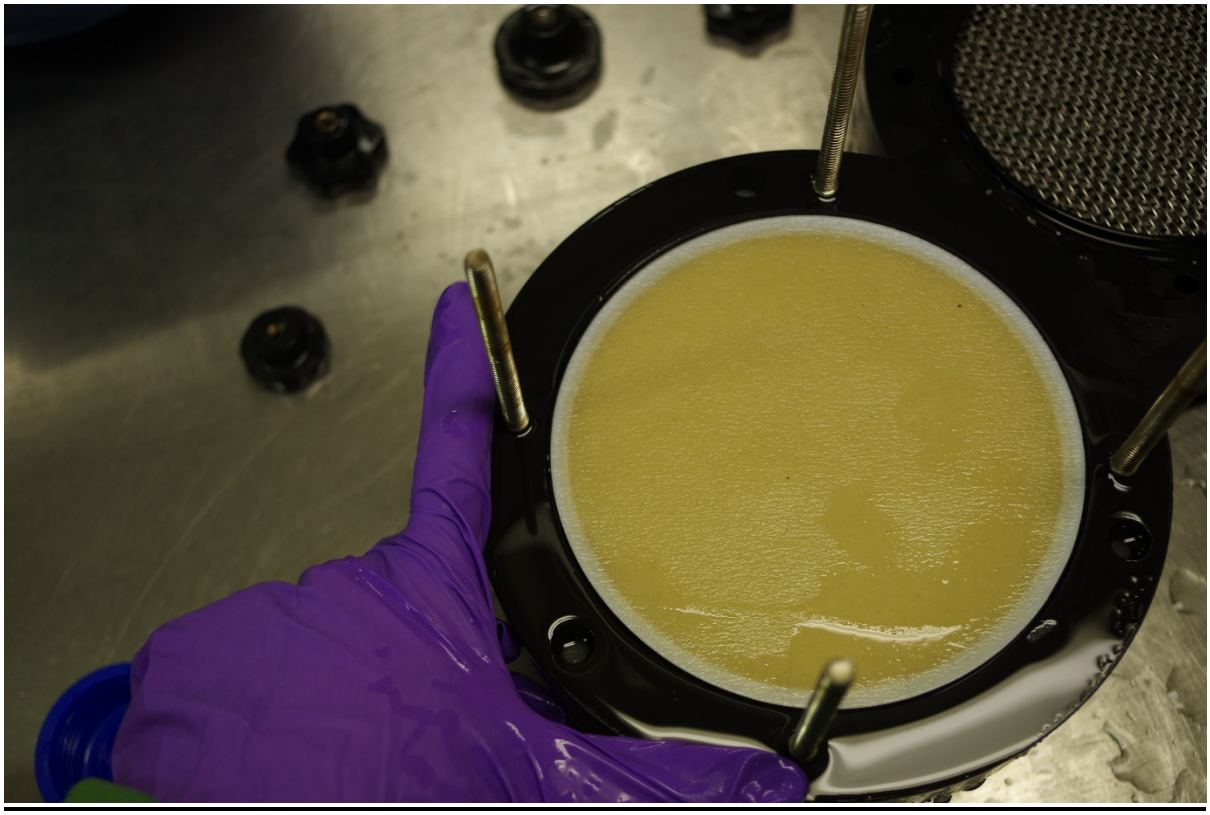
2 Niskin Bottles were filled at the same depth

- 10L of in situ water was stored at +4ºC to be used in the setup of the incubation experiments

- 3x 60 mL of water was collected and killed with ca. 200 µL of HgCl to kill any activity, to be analysed for initial methane concentration

- 5 of filters were submerged in a minimum amount of water from the Niskin bottle fired at the same depth (ca. 400 mL) and stored at +4ºC to be used once back at NIOZ

- 1 filter was frozen at -80ºC to be used for lipid and DNA analyses



26-05-2016:

13.2.2 Gotland Deep: 57º 12.734 N, 19º 56.968 E
Station 10, Cast 14

Collection:

3 filters (1 deployments of in situ pumps) were pumped for 1 hour at the oxic/anoxic transtition zone (at 68.4 m water depth) Volume of water filtered

>10 Niskin Bottles were filled at the same depth

- 10L of in situ water was stored at +4ºC to be used in the setup of the incubation experiments at NIOZ

- 3x 60 mL of water was collected and killed with ca. 200 µL of HgCl to kill any activity, to be analysed for initial methane concentration

- all 3 of filters were submerged in a minimum amount of water from the Niskin bottle fired at the same depth (ca. 400 mL) and stored at +4ºC to be used once back at NIOZ

- To maximise the amount of material used for incubation set ups and be able to start our transit to Port, instead of using one of the in situ pump filters for DNA/lipid analyses, we filtered 9 x ca. 7L of in situ water on 3 filtration units. These filter was frozen at -80ºC to be used for lipid and DNA analyses

13.3 REFERENCES

Gülzow, w., Rehder, G., Schneider v. Deimling, J., Seifert, T., and Toth Z. (2013). One year of continuous measurements constraining methane emissions from the Baltic Sea to the atmosphere using a ship of opportunity. *Biogeosciences* 10, 81-99.

14. TA, DIC, pH and CO_3^{2-} profiles

Alice Webb & Sharyn Ossebaar

The progressive mineralisation of organic matter that occurs at depth in the Baltic, together with the generally low buffer capacity in low salinity waters results in a low pH environment. This cruise offers nice gradients in pH, carbonate ions, TCO_2 and Total Alkalinity to test and try out new equipment. Our specific objectives includes:

- Describe the chemical characteristics (CO2 and nutrient) across a salinity gradient
- Test novel spectrophotometry method for the analysis of pH and carbonate ions
- Compare DIC analysed with a coulometric method (VINDTA) and DIC measured with AIRICA
- Compare calculated pH (Seacarb package, R) and measured pH (SPEC)

At all ten stations, water samples were taken from the CTD rosette sampler at depths throughout the water column. Total CO_2 (C_T also known as DIC) and Total Alkalinity were measured using a VINDTA instrument (MARIANDA, Kiel). The accuracy is set by internationally recognised and widely used certified reference material (CRM, Dickson). C_T is the sum of all dissolved inorganic species and is determined by a precise coulometric method. For every coulometric cell used in the coulometer (~1 per day), two CRMs were measured in duplicate at the beginning and the end of the analyses. The alkalinity measurements were performed by potentiometric titration with a strong acid (HCL) as a titrant. The acid consumption up to the second end point is equivalent to the titration alkalinity. The system includes a Metrohm Titrino for precise continuous additions of acid, a pH measurement electrode and a reference electrode. The measurement temperature was kept at 25 C. Analysis of samples were carried out straight after sampling. A total of 161 analyses were carried out on the VINDTA.

DIC was also measured using the AIRICA system which uses a high precision syringe pump to deliver the exact amount of sample to a stripper. CO_2 is liberated from the sample by acidification and is transported by a stream of carrier gas. The latter passes through a LICOR non-dispersive IR gas analyser , where CO_2 concentration in the gas is measured. The integration of the resulting peak is directly proportional to the amount of CO_2 extracted from the sample.

pH and CO_3^{2-} profiles were measured using a precise automated spectrophotometric pH measurement system.

DIC and TA were then used to calculate pH with SeaCarb package from the R software. This will allow us to compare calculated pH and measured pH.

Station	Cast	date	Niskin	bottle	Depth	Temp	Salinity	VINDTA	Spec pH	Spec CO_3^{2-}	Airica DIC
1	2	18/05/2016		1CRM1a				x			x
1	2	18/05/2016		1CRM1b				x			x
1	2	18/05/2016	1	A1	533	6.94	35	x	x	x	x
1	2	18/05/2016	1	B1	533	6.94	35	x			x
1	2	18/05/2016	2	A2	533	6.94	35	x			x
1	2	18/05/2016	3	A3	400	6.98	35	x			x
1	2	18/05/2016	4	A4	400	6.98	35	x			x
1	2	18/05/2016	4	B2	400	6.98	35	x			x
1	2	18/05/2016	6	A6	324.8	7.03	35	x			x
1	2	18/05/2016	8	A8	248.5	6.96	35	x			x
1	2	18/05/2016	10	A10	199.5	6.98	35	x			x
1	2	18/05/2016	12	A12	150.1	6.84	35	x	x	x	x
1	2	18/05/2016	12	A13	150.1	6.84	35	x			x
1	2	18/05/2016	14	A14	100.1	6.8	35	x			x
1	2	18/05/2016	16	A16	80.1	6.8	35	x			x
1	2	18/05/2016	18	A18	55.1	7.08	35	x	x	x	x
1	2	18/05/2016	20	A20	40.1	7.13	35	x			x
1	2	18/05/2016	22	B3	24.4	8.1	35	x			x
1	2	18/05/2016	24	B4	10.1	10.73	35	x	x	x	x
1	2	18/05/2016	24	A15	10.1	10.73	35	x			x
2	2	18/05/2016	1	A1	40			x	x	x	x
2	2	18/05/2016	1	A3	40			x			x
2	2	18/05/2016	1	A2	40			x			x
2	2	18/05/2016	4	A4	30			x	x	x	x
2	2	18/05/2016	7	A5	20			x	x	x	x
2	2	18/05/2016	10	A6	15			x			x
2	2	18/05/2016	13	A7	10			x	x	x	x
2	2	18/05/2016	16	A8	5			x			x
2	2	18/05/2016	16	A9	5			x			x

2	2	18/05/2016	16	A10	5			x			x
2	2	18/05/2016		2CRM1a				x			x
2	2	18/05/2016		2CRM1b				x			x
3	2	19/05/2016		3CRM1a				x			x
3	2	19/05/2016		3CRM1b				x			x
3	2	19/05/2016	1	A1	31.4		33.6	x	x	x	x
3	2	19/05/2016	1	A2	31.4		33.6	x			x
3	2	19/05/2016	4	A4	24.8		33.4	x	x	x	x
3	2	19/05/2016	7	A5	20.3		32.7	x	x	x	x
3	2	19/05/2016	10	A6	14.9		25.4	x			x
3	2	19/05/2016	13	A7	10.2		17.8	x	x	x	x
3	2	19/05/2016	16	A8	4.7		16.1	x	x	x	x
3	2	19/05/2016	16	A9	4.7		16.1	x			x
3	2	19/05/2016	16	A9	4.7		16.1	x			x
4	2	19/05/2016	1	A1	23.6	5.6	33.97	x	x	x	
4	2	19/05/2016	4	A2	23.6	5.6	33.97	x	x	x	
4	2	19/05/2016	7	A4	19.8	5.6	33.95	x	x	x	
4	2	19/05/2016	10	A5	14.5	6.54	28.45	x	x	x	
4	2	19/05/2016	13	A7	9.8	8.7	20.4	x	x	x	
4	2	19/05/2016	16	A8	4.8	10.74	17.5	x			
4	2	19/05/2016	19	A9	4.8	10.74	17.5	x			
4	2	19/05/2016		3CRM2a				x			
4	2	19/05/2016		3CRM2b				x			
5	2	20/05/2016		4CRM1a			35	x			
5	2	20/05/2016		4CRM1b			35	x			
5	2	20/05/2016	1		38.1		33.7	x	x	x	
5	2	20/05/2016	1		38.1		35	x			
5	2	20/05/2016	1		38.1		33.7	x			
5	2	20/05/2016	4		30.4		33.6	x	x	x	
5	2	20/05/2016	4		30.4		33.1	x			
5	2	20/05/2016	7		24.9		33.1	x	x	x	

5	2	20/05/2016	10		20.1		32.6	x	x	x	
5	2	20/05/2016	10		20.1		32.6	x			
5	2	20/05/2016	13		15		22	x	x	x	
5	2	20/05/2016	16		9.8		19.5	x	x	x	
5	2	20/05/2016	19		4.8		18.5	x	x	x	
5	2	20/05/2016	19		4.8		18.5	x			
5	2	20/05/2016	19		5.8		17.5	x			
6	2	20/05/2016	3		20.6		33.46	x	x	x	
6	2	20/05/2016	3		20.6		33.1	x			
6	2	20/05/2016	3		20.6		33.46	x			
6	2	20/05/2016	6		14.6		22.2	x	x	x	
6	2	20/05/2016	6		14.6		22.2	x			
6	2	20/05/2016	9		10		15.49	x	x	x	
6	2	20/05/2016	9		10		15.49	x			
6	2	20/05/2016	9		10		15.49	x			
6	2	20/05/2016	12		4.6		12.15	x	x	x	
6	2	20/05/2016	12		4.6		12.15	x			
6	2	20/05/2016	12		4.6		12.15	x			
6	2	20/05/2016	12		4.6		12.15	x			
6	2	20/05/2016		4CRM2a			35	x			
6	2	20/05/2016		4CRM2b			35	x			
7	9	21/05/2016		5CRM1a			35	x			x
7	9	21/05/2016		5CRM1b			35	x			x
7	9	21/05/2016	4		40.1	6	17.47	x	x	x	x
7	9	21/05/2016	4		40.1	6	17.47	x			x
7	9	21/05/2016	4		40.1	6	17.47	x			x
7	9	21/05/2016	4		40.1	6	17.47	x			x
7	9	21/05/2016	4		40.1	6	17.47	x			x
7	9	21/05/2016	7		35.6	6	14.4	x	x	x	x
7	9	21/05/2016	10		29.7	5.95	11	x	x	x	x
7	9	21/05/2016	13		24.3	5.94	9.65	x	x	x	x

7	9	21/05/2016	16		14.2	10.04	8.34	x	x	x	x
7	9	21/05/2016	19		4.6	11.9	8.16	x	x	x	x
7	9	21/05/2016	19		4.6	11.9	8.16	x			x
7	9	21/05/2016	19		4.6	11.9	8.16	x			x
7	9	21/05/2016		5CRM2a			34	x			x
7	9	21/05/2016		5CRM2b			34	x			x
8	2	22/05/2016		6CRM1a			35	x			x
8	2	22/05/2016		6CRM1b			35	x			x
8	2	22/05/2016	7		43.4	5.61	17.05	x	x	x	x
8	2	22/05/2016	7		43.4	5.61	17.05	x			x
8	2	22/05/2016	7		43.4	5.61	17.05	x			x
8	2	22/05/2016	7		43.4	5.61	17.05	x			x
8	2	22/05/2016	10		30.1	5.99	11.2	x	x	x	x
8	2	22/05/2016	10		30.1	5.99	11.2	x			x
8	2	22/05/2016	13		24.1	6.11	10.02	x	x	x	x
8	2	22/05/2016	16		18	6.44	8.28	x	x	x	x
8	2	22/05/2016	16		9.3	6.44	8.28	x			x
8	2	22/05/2016	22		4.9	11.4	8.14	x	x	x	x
8	2	22/05/2016	19		9.3	10.86	8.14	x	x	x	x
8	2	22/05/2016	22		4.9	11.4	8.14	x			x
8	2	22/05/2016		7CRM2a			33.3	x			x
8	2	22/05/2016		7CRM2b			33.3	x			x
9	2	23/05/2016	5		77	6.95	18.44	x	x	x	x
9	2	23/05/2016	5		77	6.95	18.44	x			x
9	2	23/05/2016	5		77	6.95	18.44	x			x
9	2	23/05/2016	5		77	6.95	18.44	x			x
9	2	23/05/2016		8CRM1a			33.3	x			x
9	2	23/05/2016		8CRM1b			33.3	x			x
9	2	23/05/2016	5		77	6.95	18.44	x			x
9	2	23/05/2016	7		59	5.64	13.42	x	x	x	x
9	2	23/05/2016	7		59	5.64	13.42	x			x

9	2	23/05/2016	10		45	5.82	10.58	x	x	x	x
9	2	23/05/2016	13		35	5.46	8.55	x	x	x	x
9	2	23/05/2016	13		35	5.46	8.55	x			x
9	2	23/05/2016	16		23	8.5	8.04	x	x	x	x
9	2	23/05/2016	20		5	10.63	7.82	x	x	x	x
9	2	23/05/2016	20		5	10.63	7.82	x			x
9	2	23/05/2016	20		5	10.63	7.82	x			x
9	2	23/05/2016		8CRM2a			35	x			x
9	2	23/05/2016		8CRM2b			35	x			x
10	2	25/05/2016		9CRM1a			35	x			x
10	2	25/05/2016		9CRM1b			35	x			x
10	2	25/05/2016	16		4	11.11	6.95	x	x		x
10	2	25/05/2016	16		4	11.11	6.95	x			x
10	2	25/05/2016	14		14	6.4	6.95	x	x		x
10	2	25/05/2016	14		14	6.4	6.95	x			x
10	2	25/05/2016	12		24	5.08	7.07	x	x		x
10	2	25/05/2016	10		50	4.75	7.2	x	x		x
10	2	25/05/2016	8		60	4.04	7.39	x	x		x
10	2	25/05/2016	6		72	5.2	9.2	x	x		x
10	4	25/05/2016	7		101	6.08	11.74	x	x		x
10	2	25/05/2016	3		150	6.89	12.82	x	x		x
10	2	25/05/2016	1		200	7.1	13.48	x	x		x
10	2	25/05/2016	1		200	7.1	13.48	x			x
10	2	25/05/2016					33.3	x			x
10	2	25/05/2016					33.3	x			x
10	2	25/05/2016	1		200	7.1	0	x			x
10	2	25/05/2016	1		200	7.1	13.48	x			x
10	2	25/05/2016	3		150	6.89	12.82	x			x
10	4	25/05/2016	5		101	6.08	11.74	x			x
10	2	25/05/2016	6		72	5.2	9.2	x			x
10	2	25/05/2016	8		60	4.04	7.39	x			x

10	2	25/05/2016	10		50	4.75	7.2	x			x
10	2	25/05/2016	12		24	5.08	7.07	x			x
10	2	25/05/2016	14		14	6.4	6.95	x			x
10	2	25/05/2016	16		4	11.11	6.95	x			x
10	2	25/05/2016					33.3	x			x
10	2	25/05/2016					33.3	x			x

15. LGR

Gabriella Weiss

Samples were collected hourly during transits between stations for future water isotope analysis on the LGR-Liquid Water Isotope Analyzer back at NIOZ.

(See tables below).

TRANSIT 1: North Sea to St. 1: 17/05/2016		
Name	**Ship time**	**UTC**
T1.1	14:06	12:06
T1.2	15:00	13:00
T1.3	16:00	14:00
T1.4	17:00	15:00
T1.5	17:56	15:56
T1.6	19:00	17:00
T1.7	20:00	18:00
T1.8	21:00	19:00
T1.9	22:00	20:00
T1.10	23:00	21:00
T1.11	0:00	22:00

TRANSIT 2: St. 1 to St. 2: 18/05/2016		
Name	**Ship time**	**UTC**
T2.1	10:30	8:30
T2.2	11:30	9:30
T2.3	12:28	10:28
T2.4	13:28	11:28
T2.5	14:29	12:29
T2.6	15:30	13:30
T2.7	16:34	14:34
T2.8	17:45	15:45

TRANSIT 3: St. 2 to St. 3: 18 - 19/05/2016		
Name	**Ship time**	**UTC**
T3.1	23:35	21:35
T3.2	0:30	22:30
T3.3	1:25	23:25
T3.4	2:30	0:30
T3.5	4:30	2:30
T3.6	6:50	4:50

TRANSIT 4: St. 3 to St. 4: 19/05/2016		
Name	**Ship time**	**UTC**
T4.1	13:30	11:30
T4.2	14:30	12:30
T4.3	15:30	13:30
T4.4	16:29	14:29

TRANSIT 5: St. 4 to St. 5: 19-20/05/2016		
Name	**Ship time**	**UTC**
T5.1	21:25	
T5.2	22:29	
T5.3	23:27	
T5.4	0:30	

TRANSIT 6: St 5 to St. 6: 20/05/2016		
Name	**Ship time**	**UTC**
T6.1	9:10	7:10

TRANSIT 7: St. 6 to St. 7: 20-21/05/2016		
Name	**Ship time**	**UTC**
T7.1	17:01	13:01
T7.2	18:32	14:32
T7.3	18:50	14:50
T7.4	19:59	17:59
T7.5	20:58	18:58
T7.6	22:58	20:58
T7.7	0:03	22:03

Transit 8: St. 8 to St. 9: 22 - 23/05/2016		
Name	**Ship time**	**UTC**
T8.1	23:36	19:36
T8.2	0:26	22:26
T8.3	1:31	23:31
T8.4	2:24	0:24
T8.5	3:31	1:31
T8.6	4:30	2:30

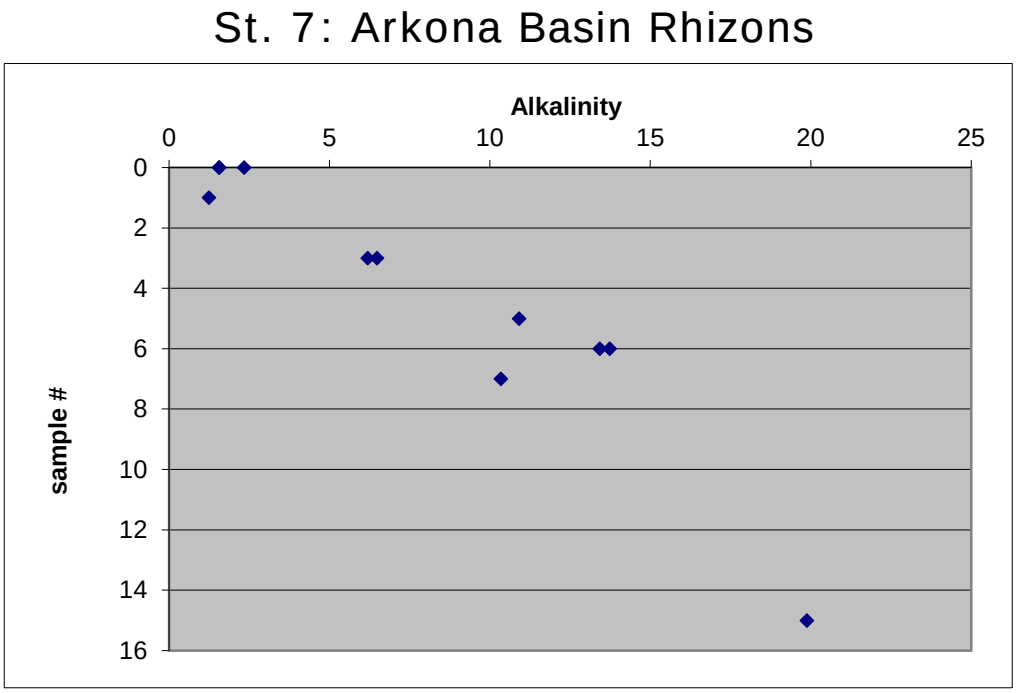
Transit 9: St. 9 to St. 10: 24 - 25/05/2016		
Name	**Ship time**	**UTC**
T9.1	9:00	7:00
T9.2	9:59	7:59
T9.3	11:00	9:00
T9.4	12:00	10:00
T9.5	12:59	10:59
T9.6	14:03	12:03
T9.7	15:00	13:00
T9.8	skipped	
T9.9	17:00	15:00
T9.10	18:00	16:00
T9.11	19:00	17:00
T9.12	20:00	18:00
T9.13	21:04	19:04
T9.14	22:30	20:30
T9.15	23:15	21:15
T9.16	0:01	22:01
T9.17	1:00	23:00
T9.18	2:01	0:01
T9.19	3:12	1:12
T9.20	3:59	1:59

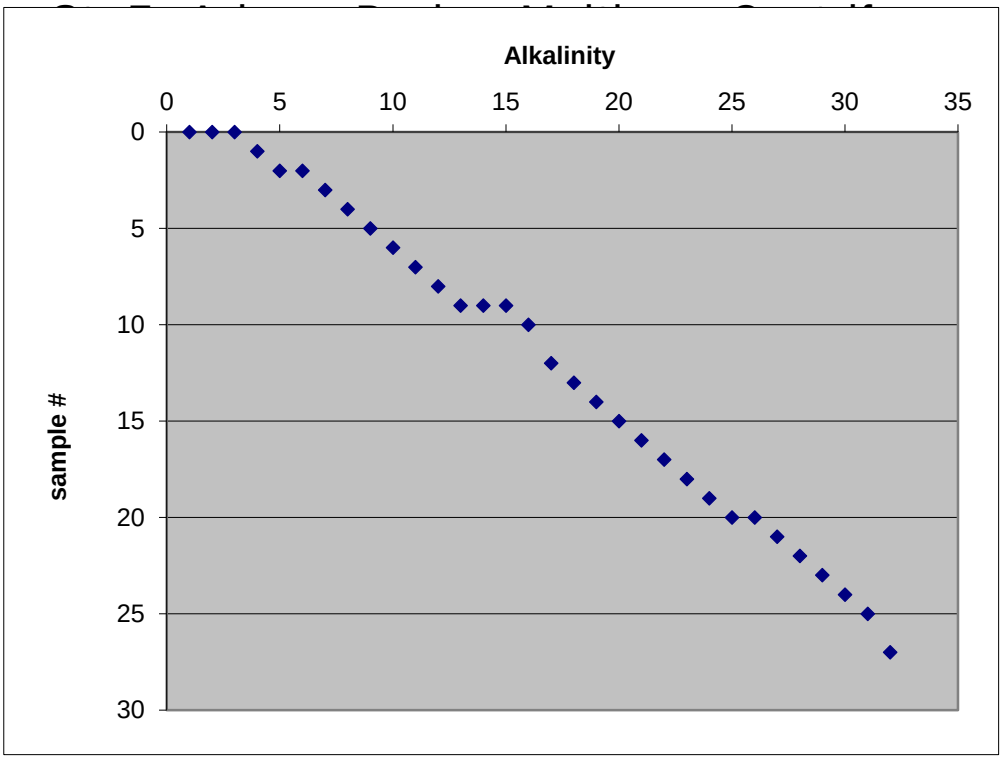
Transit 10: St. 10 to Harbour: 26 - 27/05/2016		
Name	**Ship time**	**UTC**
T10.1	18:30	16:30
T10.2	20:30	18:30
T10.3	21:26	19:26
T10.4	23:27	21:27
T10.5	0:31	22:31
T10.6	1:31	23:31
T10.7	2:31	0:31
T10.8	3:29	1:29
T10.9	4:30	2:30
T10.10	5:27	3:27
T10.11	6:32	4:32
T10.12	7:32	5:32
T10.13	8:31	6:31

16. Alkalinity Titrations – Pore water

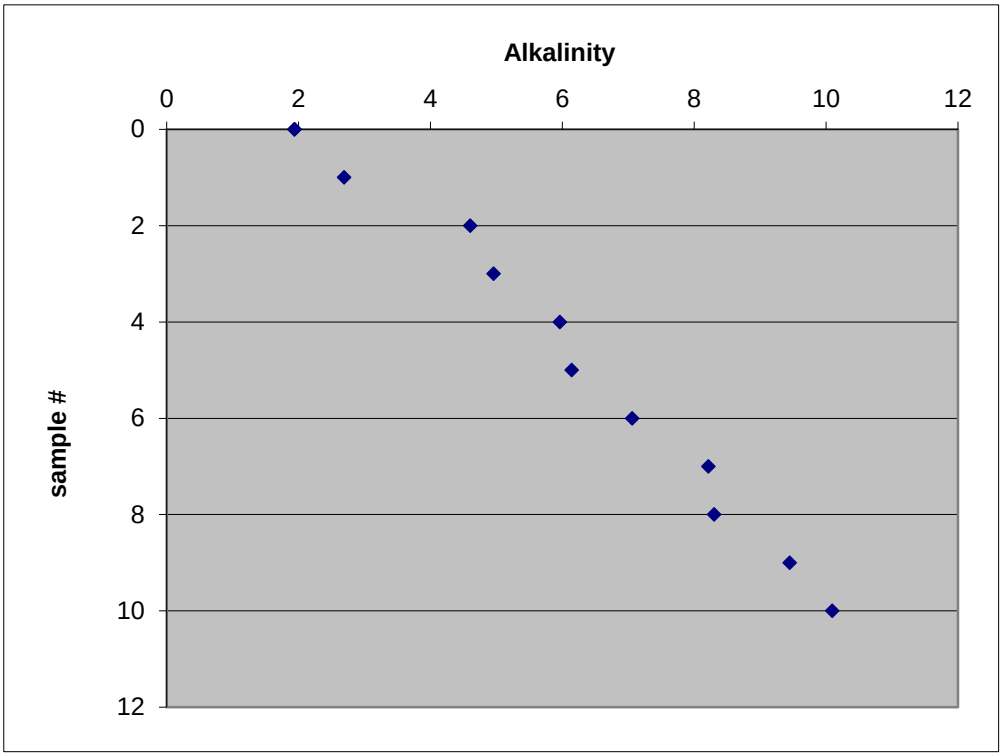
Gabriella Weiss

Alkalinity from pore water extractions was determined by titrations with 0.01 M HCl on 1 mL of pore water. Below are the results (for sample # see porewaters subsampling, section 12) .

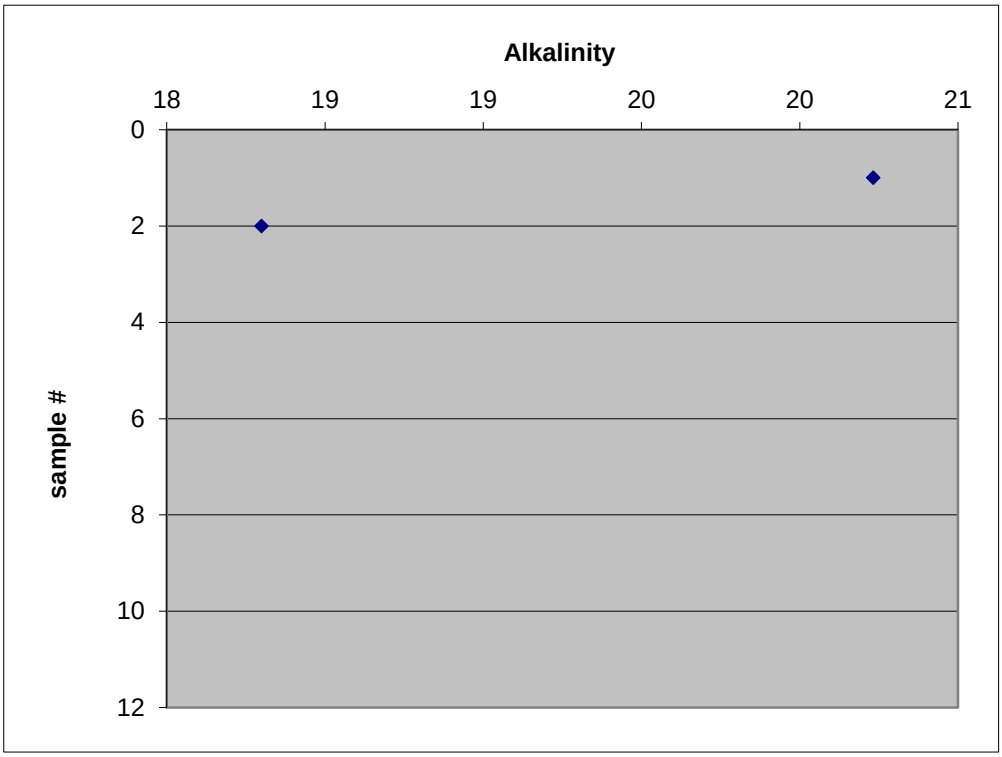




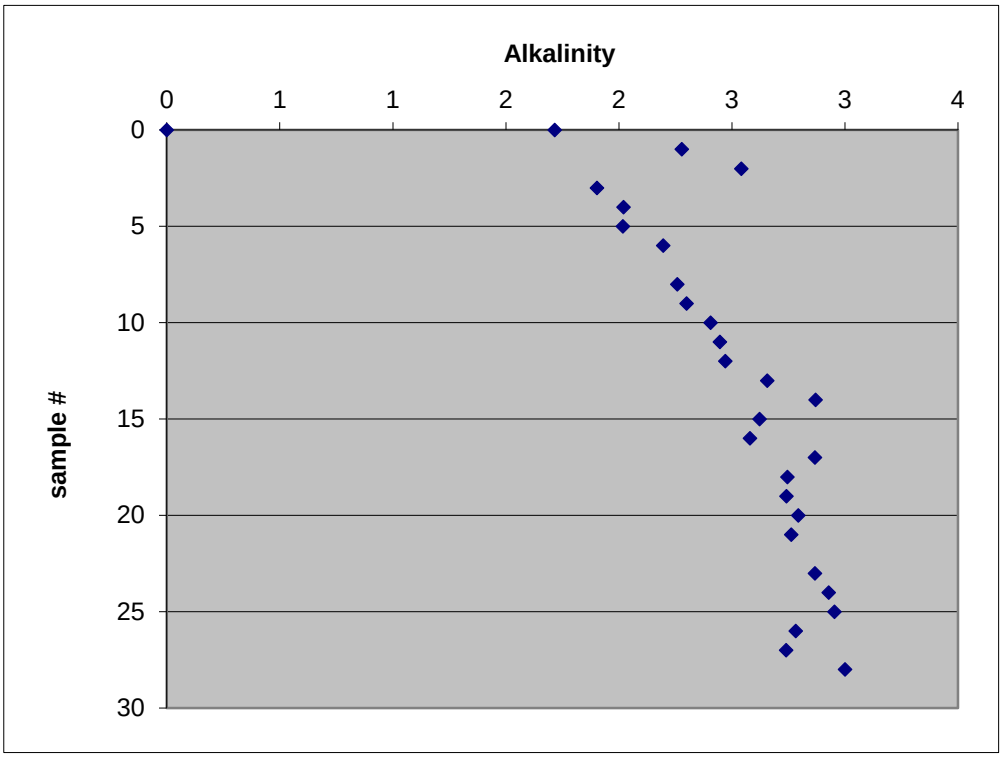
St. 9: Bornholm Basin – Multicore Rhizons



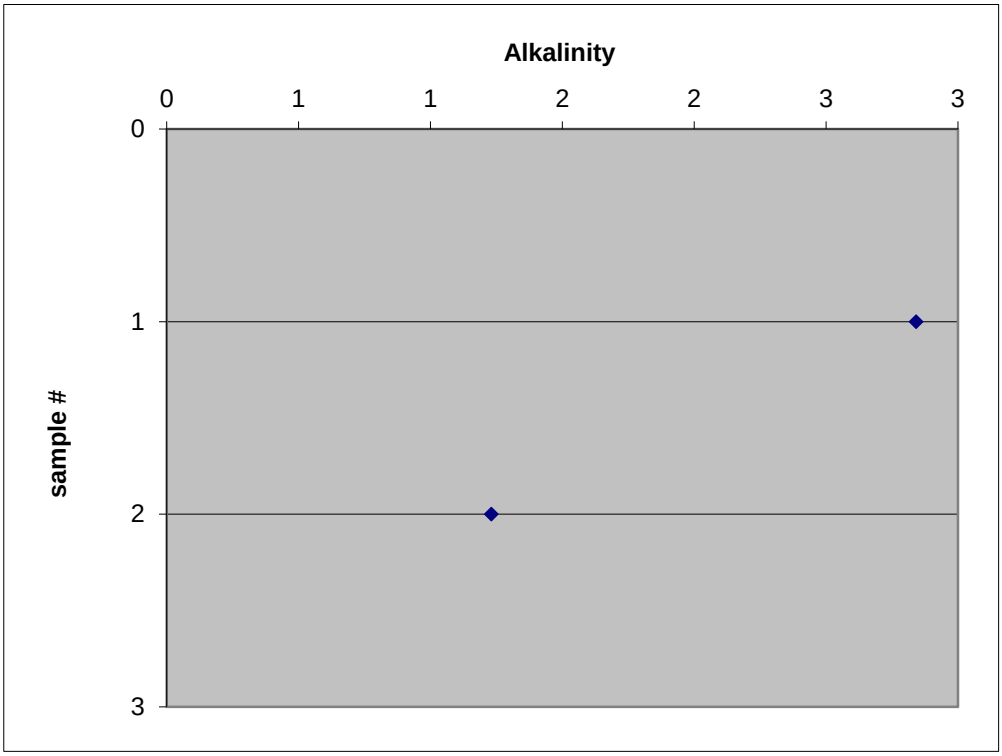
St. 9: Bornholm Basin - Piston Core



St. 10: Gotland Basin – Multicore Centrifuge



St. 10: Gotland Basin – Piston Core



Appendix 1: CTD casts as filled out during cruise

STATION	**1**			
CAST	**2**			
Date	**18-05-2016**			
location	**58°29.761'N 9°35.906'E**			
max depth	**550**			
surface temp	**11.5**			
BOTTLE	**Depth (m)**	**temp.**	**Sal.**	**Remark**
1	533	6.94		
2	533	6.94		
3	*400*	*6.98*		
4	*400*	*6.98*		
5	324.8	7.03		
6	324.8	7.03		
7	*248.5*	*6.96*		
8	*248.5*	*6.96*		
9	199.5	6.98		O_2 dip
10	199.5	6.98		O_2 dip
11	*150.1*	*6.84*		
12	*150.1*	*6.84*		
13	100.1	6.80		
14	100.1	6.80		
15	*80.1*	*6.80*		*O_2 peak*
16	*80.1*	*6.80*		*O_2 peak*
17	55.1	7.08		Small O_2 and fluorescence peak
18	55.1	7.08		Small O_2 and fluorescence peak
19	*40.1*	*7.13*		
20	*40.1*	*7.13*		
21	24.4	8.10		fluorescence peak
22	24.4	8.10		fluorescence peak
23	*10.1*	*10.73*		
24	*10.1*	*10.73*		

STATION	**2**			
CAST	**2**			
Date	**18-05-2016**			
location	**57°45.896'N 11°7.003'E**			
max depth (m)	**44**			
surface temp (°C)	**11.5**			
BOTTLE	**Depth (m)**	**temp.**	**Sal.**	**Remark**
1	40	7.6	34	
2	40	7.6	34	
3	40	7.6	34	
4	*30*	*7.87*	*33.97*	
5	*30*	*7.87*	*33.97*	
6	*30*	*7.87*	*33.97*	
7	20.2	8.28	33.50	O_2 sub max + fluorescence peak
8	20.2	8.28	33.50	O_2 sub max + fluorescence peak
9	20.2	8.28	33.50	O_2 max + fluorescence peak
10	*14.9*	*8.67*	*32.72*	*O_2 maximum + fluorescence peak*
11	*14.9*	*8.67*	*32.72*	*O_2 maximum + fluorescence peak*
12	*14.9*	*8.67*	*32.72*	*O_2 maximum + fluorescence peak*
13	10	10.69	28.79	O_2 max
14	10	10.69	28.79	O_2 max
15	10	10.69	28.79	O_2 max
16	*5.2*	*11.06*	*25.96*	
17	*5.2*	*11.06*	*25.96*	
18	*5.2*	*11.06*	*25.96*	
19				
20				
21				
22				
23				
24				

STATION	**3**			
CAST	**2**			
Date	**19-05-2016**			
location	**56°36.155'N 11°46.523'E**			
max depth (m)	**37.5**			
surface temp (°C)	**11.5**			
BOTTLE	**Depth (m)**	**temp.**	**Sal.**	**Remark**
1	31.4	5.5	33.6	
2	31.4	5.5	33.6	
3	31.4	5.5	33.6	
4	*24.8*	*5.8*	*33.4*	
5	*24.8*	*5.8*	*33.4*	
6	*24.8*	*5.8*	*33.4*	
7	20.3	5.7	32.7	Fluorescence maximum
8	20.3	5.7	32.7	Fluorescence maximum
9	20.3	5.7	32.7	Fluorescence maximum
10	14.9	7.4	25.4	(Temp/sal variable)
11	14.9	7.4	25.4	(Temp/sal variable)
12	14.9	7.4	25.4	(Temp/sal variable)
13	*10.2*	*11.2*	*17.8*	(Temp/sal variable)
14	*10.2*	*11.2*	*17.8*	(Temp/sal variable)
15	*10.2*	*11.2*	*17.8*	(Temp/sal variable)
16	4.7	11.5	16.1	
17	4.7	11.5	16.1	
18	4.7	11.5	16.1	
19				
20				
21				
22				
23				
24				

STATION	**4**			
CAST	**2**			
Date	**19-05-2016**			
location	**56°17.021'N 12°16.840'E**			
max depth (m)	**30.3**			
surface temp				
BOTTLE	**Depth (m)**	**temp.**	**Sal.**	**Remark**
1	23.6	5.6	33.97	
2	23.6	5.6	33.97	
3	23.6	5.6	33.97	
4	*19.8*	*5.6*	*33.95*	*Fluorescence peak*
5	*19.8*	*5.6*	*33.95*	*Fluorescence peak*
6	*19.8*	*5.6*	*33.95*	*Fluorescence peak*
7	14.5	6.54	28.45	O_2 peak
8	14.5	6.54	28.45	Did not close
9	14.5	6.54	28.45	O_2 peak
10	*9.8*	*8.70*	*20.40*	
11	*9.8*	*8.70*	*20.40*	
12	*9.8*	*8.70*	*20.40*	
13	4.8	10.74	17.50	
14	4.8	10.74	17.50	
15	4.8	10.74	17.50	
16				
17				
18				
19				
20				
21				
22				
23				
24				

STATION	**5**			
CAST	**2**			
Date	**20-05-2016**			
location				
max depth (m)	**45**			
surface temp (°C)	**11.2**			
BOTTLE	**Depth (m)**	**temp.**	**Sal.**	**Remark**
1	38.1	5.83	33.7	
2	38.1	5.83	33.7	
3	38.1	5.83	33.7	
4	*30.4*	*5.87*	*33.6*	
5	*30.4*	*5.87*	*33.6*	
6	*30.4*	*5.87*	*33.6*	
7	24.9	5.96	33.1	
8	24.9	5.96	33.1	
9	24.9	5.96	33.1	
10	*20.1*	*6.17*	*32.6*	*Fluorescence maximum*
11	*20.1*	*6.17*	*32.6*	*Fluorescence maximum*
12	*20.1*	*6.17*	*32.6*	*Fluorescence maximum*
13	15.0	8.9	22	
14	15.0	8.9	22	
15	15.0	8.9	22	
16	*9.8*	*9.58*	*19.5*	
17	*9.8*	*9.58*	*19.5*	
18	*9.8*	*9.58*	*19.5*	
19	4.8	10.2	18.5	
20	4.8	10.2	18.5	
21	4.8	10.2	18.5	
22				
23				
24				

STATION	**6**			
CAST	**3**			
Date	**20-05-2016**			
location	**55°49.748'N 12°45.271'E**			
max depth (m)	**27**			
surface temp (°C)	**11.951**			
BOTTLE	**Depth (m)**	**temp.**	**Sal.**	**Remark**
1	20.6	5.98	33.462	Closed to early after reaching depth.
2	20.6	5.98	33.462	Did not close!
3	20.6	5.98	33.462	
4	*14.6*	*9.14*	*22.2*	
5	*14.6*	*9.14*	*22.2*	
6	*14.6*	*9.14*	*22.2*	
7	10	11.1	15.49	
8	10	11.1	15.49	
9	10	11.1	15.49	
10	*4.6*	*11.7*	*12.15*	
11	*4.6*	*11.7*	*12.15*	
12	*4.6*	*11.7*	*12.15*	
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				

STATION	**7**			
CAST	**9**			
Date	**21-05-2016**			
location	**54°53.569'N 13°24.968'E**			
max depth (m)	**51**			
surface temp (°C)	**11.94**			
BOTTLE	**Depth (m)**	**temp.**	**Sal.**	**Remark**
1	40.1	6	17.47	Goflo
2	40.1	6	17.47	Goflo (did not close)
3	40.1	6	17.47	Goflo
4	40.1	6	17.47	
5	40.1	6	17.47	
6	40.1	6	17.47	
7	*35.6*	*5.919*	*14.396*	
8	*35.6*	*4.919*	*14.396*	
9	*35.6*	*5.919*	*14.396*	
10	29.7	5.944	11	
11	29.7	5.944	11	
12	29.7	5.944	11	
13	*24.3*	*5.935*	*9.654*	*Fluorescence peak*
14	*24.3*	*5.935*	*9.654*	*Fluorescence peak*
15	*24.3*	*5.935*	*9.654*	*Fluorescence peak*
16	14.2	10.038	8.337	
17	14.2	10.038	8.337	
18	14.2	10.038	8.337	
19	*4.6*	*11.899*	*8.26*	
20	*4.6*	*11.899*	*8.26*	
21	*4.6*	*11.899*	*8.26*	
22				
23				
24				

STATION	**7**			
CAST	**17**			
Date	**22-05-2016**			
location				
max depth (m)	**49.5**			
surface temp				
BOTTLE	**Depth (m)**	**temp.**	**Sal.**	**Remark**
1	18.6	7.7	8.38	Goflo
2				
3	18.6	7.7	8.38	Goflo
4	18.6	7.7	8.38	Goflo
5	18.6	7.7	8.38	
6	18.6	7.7	8.38	
7	*19.2*	*8.68*	*8.68*	
8	*19.2*	*8.68*	*8.68*	
9	21.4	8.9	8.9	
10	21.4	8.9	8.9	
11	*Repeat of 21-05-2016, sampling the fluorescence peak!*			
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				

STATION	**8**			
CAST	**2**			
Date	**22-05-2016**			
location	**54°55.208'N 13°29.992'E**			
max depth (m)	**53.4**			
surface temp (°C)	**11.275**			
BOTTLE	**Depth (m)**	**temp.**	**Sal.**	**Remark**
1	43.4	5.61	17.05	Goflo
2				
3	43.4	5.61	17.05	Goflo
4	43.4	5.61	17.05	Goflo
5	43.4	5.61	17.05	
6	43.4	5.61	17.05	
7	43.4	5.61	17.05	
8	43.4	5.61	17.05	
9	*30.1*	*5.99*	*11.2*	
10	*30.1*	*5.99*	*11.2*	
11	*30.1*	*5.99*	*11.2*	
12	24.1	6.11	10.02	
13	24.1	6.11	10.02	
14	24.1	6.11	10.02	
15	*18*	*6.44*	*8.28*	
16	*18*	*6.44*	*8.28*	
17	*18*	*6.44*	*8.28*	
18	9.3	10.86	8.14	Fluorescence max.
19	9.3	10.96	8.14	Fluorescence max.
20	9.3	10.86	8.14	Fluorescence max.
21	4.9	11.14	8.14	
22	4.9	11.14	8.14	
23	4.9	11.14	8.14	
24				

STATION	**9**			
CAST	**2**			
Date	**23-05-2016**			
location	**55°28.084'N 15°28.616'E**			
max depth (m)	**89.3**			
surface temp (°C)	**10.646**			
BOTTLE	**Depth (m)**	**temp.**	**Sal.**	**Remark**
1	77.4	6.95	18.44	Goflo
2				
3	77.4	6.95	18.44	Goflo
4	77.4	6.95	18.44	Goflo
5	77.4	6.95	18.44	
6	77.4	6.95	18.44	
7	*59.2*	*5.64*	*13.42*	
8	*59.2*	*5.64*	*13.42*	
9	*59.2*	*5.64*	*13.42*	
10	45.4	5.82	10.58	
11	45.4	5.82	10.58	
12	45.4	*5.82*	10.58	
13	*34.8*	*5.46*	*8.55*	
14	*34.8*	*5.46*	*8.55*	
15	*34.8*	*5.46*	*8.55*	
16	*22.5*	*8.50*	*8.04*	*Fluorescence*
17	22.5	8.50	8.04	*Fluorescence*
18	22.5	8.50	8.04	*Fluorescence*
19	*5.1*	*10.63*	*7.82*	
20	*5.1*	*10.63*	*7.82*	
21	*5.1*	*10.63*	*7.82*	
22				
23				
24				

STATION	**10**			
CAST	**2**			
Date	**25-05-2016**			
location	**57°12.700'N 19°56.996'E**			
max depth (m)	**246 (probably less, ±220)**			
surface temp (°C)	**11.6**			
BOTTLE	**Depth (m)**	**temp.**	**Sal.**	**Remark**
1	*199.8*	*7.205*	*13.475*	
2				
3	149.7	6.878	12.818	
4	*99.4*	*6.068*	*11.180*	*Goflo did not close*
5	*99.4*	*6.068*	*11.180*	
6	71.9	5.202	9.196	Oxycline bottom
7	71.9	5.202	9.196	Oxycline bottom
8	*59.8*	*4.036*	*7.387*	*Oxycline top*
9	*59.8*	*4.036*	*7.387*	*Oxycline top*
10	49.5	4.75	7.2	
11	49.5	4.75	7.2	
12	*24.1*	*5.082*	*7.071*	
13	*24.1*	*5.082*	*7.071*	
14	13.8	6.900	6.95	Fluorescence peak
15	13.8	6.900	6.95	
16	*4.2*	*11.108*	*6.95*	
17	*4.2*	*11.108*	*6.95*	
18				
19				
20				
21				
22				
23				
24				

STATION	**10**			
CAST	**3**			
Date	**25-05-2016**			
location	**57°12.670'N 19°56.983'E**			
max depth (m)	**220**			
surface temp (°C)	**11.4**			
BOTTLE	**Depth (m)**	**temp.**	**Sal.**	**Remark**
1	199.8	7.214	13.489	
2				
3	*99.8*	*6.076*	*11.193*	*Goflo did not close*
4	71.3	5.141	8.902	
5	71.3	5.141	8.902	
6	60.4	4.09	7.437	
7	60.4	4.09	7.437	
8	Cast was emptied and redone!			
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				

STATION	**10**			
CAST	**4**			
Date	**25-05-2016**			
location	**57°12.710'N 19°57.012'E**			
max depth (m)	**220**			
surface temp (°C)	**11.4**			
BOTTLE	**Depth (m)**	**temp.**	**Sal.**	**Remark**
1	101.4	6.08	11.24	Goflo
2				
3	101.4	6.08	11.24	Goflo
4	101.4	6.08	11.24	Goflo
5	101.4	6.08	11.24	
6	101.4	6.08	11.24	
7	*70.2*	*5.052*	*8.8*	
8	*70.2*	*5.052*	*8.8*	
9	60.0	4.08	7.4	
10	60.0	4.08	7.4	
11				At least 1 worked!
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				

STATION	**10**			
CAST	**14**			
Date	**26-05-2016**			
location	**57°12.734'N 19°56.968'E**			
max depth (m)	**246?**			
surface temp (°C)	**10.7**			
BOTTLE	**Depth (m)**	**temp.**	**Sal.**	**Remark**
1	68.4	4.9	8.4	Fluorescence 0.169
2				
3	Extra water for Darci, all bottles closed, 11 bottles were removed to hang the 3 in situ pumps in the CTD frame.			
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				

Appendix 2: N/P station 1

					ANAL	Q3 64PE410 NIOZ BALTIC 2016.ANL				
					RUN	160518-NP-CTDSt1R1.RUN				
					DATE	18-5-2016				
					TIME	12:18:52				
					OPER	SO				
					COMM	Recalculate from Run160518-NP-CTDSt1.run				
					METH	**PO4**	**NH4**	**NO3+NO2**	**NO2**	**COMMENTS**
					UNIT	**µmol/L**	**µmol/L**	**µmol/L**	**µmol/L**	
					Baseline	0.005	0.015	0.002	0.001	
CRUISE No.	**Station No.**	**Cast No.**	**Bottle No.**	**Depth (m)**	**Sample ID**					
64PE410	1	2	24	10.1	64PE410 St1-2-24	**0.005**	**0.09**	**0.01**	**0.003**	PO4 DETECTION LIMIT
64PE410	1	2	23	10.1	64PE410 St1-2-23	**0.005**	**0.08**	**0.01**	**0.003**	PO4 DETECTION LIMIT
64PE410	1	2	22	24.4	64PE410 St1-2-22	**0.009**	**0.21**	**0.09**	**0.009**	
64PE410	1	2	21	24.4	64PE410 St1-2-21	**0.014**	**0.23**	**0.12**	**0.009**	
64PE410	1	2	20	40.1	64PE410 St1-2-20	**0.312**	**1.93**	**1.09**	**0.055**	
64PE410	1	2	19	40.1	64PE410 St1-2-19	**0.309**	**1.93**	**1.08**	**0.054**	
64PE410	1	2	18	55.1	64PE410 St1-2-18	**0.415**	**2.15**	**2.48**	**0.125**	
64PE410	1	2	17	55.1	64PE410 St1-2-17	**0.417**	**2.15**	**2.47**	**0.123**	
64PE410	1	2	16	80.1	64PE410 St1-2-16	**0.475**	**1.84**	**3.64**	**0.289**	
64PE410	1	2	15	80.1	64PE410 St1-2-15	**0.478**	**1.83**	**3.63**	**0.289**	
64PE410	1	2	14	100.1	64PE410 St1-2-14	**0.539**	**1.57**	**4.79**	**0.391**	
64PE410	1	2	13	100.1	64PE410 St1-2-13	**0.546**	**1.56**	**4.85**	**0.397**	
64PE410	1	2	12	150.1	64PE410 St1-2-12	**0.671**	**0.84**	**7.44**	**0.510**	
64PE410	1	2	11	150.1	64PE410 St1-2-11	**0.673**	**0.83**	**7.46**	**0.512**	
64PE410	1	2	10	199.5	64PE410 St1-2-10	**0.732**	**0.07**	**9.39**	**0.269**	
64PE410	1	2	9	199.5	64PE410 St1-2-9	**0.733**	**0.07**	**9.38**	**0.272**	
64PE410	1	2	8	248.5	64PE410 St1-2-8	**0.728**	**0.52**	**8.73**	**0.480**	
64PE410	1	2	7	248.5	64PE410 St1-2-7	**0.719**	**0.60**	**8.62**	**0.494**	
64PE410	1	2	6	324.8	64PE410 St1-2-6	**0.816**	**0.07**	**10.48**	**0.034**	
64PE410	1	2	5	324.8	64PE410 St1-2-5	**0.819**	**0.06**	**10.49**	**0.031**	
64PE410	1	2	4	400.0	64PE410 St1-2-4	**0.823**	**0.05**	**10.39**	**0.038**	
64PE410	1	2	3	400.0	64PE410 St1-2-3	**0.823**	**0.05**	**10.37**	**0.039**	
64PE410	1	2	2	533.0	64PE410 St1-2-2	**1.010**	**0.05**	**11.58**	**0.037**	
64PE410	1	2	1	533.0	64PE410 St1-2-1	**0.992**	**0.04**	**11.64**	**0.037**	

Appendix 3: N/P station 2

					ANAL	Q3 64PE410 NIOZ BALTIC 2016.ANL				
					RUN	160519-NP-CTD St2_St3aR1.RUN				
					DATE	19-5-2016				
					TIME	10:38:30				
					OPER	SO				
					COMM	Recalculate from Run160519-NP-CTD St2_St3a.run				
					METH	**PO4**	**NH4**	**NO3+NO2**	**NO2**	**COMMENTS**
					UNIT	**µmol/L**	**µmol/L**	**µmol/L**	**µmol/L**	
					Baseline	0.004	0.055	0.008	0.001	
CRUISE No.	**Station No.**	**Cast No.**	**Bottle No.**	**Depth (m)**	**Sample ID**					
64PE410	2	2	17	5.2	64PE410 St2-2-17	0.005	0.14	0.05	0.006	PO4 DETECTION LIMIT
64PE410	2	2	16	5.2	64PE410 St2-2-16	0.005	0.15	0.05	0.009	PO4 DETECTION LIMIT
64PE410	2	2	15	10.0	64PE410 St2-2-15	0.017	0.12	0.06	0.012	
64PE410	2	2	14	10.0	64PE410 St2-2-14	0.015	0.24	0.08	0.018	
64PE410	2	2	13	10.0	64PE410 St2-2-13	0.018	0.22	0.05	0.013	
64PE410	2	2	11	14.9	64PE410 St2-2-11	0.053	0.17	0.04	0.018	
64PE410	2	2	10	14.9	64PE410 St2-2-10	0.051	0.13	0.05	0.019	
64PE410	2	2	9	20.2	64PE410 St2-2-9	0.069	0.25	0.16	0.033	
64PE410	2	2	8	20.2	64PE410 St2-2-8	0.068	0.22	0.18	0.040	
64PE410	2	2	7	20.2	64PE410 St2-2-7	0.066	0.26	0.11	0.022	
64PE410	2	2	5	30.0	64PE410 St2-2-5	0.215	1.27	0.77	0.059	
64PE410	2	2	4	30.0	64PE410 St2-2-4	0.223	1.26	0.84	0.067	
64PE410	2	2	3	40.0	64PE410 St2-2-3	0.304	1.48	1.02	0.080	
64PE410	2	2	2	40.0	64PE410 St2-2-2	0.266	1.45	1.03	0.075	
64PE410	2	2	1	40.0	64PE410 St2-2-1	0.270	1.50	1.00	0.073	

Appendix 4: N/P Station 3, 4, 5 and 6

					ANAL	Q3 64PE410 NIOZ BALTIC 2016.ANL				
					RUN	160520-NP-CTD St3b_St4b_St5b_St6bR1.RUN				
					DATE	20-5-2016				
					TIME	17:16:13				
					OPER	SO				
					COMM	Recalculate from Run160520-NP-CTD St3b_St4b_St5b_S				
					METH	**PO4**	**NH4**	**NO3+NO2**	**NO2**	**COMMENTS**
					UNIT	**µmol/L**	**µmol/L**	**µmol/L**	**µmol/L**	
					Baseline 17	0.003	0.045	0.003	0.001	
CRUISE No.	**Station No.**	**Cast No.**	**Bottle No.**	**Depth (m)**	**Sample ID**					
64PE410	3	2	17	4.7	64PE410 St3-2-17	0.025	0.16	0.05	0.013	
64PE410	3	2	16	4.7	64PE410 St3-2-16	0.024	0.12	0.02	0.005	
64PE410	3	2	14	10.2	64PE410 St3-2-14	0.029	0.12	0.04	0.01	
64PE410	3	2	13	10.2	64PE410 St3-2-13	0.025	0.11	0.01	0.003	
64PE410	3	2	11	14.9	64PE410 St3-2-11	0.012	0.10	0.34	0.030	
64PE410	3	2	10	14.9	64PE410 St3-2-10	0.015	0.11	0.24	0.020	
64PE410	3	2	8	20.3	64PE410 St3-2-8	0.353	0.24	6.41	0.274	
64PE410	3	2	7	20.3	64PE410 St3-2-7	0.355	0.23	6.45	0.276	
64PE410	3	2	5	24.8	64PE410 St3-2-5	0.606	0.22	9.64	0.289	
64PE410	3	2	4	24.8	64PE410 St3-2-4	0.595	0.20	9.63	0.289	
64PE410	3	2	2	31.4	64PE410 St3-2-2	0.642	0.13	10.06	0.251	
64PE410	3	2	1	31.4	64PE410 St3-2-1	0.644	0.13	10.08	0.246	
64PE410	4	2	14	4.8	64PE410 St4-2-14	0.026	0.16	0.05	0.005	
64PE410	4	2	13	4.8	64PE410 St4-2-13	0.022	0.14	0.05	0.005	
64PE410	4	2	11	9.8	64PE410 St4-2-11	0.059	0.14	0.06	0.004	
64PE410	4	2	10	9.8	64PE410 St4-2-10	0.053	0.14	0.05	0.003	
64PE410	4	2	7	14.5	64PE410 St4-2-7	0.037	0.14	0.10	0.006	
64PE410	4	2	5	19.8	64PE410 St4-2-5	0.727	0.18	9.38	0.098	
64PE410	4	2	4	19.8	64PE410 St4-2-4	0.721	0.14	9.26	0.097	
64PE410	4	2	2	23.6	64PE410 St4-2-2	0.780	0.13	9.78	0.078	
64PE410	4	2	1	23.6	64PE410 St4-2-1	0.762	0.12	9.58	0.079	
64PE410	5	2	20	4.8	64PE410 St5-2-20	0.070	0.18	0.07	0.007	
64PE410	5	2	19	4.8	64PE410 St5-2-19	0.069	0.12	0.02	0.003	
64PE410	5	2	17	9.8	64PE410 St5-2-17	0.084	0.15	0.06	0.010	
64PE410	5	2	16	9.8	64PE410 St5-2-16	0.080	0.12	0.06	0.009	
64PE410	5	2	14	15.0	64PE410 St5-2-14	0.151	0.14	0.27	0.023	
64PE410	5	2	13	15.0	64PE410 St5-2-13	0.135	0.13	0.16	0.013	
64PE410	5	2	11	20.1	64PE410 St5-2-11	0.803	0.34	7.85	0.141	
64PE410	5	2	10	20.1	64PE410 St5-2-10	0.802	0.33	7.78	0.137	
64PE410	5	2	8	24.9	64PE410 St5-2-8	0.809	0.35	7.85	0.139	
64PE410	5	2	7	24.9	64PE410 St5-2-7	0.905	0.38	9.79	0.140	
64PE410	5	2	5	30.4	64PE410 St5-2-5	0.920	0.42	10.33	0.140	
64PE410	5	2	4	30.4	64PE410 St5-2-4	0.922	0.42	10.37	0.138	
64PE410	5	2	2	38.1	64PE410 St5-2-2	0.919	0.45	10.30	0.138	
64PE410	5	2	1	38.1	64PE410 St5-2-1	0.916	0.45	10.35	0.138	
64PE410	6	4	12	4.6	64PE410 St6-4-12	0.117	0.12	0.03	0.010	
64PE410	6	4	11	4.6	64PE410 St6-4-11	0.119	0.12	0.03	0.007	
64PE410	6	4	9	10.0	64PE410 St6-4-9	0.122	0.11	0.03	0.003	
64PE410	6	4	8	10.0	64PE410 St6-4-8	0.119	0.11	0.03	0.002	
64PE410	6	4	6	14.6	64PE410 St6-4-6	0.127	0.13	0.19	0.008	
64PE410	6	4	5	14.6	64PE410 St6-4-5	0.178	0.15	0.64	0.018	
64PE410	6	4	3	20.6	64PE410 St6-4-3	0.918	0.50	9.93	0.139	
64PE410	6	4	1	20.6	64PE410 St6-4-1 TEST	0.927	0.50	9.99	0.139	NISKIN BOTTLE CLOSED TOO FAST

Appendix 5: N/P station 7

					ANAL	Q3 64PE410 NIOZ BALTIC 2016.ANL				
					RUN	160522-NP-CTD St7R1.RUN				
					DATE	22-5-2016				
					TIME	12:35:18				
					OPER	SO				
					COMM	Recalculate from Run160522-NP-CTD St7.run				
					METH	**PO4**	**NH4**	**NO3+NO2**	**NO2**	
					UNIT	**µmol/L**	**µmol/L**	**µmol/L**	**µmol/L**	**COMMENTS**
					Baseline	0.001	0.055	0.002	0.000	
CRUISE No	**Station No**	**Cast No.**	**Bottle No.**	**Depth (m)**	**Sample ID**					
64PE410	7	9	20	4.6	64PE410 St7-9-20	0.217	0.18	0.07	0.004	
64PE410	7	9	19	4.6	64PE410 St7-9-19	0.223	0.14	0.03	0.003	
64PE410	7	9	17	14.2	64PE410 St7-9-17	0.228	0.12	0.02	0.004	
64PE410	7	9	16	14.2	64PE410 St7-9-16	0.225	0.12	0.02	0.003	
64PE410	7	9	14	24.3	64PE410 St7-9-14	0.448	0.57	0.07	0.019	
64PE410	7	9	13	24.3	64PE410 St7-9-13	0.454	0.58	0.10	0.023	
64PE410	7	9	11	29.7	64PE410 St7-9-11	0.542	1.30	0.57	0.175	
64PE410	7	9	10	29.7	64PE410 St7-9-10	0.526	1.28	0.53	0.106	
64PE410	7	9	8	35.6	64PE410 St7-9-8	0.579	1.11	1.29	0.400	
64PE410	7	9	7	35.6	64PE410 St7-9-7	0.570	1.09	1.22	0.393	
64PE410	7	9	5	40.1	64PE410 St7-9-5	0.840	0.96	3.50	0.287	
64PE410	7	9	4	40.1	64PE410 St5-2-4	0.724	0.70	2.72	0.313	
64PE410	7	9	3	40.1	64PE410 St5-2-3GOFL	0.852	1.00	3.58	0.283	GO FLO BOTTLE
64PE410	7	9	1	40.1	64PE410 St5-2-1GOFL	0.824	1.01	4.27	0.241	GO FLO BOTTLE

Appendix 6: N/P station 8

					ANAL	Q3 64PE410 NIOZ BALTIC 2016.ANL			
					RUN	160522-NP-CTD St8R1.RUN			
					DATE	22-5-2016			
					TIME	17:46:22			
					OPER	SO			
					COMM	Recalculate from Run160522-NP-CTD St8.r			
					METH	**PO4**	**NH4**	**NO3+NO2**	**NO2**
					UNIT	**µmol/L**	**µmol/L**	**µmol/L**	**µmol/L**
					Baseline	0.009	0.043	0.002	0.000
CRUISE No.	**Station No.**	**Cast No.**	**Bottle No.**	**Depth (m)**	**Sample ID**				
64PE410	8	2	22	4.9	64PE410 St8-2-22	0.282	0.141	0.049	0.001
64PE410	8	2	21	4.9	64PE410 St8-2-21	0.289	0.109	0.031	0.002
64PE410	8	2	19	9.3	64PE410 St8-2-19	0.317	0.101	0.022	0.002
64PE410	8	2	18	9.3	64PE410 St8-2-18	0.322	0.083	0.021	0.002
64PE410	8	2	16	18.0	64PE410 St8-2-16	0.442	0.115	0.043	0.008
64PE410	8	2	15	18.0	64PE410 St8-2-15	0.452	0.100	0.023	0.010
64PE410	8	2	13	24.1	64PE410 St8-2-13	0.504	1.002	0.368	0.043
64PE410	8	2	12	24.1	64PE410 St8-2-12	0.507	1.001	0.364	0.041
64PE410	8	2	10	30.1	64PE410 St8-2-10	0.535	1.286	0.578	0.135
64PE410	8	2	9	30.1	64PE410 St8-2-9	0.531	1.264	0.592	0.143
64PE410	8	2	7	43.4	64PE410 St8-2-7	0.871	0.889	3.564	0.188
64PE410	8	2	6	43.4	64PE410 St8-2-6	0.995	1.191	4.143	0.135

Appendix 7: N/P station 9

					ANAL	Q3 64PE410 NIOZ BALTIC 2016.ANL				
					RUN	160523-NP-CTD St9R1.RUN				
					DATE	23-5-2016				
					TIME	10:29:55				
					OPER	SO				
					COMM	Recalculate from Run160523-NP-CTD St9R1.run				
					METH	**PO4**	**NH4**	**NO3+NO2**	**NO2**	**COMMENTS**
					UNIT	**µmol/L**	**µmol/L**	**µmol/L**	**µmol/L**	
					Baseline	0.002	0.040	0.002	0.000	
CRUISE No.	**Station No.**	**Cast No.**	**Bottle No.**	**Depth (m)**	**Sample ID**					
64PE410	9	2	21	5.1	64PE410 St9-2-21	0.339	0.13	0.04	0.001	
64PE410	9	2	20	5.1	64PE410 St9-2-20	0.333	0.12	0.03	0.001	
64PE410	9	2	17	22.5	64PE410 St9-2-17	0.391	0.15	0.02	0.000	
64PE410	9	2	16	22.5	64PE410 St9-2-16	0.395	0.20	0.02	0.004	
64PE410	9	2	14	34.8	64PE410 St9-2-14	0.613	0.54	0.06	0.014	
64PE410	9	2	13	34.8	64PE410 St9-2-13	0.631	0.53	0.06	0.015	
64PE410	9	2	11	45.4	64PE410 St9-2-11	0.574	1.02	0.39	0.087	
64PE410	9	2	10	45.4	64PE410 St9-2-10	0.568	1.01	0.38	0.094	
64PE410	9	2	8	59.2	64PE410 St9-2-8	0.582	0.96	1.13	0.347	
64PE410	9	2	7	59.2	64PE410 St8-2-7	0.583	0.96	1.11	0.349	
64PE410	9	2	5	77.4	64PE410 St8-2-5	1.977	0.11	10.75	0.019	HYPOXIC
64PE410	9	2	3	77.4	64PE410 St8-2-3 GOF	1.940	0.11	10.81	0.018	GO FLO, HYPOXIC

Appendix 8: N/P station 10

					ANAL	Q3 64PE410 NIOZ BALTIC 2016.ANL				
					RUN	160525-NP-CTD St10_PCPW St9R1.RUN				
					DATE	25-5-2016				
					TIME	13:33:02				
					OPER	SO				
					COMM	Recalculate from Run160525-NP-CTD St10_PCPW St9.ru				
					METH	**PO4**	**NH4**	**NO3+NO2**	**NO2**	**COMMENTS**
					UNIT	**µmol/L**	**µmol/L**	**µmol/L**	**µmol/L**	
					Baseline	0.002	0.042	0.002	0.001	
CRUISE No.	**Station No.**	**Cast No.**	**Bottle No.**	**Depth (m)**	**Sample ID**					
64PE410	10	2	16	4.2	64PE410 St10-2-16	0.040	0.10	0.00	0.001	DETECTION LIMIT
64PE410	10	2	14	13.8	64PE410 St10-2-14	0.183	0.13	0.00	0.001	DETECTION LIMIT
64PE410	10	2	12	24.1	64PE410 St10-2-12	0.287	0.32	0.00	0.001	DETECTION LIMIT
64PE410	10	2	10	49.5	64PE410 St10-2-10	0.432	0.43	0.15	0.032	
64PE410	10	2	8	59.8	64PE410 St10-2-8	0.858	0.49	1.64	0.144	
64PE410	10	2	6	71.9	64PE410 St10-2-6	2.301	0.47	5.00	0.097	
64PE410	10	2	5	99.4	64PE410 St10-2-5	2.506	0.14	6.13	0.030	
64PE410	10	4	4	100	64PE410 St10-4-4 GF	2.545	0.10	5.99	0.040	GO FLO BOTTLE
64PE410	10	2	3	149.7	64PE410 St10-2-3 GF	2.392	0.11	8.27	0.007	GO FLO BOTTLE
64PE410	10	2	1	199.8	64PE410 St10-2-1 GF	2.474	0.14	9.80	0.025	GO FLO BOTTLE

Appendix 9: station 7 piston core pore water N species (Rhizons)

					ANAL	Q3 64PE410 NIOZ BALTIC 2016.ANL					
					RUN	160522-NH4-PCPW St7R1.RUN					
					DATE	22-5-2016					
					TIME	14:13:41					
					OPER	SO					
					COMM	Recalculate from Run160522-NH4-PCPW St7.run					
					METH	**CALC. NH4**	**CALC. NO2**		DILUTION	DILUTION	**COMMENTS**
					UNIT	**µmol/L**	**µmol/L**		FACTOR	FACTOR	
					Baseline	0.051	0.001		USED	USED	
CRUISE No.	**Station No.**	**Cast No.**	**Depth No.**	**Type**	**Sample ID**				NO2	NH4	
					64PE4710 PC PWRH						
64PE410	7		1	Rhizon	PWRH St7-1	3459	0.43		11	1111	
64PE411	7		2	Rhizon	PWRH St7-2	4209	0.39		11	1111	
64PE412	7		3	Rhizon	PWRH St7-3	4588	0.50		11	1111	
64PE413	7		4	Rhizon	PWRH St7-4	5222	0.55		11	1111	
64PE414	7		6	Rhizon	PWRH St7-6	4800	0.52		11	1111	
64PE415	7		8	Rhizon	PWRH St7-8	5901	0.59		11	1111	
64PE416	7		9	Rhizon	PWRH St7-9	5994	0.76		11	1111	
64PE417	7		11	Rhizon	PWRH St7-11	6788	0.74		11	1111	
64PE418	7		12	Rhizon	PWRH St7-12	7226	0.72		11	1111	
64PE419	7		17	Rhizon	PWRH St7-17	7202	0.77		11	1111	
64PE420	7		21	Rhizon	PWRH St7-18	6750			11	1111	Not enough sample for NO2
64PE421	7		21	Rhizon	PWRH St7-21	7235	0.66		11	1111	
64PE422	7		22	Rhizon	PWRH St7-22	7240	0.59		11	1111	
64PE423	7		23	Rhizon	PWRH St7-23	6829	0.61		11	1111	
64PE424	7		35	Rhizon	PWRH St7-35	5529	0.63		11	1111	

For depth # see section 12, pore water sampling

Appendix 10: station 7 multi core pore water N species (2 sampling methods, Rhizons and Centrifugation)

					ANAL	Q3 64PE410 NIOZ BALTIC 2016.AN		
					RUN	160523-NH4NO2-MCPW St7R1.RU		
					DATE	23-5-2016		
					TIME	13:14:03		
					OPER	SO		
					COMM	Recalculate from Run160523-NH4		
					METH	**CALC. NH4**	**CALC.NO2**	
					UNIT	**µmol/L**	**µmol/L**	
					Baseline	0.036	0.000	
CRUISE No.	**Station No.**	**Cast No.**	**Depth No.**	**Extraction**	Sample ID			
					MC PW Rhizons St7			
64PE410	7	Multicore	0	Rhizon	MCRH St7-0	3.0	0.36	
64PE410	7	Multicore	1	Rhizon	MCRH St7-1	240.0	0.26	
64PE410	7	Multicore	3	Rhizon	MCRH St7-3	617.8	0.28	
64PE410	7	Multicore	4	Rhizon	MCRH St7-4	735.5	0.28	
64PE410	7	Multicore	5	Rhizon	MCRH St7-5	884.4	0.30	
64PE410	7	Multicore	6	Rhizon	MCRH St7-6	986.6	0.25	
64PE410	7	Multicore	7	Rhizon	MCRH St7-7	1132.2	0.23	
64PE410	7	Multicore	8	Rhizon	MCRH St7-8	1237.7	0.13	
64PE410	7	Multicore	9	Rhizon	MCRH St7-9	1351.0	0.07	
64PE410	7	Multicore	10	Rhizon	MCRH St7-10	1492.1	0.06	
64PE410	7	Multicore	11	Rhizon	MCRH St7-11	1425.5	0.10	
64PE410	7	Multicore	13	Rhizon	MCRH St7-13	1518.8	0.13	
64PE410	7	Multicore	14	Rhizon	MCRH St7-14	1661.0	0.12	
64PE410	7	Multicore	15	Rhizon	MCRH St7-15	1819.9	0.14	
64PE410	7	Multicore	16	Rhizon	MCRH St7-16	1854.3	0.33	
64PE410	7	Multicore	18	Rhizon	MCRH St7-18	1985.4	0.21	
64PE410	7	Multicore	20	Rhizon	MCRH St7-20	2104.3	0.25	
64PE410	7	Multicore	22	Rhizon	MCRH St7-22	2233.2	0.23	
64PE410	7	Multicore	23	Rhizon	MCRH St7-23	2282.0	0.26	
64PE410	7	Multicore	24	Rhizon	MCRH St7-24	2345.4	0.30	
64PE410	7	Multicore	26	Rhizon	MCRH St7-26	2524.2	0.51	
64PE410	7	Multicore	27	Rhizon	MCRH St7-27	2544.2	0.78	
64PE410	7	Multicore	28	Rhizon	MCRH St7-28	2617.6	0.30	
					MC PW Centrifuge St7			
64PE410	7	Multicore	0	Centrifuge	MCCent St7-0	9.9	0.63	
64PE410	7	Multicore	1	Centrifuge	MCCent St7-1	178.9	1.32	
64PE410	7	Multicore	2	Centrifuge	MCCent St7-2	203.4	1.32	
64PE410	7	Multicore	3	Centrifuge	MCCent St7-3	267.8	1.22	
64PE410	7	Multicore	4	Centrifuge	MCCent St7-4	315.6	1.21	
64PE410	7	Multicore	5	Centrifuge	MCCent St7-5	366.7	1.40	
64PE410	7	Multicore	6	Centrifuge	MCCent St7-6	441.1	2.02	
64PE410	7	Multicore	7	Centrifuge	MCCent St7-7	481.1	2.21	
64PE410	7	Multicore	8	Centrifuge	MCCent St7-8	612.2	1.46	
64PE410	7	Multicore	9	Centrifuge	MCCent St7-9	636.7	1.54	
64PE410	7	Multicore	10	Centrifuge	MCCent St7-10	698.9	0.79	
64PE410	7	Multicore	11	Centrifuge	MCCent St7-11	472.2	2.09	
64PE410	7	Multicore	12	Centrifuge	MCCent St7-12	827.7	0.96	
64PE410	7	Multicore	13	Centrifuge	MCCent St7-13	901.1	1.13	
64PE410	7	Multicore	14	Centrifuge	MCCent St7-14	977.7	1.10	
64PE410	7	Multicore	15	Centrifuge	MCCent St7-15	1089.9	0.55	
64PE410	7	Multicore	16	Centrifuge	MCCent St7-16	1137.7	0.70	
64PE410	7	Multicore	17	Centrifuge	MCCent St7-17	1301.0	0.44	
64PE410	7	Multicore	18	Centrifuge	MCCent St7-18	1312.1	0.36	
64PE410	7	Multicore	19	Centrifuge	MCCent St7-19	1434.4	0.54	
64PE410	7	Multicore	20	Centrifuge	MCCent St7-20	1555.5	0.86	
64PE410	7	Multicore	21	Centrifuge	MCCent St7-21	1554.3	0.74	
64PE410	7	Multicore	22	Centrifuge	MCCent St7-22	1595.4	0.66	
64PE410	7	Multicore	23	Centrifuge	MCCent St7-23	1659.9	0.92	
64PE410	7	Multicore	24	Centrifuge	MCCent St7-24	1738.8	1.31	
64PE410	7	Multicore	25	Centrifuge	MCCent St7-25	1902.1	0.80	
64PE410	7	Multicore	26	Centrifuge	MCCent St7-26	1925.4	0.68	
64PE410	7	Multicore	27	Centrifuge	MCCent St7-27	1856.5	0.84	

For depth # see section 12, pore water sampling

Appendix 11: station 9 piston core pore water N species (Centrifugation)

					ANAL	Q3 64PE410 NIOZ BALTIC 2016.ANL				
					RUN	160525-NP-CTD St10_PCPW St9R1.RUN				
					DATE	25-5-2016				
					TIME	13:33:02				
					OPER	SO				
					COMM	Recalculate from Run160525-NP-CTD St10_PCPW St9.ru				
					METH	**PO4**	**NH4**	**NO3+NO2**	**NO2**	**COMMENTS**
					UNIT	**µmol/L**	**µmol/L**	**µmol/L**	**µmol/L**	
					Baseline	0.002	0.042	0.002	0.001	
CRUISE No.	**Station No.**	**Cast No.**	**Depth No.**	**Extraction**						
					PC PW Centrifuged St9					
64PE410	9	Multicore	1	Centrifuge	PCPWCent St9-1		1572.1	6.18	2.59	
64PE411	9	Multicore	2	Centrifuge	PCPWCent St9-2		1769.9	5.70	1.25	
64PE412	9	Multicore	3	Centrifuge	PCPWCent St9-3		2513.1	8.57	2.05	
64PE413	9	Multicore	4	Centrifuge	PCPWCent St9-4		2637.6	5.76	2.35	
64PE414	9	Multicore	19	Centrifuge	PCPWCent St9-19		5421.7	11.41	7.48	

For depth # see section 12, pore water sampling

Appendix 12: station 9 multi core pore water N species (Rhizons)

					ANAL	Q3 64PE410 NIOZ BALTIC 2016.ANL		
					RUN	160523-NH4NO2-MCPW St9R1.RUN		
					DATE	23-5-2016		
					TIME	18:58:31		
					OPER	SO		
					COMM	Recalculate from Run160523-NH4NO2-MCPV		
					METH	**CALC. NH4**	**CALC. NO2**	**COMMENTS**
					UNIT	**µmol/L**	**µmol/L**	
					Baseline	0.042	0.000	
CRUISE No.	**Station No.**	**Cast No.**	**Depth No.**	**Extraction**	**Sample ID**			
					MC PW Rhizons St9			
64PE410	9	Multicore	0	Rhizon	MCRH St9-0	2.5	0.21	
64PE410	9	Multicore	1	Rhizon	MCRH St9-1	186.7	0.42	
64PE410	9	Multicore	2	Rhizon	MCRH St9-2	345.6	0.21	
64PE410	9	Multicore	3	Rhizon	MCRH St9-3	378.9	0.34	
64PE410	9	Multicore	4	Rhizon	MCRH St9-4	470.0	0.42	
64PE410	9	Multicore	5	Rhizon	MCRH St9-5	500.0	0.50	
64PE410	9	Multicore	6	Rhizon	MCRH St9-6	574.4	0.09	
64PE410	9	Multicore	7	Rhizon	MCRH St9-7	712.2	0.00	
64PE410	9	Multicore	8	Rhizon	MCRH St9-8	726.6	0.01	
64PE410	9	Multicore	9	Rhizon	MCRH St9-9	756.6	0.00	
64PE410	9	Multicore	10	Rhizon	MCRH St9-10	742.2	0.06	
64PE410	9	Multicore	11	Rhizon	MCRH St9-11	748.9	0.29	NO2 PEAK CHECKED
64PE410	9	Multicore	12	Rhizon	MCRH St9-12	887.7	0.06	
64PE410	9	Multicore	13	Rhizon	MCRH St9-13	943.3	0.00	
64PE410	9	Multicore	14	Rhizon	MCRH St9-14	897.7	0.00	
64PE410	9	Multicore	15	Rhizon	MCRH St9-15	987.7	0.00	
64PE410	9	Multicore	16	Rhizon	MCRH St9-16	1003.3	1.46	NO2 PEAK CHECKED
64PE410	9	Multicore	17	Rhizon	MCRH St9-17	1109.9	0.00	
64PE410	9	Multicore	18	Rhizon	MCRH St9-18	1184.4	0.02	
64PE410	9	Multicore	19	Rhizon	MCRH St9-19	1131.0	0.01	
64PE410	9	Multicore	20	Rhizon	MCRH St9-20	1167.7	0.01	
64PE410	9	Multicore	21	Rhizon	MCRH St9-21	1224.4	0.89	NO2 PEAK CHECKED
64PE410	9	Multicore	23	Rhizon	MCRH St9-23	1282.1	0.00	

For depth # see section 12, pore water sampling

Appendix 13: station 10 piston core pore water N species (Centrifugation)

					ANAL	Q3 64PE410 NIOZ BALTIC 2016.ANL			
					RUN	160526-NP-PCPW St0R1.RUN			
					DATE	26-5-2016			
					TIME	17:59:50			
					OPER	SO			
					COMM	Recalculate from Run160526-NP-PCPW St0.			
					METH	**NH4**	**NO3+NO2**	**NO2**	
					UNIT	**µmol/L**	**µmol/L**	**µmol/L**	
					Baseline	0.046	0.002	0.001	
CRUISE No.	**Station No.**	**Cast No.**	**Depth No.**	**Extraction**	Sample ID				
64PE410	10	Pistoncore	1	Centrifuge	PCCen St10-1	**84.6**	**7.11**	**2.10**	
64PE410	10	Pistoncore	2	Centrifuge	PCCen St10-2	**99.2**	**4.62**	**0.68**	
64PE410	10	Pistoncore	3	Centrifuge	PCCen St10-3	**115.3**	**6.76**	**2.81**	
64PE410	10	Pistoncore	4	Centrifuge	PCCen St10-4	**134.8**	**8.65**	**4.29**	
64PE410	10	Pistoncore	9	Centrifuge	PCCen St10-19	**253.1**	**7.00**	**4.91**	
64PE410	10	Pistoncore	20	Centrifuge	PCCen St10-20	**274.8**	**12.27**	**5.92**	
64PE410	10	Pistoncore	21	Centrifuge	PCCen St10-21	**272.6**	**16.08**	**13.21**	
64PE410	10	Pistoncore	22	Centrifuge	PCCen St10-22	**290.9**	**15.69**	**4.98**	
64PE410	10	Pistoncore	26	Centrifuge	PCCen St10-26	**303.2**	**17.50**	**12.13**	
64PE410	10	Pistoncore	28	Centrifuge	PCCen St10-28	**296.1**	**9.68**	**5.90**	
64PE410	10	Pistoncore	30	Centrifuge	PCCen St10-30	**300.8**	**24.49**	**20.31**	
64PE410	10	Pistoncore	31	Centrifuge	PCCen St10-31	**284.9**	**16.28**	**14.00**	
64PE410	10	Pistoncore	32	Centrifuge	PCCen St10-32	**266.0**	29.19	**23.74**	
64PE410	10	Pistoncore	33	Centrifuge	PCCen St10-33	**298.0**	**23.85**	**19.17**	
64PE410	10	Pistoncore	34	Centrifuge	PCCen St10-34	**298.0**	**6.88**	**4.97**	
64PE410	10	Pistoncore	35	Centrifuge	PCCen St10-35	**291.7**	**7.19**	**5.18**	
64PE410	10	Pistoncore	36	Centrifuge	PCCen St10-36	**275.6**	**10.44**	**6.84**	
64PE410	10	Pistoncore	37	Centrifuge	PCCen St10-37	**271.1**	**13.94**	**9.13**	
64PE410	10	Pistoncore	38	Centrifuge	PCCen St10-38	**261.0**	**17.38**	**14.49**	
64PE410	10	Pistoncore	39	Centrifuge	PCCen St10-39	**279.7**	**21.38**	**18.01**	
64PE410	10	Pistoncore	40	Centrifuge	PCCen St10-40	**267.9**	**21.92**	**17.98**	

For depth # see section 12, pore water sampling

Appendix 14: station 10 multi core pore water N species (Centrifugation)

					ANAL	Q3 64PE410 NIOZ BALTIC 2016.ANL			
					RUN	160526-NH4NO2-MCPW St10R1.RUN			
					DATE	26-5-2016			
					TIME	10:02:43			
					OPER	SO			
					COMM	Recalculate from Run160526-NH4NO2-MCPW St1(			
					METH	**NH4**	**NO3+NO2**	**NO2**	
					UNIT	**µmol/L**	**µmol/L**	**µmol/L**	
					Baseline	0.048		0.003	
CRUISE No.	**Station No.**	**Cast No.**	**Depth No.**	**Extraction**	**Sample ID**				
					MC PW Centrifuge St10				
64PE410	10	Multicore	0	Centrifuge	MCCen St10-0	2.8	14.7	0.28	
64PE410	10	Multicore	1	Centrifuge	MCCen St10-1	8.3	2.6	0.61	
64PE410	10	Multicore	2	Centrifuge	MCCen St10-2	23.2	3.2	0.52	
64PE410	10	Multicore	3	Centrifuge	MCCen St10-3	29.4	3.8	1.53	
64PE410	10	Multicore	4	Centrifuge	MCCen St10-4	35.1	3.3	1.87	
64PE410	10	Multicore	5	Centrifuge	MCCen St10-5	37.0	3.1	0.44	
64PE410	10	Multicore	6	Centrifuge	MCCen St10-6	39.1	1.3	0.26	
64PE410	10	Multicore	7	Centrifuge	MCCen St10-7	42.7	6.5	1.09	
64PE410	10	Multicore	8	Centrifuge	MCCen St10-8	48.3	2.2	0.73	
64PE410	10	Multicore	9	Centrifuge	MCCen St10-9	49.8	2.6	0.48	
64PE410	10	Multicore	10	Centrifuge	MCCen St10-10	52.0	3.9	0.83	
64PE410	10	Multicore	11	Centrifuge	MCCen St10-11	57.0	4.1	1.21	
64PE410	10	Multicore	12	Centrifuge	MCCen St10-12	59.1	3.4	0.86	
64PE410	10	Multicore	13	Centrifuge	MCCen St10-13	60.8	4.7	1.41	
64PE410	10	Multicore	14	Centrifuge	MCCen St10-14	62.1	5.1	1.83	
64PE410	10	Multicore	15	Centrifuge	MCCen St10-15	65.2	5.3	2.47	
64PE410	10	Multicore	16	Centrifuge	MCCen St10-16	67.1	5.2	1.61	
64PE410	10	Multicore	17	Centrifuge	MCCen St10-17	68.1	4.2	1.56	
64PE410	10	Multicore	18	Centrifuge	MCCen St10-18	71.2	3.6	1.40	
64PE410	10	Multicore	19	Centrifuge	MCCen St10-19	75.0	4.0	1.48	
64PE410	10	Multicore	20	Centrifuge	MCCen St10-20	75.0	6.4	3.32	
64PE410	10	Multicore	21	Centrifuge	MCCen St10-21	76.9	5.1	1.74	
64PE410	10	Multicore	23	Centrifuge	MCCen St10-23	79.5	5.2	1.81	
64PE410	10	Multicore	24	Centrifuge	MCCen St10-24	82.6	2.5	0.40	
64PE410	10	Multicore	25	Centrifuge	MCCen St10-25	80.8	2.9	0.99	
64PE410	10	Multicore	26	Centrifuge	MCCen St10-26	82.7	1.5	0.46	
64PE410	10	Multicore	27	Centrifuge	MCCen St10-27	85.3	4.1	1.29	
64PE410	10	Multicore	28	Centrifuge	MCCen St10-28	86.1	5.9	1.16	
64PE410	10	Multicore	29	Centrifuge	MCCen St10-29	87.6	6.3	2.02	
64PE410	10	Multicore	30	Centrifuge	MCCen St10-30	88.2	7.1	2.90	

For depth # see section 12, pore water sampling

Appendix 15: Pore water DIC stations 7 and 9

					ANAL	Q2 64PE410 NIOZ BALTIC 2016.ANL	
					RUN	DIC-160524-PWR1.RUN	
					DATE	24-5-2016	
					TIME	15:44:50	
					OPER	SO	
					COMM	Recalculate from RunDIC-160524-P	
					METH	**CALC. DIC**	**COMMENTS**
					UNIT	**µmol/l**	
					Baseline 21 NaCl		
Cruise No.	**Station No.**	**Cast No.**	**Slice No.**	**Extraction**	**Sample ID**		
64PE410	7	Multicore	0	Rhizons	MCPWRH St7-0	1654.1	
64PE410	7	Multicore	1	Rhizons	MCPWRH St7-1	1584.7	
64PE410	7	Multicore	2	Rhizons	MCPWRH St7-2	5450.9	
64PE410	7	Multicore	3	Rhizons	MCPWRH St7-3	10944.8	
64PE410	7	Multicore	4	Rhizons	MCPWRH St7-4	11180.2	
64PE410	7	Multicore	5	Rhizons	MCPWRH St7-5	14366.5	
64PE410	7	Multicore	6	Rhizons	MCPWRH St7-6	15737.4	
64PE410	7	Multicore	7	Rhizons	MCPWRH St7-7	18583.5	
64PE410	7	Multicore	8	Rhizons	MCPWRH St7-8	16292.6	
64PE410	7	Multicore	0	Centrifuge	MCPW Cen St7-0	1761.2	
64PE410	7	Multicore	1	Centrifuge	MCPW Cen St7-1	2376.4	
64PE410	7	Multicore	2	Centrifuge	MCPW Cen St7-2	2866.3	
64PE410	7	Multicore	3	Centrifuge	MCPW Cen St7-3	3647.0	
64PE410	7	Multicore	4	Centrifuge	MCPW Cen St7-4	3783.2	
64PE410	7	Multicore	5	Centrifuge	MCPW Cen St7-5	4444.4	
64PE410	7	Multicore	6	Centrifuge	MCPW Cen St7-6	4899.7	
64PE410	7	Multicore	7	Centrifuge	MCPW Cen St7-7	5567.8	
64PE410	7	Multicore	8	Centrifuge	MCPW Cen St7-8	6384.0	
64PE410	7	Multicore	9	Centrifuge	MCPW Cen St7-9	7170.0	
64PE410	7	Multicore	10	Centrifuge	MCPW Cen St7-10	7025.0	
64PE410	7	Multicore	11	Centrifuge	MCPW Cen St7-11	4887.3	
64PE410	7	Multicore	12	Centrifuge	MCPW Cen St7-12	9372.8	
64PE410	7	Multicore	13	Centrifuge	MCPW Cen St7-13	10615.4	
64PE410	7	Multicore	14	Centrifuge	MCPW Cen St7-14	11127.7	
64PE410	7	Multicore	15	Centrifuge	MCPW Cen St7-15	11879.5	
64PE410	7	Multicore	16	Centrifuge	MCPW Cen St7-16	13992.2	
64PE410	7	Multicore	17	Centrifuge	MCPW Cen St7-17	12783.5	
64PE410	7	Multicore	18	Centrifuge	MCPW Cen St7-18	16639.2	
64PE410	7	Multicore	19	Centrifuge	MCPW Cen St7-19	16682.2	
64PE410	7	Multicore	20	Centrifuge	MCPW Cen St7-20	18614.5	
64PE410	7	Multicore	21	Centrifuge	MCPW Cen St7-21	20170.2	
64PE410	7	Multicore	22	Centrifuge	MCPW Cen St7-22	20149.7	
64PE410	7	Multicore	23	Centrifuge	MCPW Cen St7-23	19274.9	
64PE410	7	Multicore	24	Centrifuge	MCPW Cen St7-24	21556.6	
64PE410	7	Multicore	25	Centrifuge	MCPW Cen St7-25	21191.5	
64PE410	7	Multicore	26	Centrifuge	MCPW Cen St7-26	22668.4	
64PE410	7	Multicore	27	Centrifuge	MCPW Cen St7-27	21738.6	
64PE410	9	Multicore	0	Rhizons	MCPWRH St9-0	1867.0	
64PE410	9	Multicore	1	Rhizons	MCPWRH St9-1	2404.1	
64PE410	9	Multicore	2	Rhizons	MCPWRH St9-2	3987.5	
64PE410	9	Multicore	3	Rhizons	MCPWRH St9-3	4412.4	
64PE410	9	Multicore	4	Rhizons	MCPWRH St9-4	5277.3	
64PE410	9	Multicore	5	Rhizons	MCPWRH St9-5	5450.9	
64PE410	9	Multicore	6	Rhizons	MCPWRH St9-6	6165.2	
64PE410	9	Multicore	7	Rhizons	MCPWRH St9-7	7005.0	
64PE410	9	Multicore	8	Rhizons	MCPWRH St9-8	7821.4	
64PE410	9	Multicore	9	Rhizons	MCPWRH St9-9	8703.2	
64PE410	9	Multicore	10	Rhizons	MCPWRH St9-10	9107.3	
64PE410	9	Multicore	11	Rhizons	MCPWRH St9-11	9847.5	
64PE410	9	Multicore	12	Rhizons	MCPWRH St9-12	6626.5	
64PE410	9	Multicore	13	Rhizons	MCPWRH St9-13	12211.3	
64PE410	9	Multicore	14	Rhizons	MCPWRH St9-14	9675.6	
64PE410	9	Multicore	15	Rhizons	MCPWRH St9-15	13344.7	
64PE410	9	Multicore	16	Rhizons	MCPWRH St9-16	13275.9	
64PE410	9	Multicore	19	Rhizons	MCPWRH St9-19	14833.8	
64PE410	9	Multicore	20	Rhizons	MCPWRH St9-20	15347.1	
64PE410	9	Multicore	21	Rhizons	MCPWRH St9-21	16090.5	
64PE410	9	Multicore	23	Rhizons	MCPWRH St9-23	17145.2	
64PE410	9	Pistoncore	1	Centrifuge	PCPWCentt9-1	17651.1	NO SEPTUM IN CAP
64PE410	9	Pistoncore	2	Centrifuge	PCPWCentt9-2	16618.3	

For depth # see section 12, pore water sampling

Appendix 16: Pore water DIC station 10

					ANAL	Q2 64PE410 NIOZ BALTIC 2016.AN		
					RUN	DIC-160527-MCPCPW St10R1.RUN		
					DATE	27-5-2016		
					TIME	9:46:37		
					OPER	SO		
					COMM	Recalculate from RunDIC-160527		
					METH	**DIC**		DILUTION
					UNIT	**µmol/l**		FACTOR
Cruise No.	**Station No.**	**Cast No.**	**Slice No.**	**Extraction**	**Sample ID**	CALC.		GLOVEBAG
								FOR INFO ONL
64PE410	10	Multicore	0	Centrifuge	MCPWCen St10-0	1571.6		10
64PE410	10	Multicore	1	Centrifuge	MCCen St10-1	2044.8		10
64PE410	10	Multicore	2	Centrifuge	MCCen St10-2	2056.0		10
64PE410	10	Multicore	3	Centrifuge	MCCen St10-3	1968.0		10
64PE410	10	Multicore	4	Centrifuge	MCCen St10-4	2265.7		10
64PE410	10	Multicore	5	Centrifuge	MCCen St10-5	2189.0		10
64PE410	10	Multicore	6	Centrifuge	MCCen St10-6	2257.1		10
64PE410	10	Multicore	7	Centrifuge	MCCen St10-7	2329.2		10
64PE410	10	Multicore	8	Centrifuge	MCCen St10-8	2329.8		10
64PE410	10	Multicore	9	Centrifuge	MCCen St10-9	2377.4		10
64PE410	10	Multicore	10	Centrifuge	MCCen St10-10	2230.7		10
64PE410	10	Multicore	11	Centrifuge	MCCen St10-11	3111.9		10
64PE410	10	Multicore	12	Centrifuge	MCCen St10-12	3443.2		10
64PE410	10	Multicore	13	Centrifuge	MCCen St10-13	2955.2		10
64PE410	10	Multicore	14	Centrifuge	MCCen St10-14	2507.5		10
64PE410	10	Multicore	15	Centrifuge	MCCen St10-15	2372.8		10
64PE410	10	Multicore	16	Centrifuge	MCCen St10-16	2903.2		10
64PE410	10	Multicore	17	Centrifuge	MCCen St10-17	2516.7		10
64PE410	10	Multicore	18	Centrifuge	MCCen St10-18	2590.7		10
64PE410	10	Multicore	19	Centrifuge	MCCen St10-19	2553.0		10
64PE410	10	Multicore	20	Centrifuge	MCCen St10-20	2414.4		10
64PE410	10	Multicore	21	Centrifuge	MCCen St10-21	2465.2		10
64PE410	10	Multicore	23	Centrifuge	MCCen St10-23	2635.5		10
64PE410	10	Multicore	24	Centrifuge	MCCen St10-24	2638.2		10
64PE410	10	Multicore	25	Centrifuge	MCCen St10-25	2504.9		10
64PE410	10	Multicore	26	Centrifuge	MCCen St10-26	2376.7		10
64PE410	10	Multicore	27	Centrifuge	MCCen St10-27	2654.0		10
64PE410	10	Multicore	28	Centrifuge	MCCen St10-28	2380.0		10
64PE410	10	Multicore	29	Centrifuge	MCCen St10-29	1948.1		10
64PE410	10	Pistoncore	1	Centrifuge	PCCen St10-1	1183.7		10
64PE410	10	Pistoncore	2	Centrifuge	PCCen St10-2	2673.1		10
64PE410	10	Pistoncore	4	Centrifuge	PCCen St10-4	2637.5		10
64PE410	10	Pistoncore	6	Centrifuge	PCCen St10-6	3057.3		10
64PE410	10	Pistoncore	7	Centrifuge	PCCen St10-7	52.0		10

For depth # see section 12, pore water sampling

Appendix 17: HS station 7 and 9

					ANAL	Q2 64PE410 NIOZ BALTIC 2016.ANL			
					RUN	HS-160524-PW-PC_MC St7_St9R1.RUN			
					DATE	24-5-2016			
					TIME	10:41:43			
					OPER	SO			
					COMM	Recalculate from RunHS-160524-PW-PC_MC St7_St9R1			
					METH	**CALC. HS-**	**COMMENTS**	DILUTION	DILUTION
					UNIT	**µmol/l**		FACTOR	FACTOR
					Baseline	0.252		GLOVEBAG	LAB
Cruise No.	**Station No.**	**Cast No.**	**Bottle No.**	**Depth (m)**	Sample ID			FOR INFO ONLY	
64PE410	9	2	5	99.4	CTD St9-2-5	0			
64PE410	9	2	3	199..8	CTD St9-2-3 GOFLO	0	GO FLO BOTTLE		
Cruise No.	**Station No.**	**Cast No.**	**Slice No.**	**Extraction**	PC PW Rhizons St7				
64PE410	7	Multicore	1	Rhizons	PCPWRHSt7-1	202.5		4	
64PE410	7	Multicore	2	Rhizons	PC PW St7-2	271.1		4	
64PE410	7	Multicore	3	Rhizons	PC PW St7-3	29.8		4	
64PE410	7	Multicore	4	Rhizons	PC PW St7-4	23.0		4	
64PE410	7	Multicore	5	Rhizons	PC PW St7-5	9.6		4	
64PE410	7	Multicore	6	Rhizons	PC PW St7-6	10.1		4	
64PE410	7	Multicore	7	Rhizons	PC PW St7-7	7.2		4	
64PE410	7	Multicore	8	Rhizons	PC PW St7-8	7.0		4	
64PE410	7	Multicore	9	Rhizons	PC PW St7-9	5.4		4	
64PE410	7	Multicore	10	Rhizons	PC PW St7-10	3.5		4	
64PE410	7	Multicore	11	Rhizons	PC PW St7-11	2.9		4	
64PE410	7	Multicore	12	Rhizons	PC PW St7-12	2.0		4	
64PE410	7	Multicore	13	Rhizons	PC PW St7-15	1.1		4	
64PE410	7	Multicore	14	Rhizons	PC PW St7-16	0.0		4	
64PE410	7	Multicore	15	Rhizons	PC PW St7-17	0.0		4	
64PE410	7	Multicore	16	Rhizons	PC PW St7-18	0.0		4	
64PE410	7	Multicore	17	Rhizons	PC PW St7-21	0.0		4	
64PE410	7	Multicore	18	Rhizons	PC PW St7-22	0.0		4	
64PE410	7	Multicore	19	Rhizons	PC PW St7-23	0.0		4	
64PE410	7	Multicore	20	Rhizons	PC PW St7-24	0.0		4	
64PE410	7	Multicore	21	Rhizons	PC PW St7-26	0.0		4	
64PE410	7	Multicore	22	Rhizons	PC PW St7-27	0.0		4	
64PE410	7	Multicore	23	Rhizons	PC PW St7-31	0.0		4	
64PE410	7	Multicore	24	Rhizons	PC PW St7-32	0.0	NO SEPTUM IN CAP	4	
64PE410	7	Multicore	25	Rhizons	PC PW St7-34	0.0	NO SEPTUM IN CAP	4	
64PE410	7	Multicore	26	Rhizons	PC PW St7-35	0.0		4	
64PE410	7	Multicore	27	Rhizons	PCPWRHSt7-36	0.0		4	

					MC PW Rhizons St9				
64PE435	9	Multicore	0	Rhizons	MCPW RH St9-0	0.0		4	
64PE434	9	Multicore	1	Rhizons	MCPW RH St9-1	0.0		4	
64PE433	9	Multicore	2	Rhizons	MCPW RH St9-2	3.3		4	
64PE432	9	Multicore	3	Rhizons	MCPW RH St9-3	75.6		4	
64PE431	9	Multicore	4	Rhizons	MCPW RH St9-4	221.1		4	
64PE430	9	Multicore	5	Rhizons	MCPW RH St9-5	151.8	NO SEPTUM IN CAP	4	
64PE429	9	Multicore	6	Rhizons	MCPW RH St9-6	423.1		4	
64PE428	9	Multicore	7	Rhizons	MCPW RH St9-7	522.8		4	
64PE427	9	Multicore	8	Rhizons	MCPW RH St9-8	500.5		4	
64PE426	9	Multicore	9	Rhizons	MCPW RH St9-9	645.8		4	
64PE425	9	Multicore	10	Rhizons	MCPW RH St9-10	753.3		4	
64PE424	9	Multicore	11	Rhizons	MCPW RH St9-11	798.0		4	
64PE423	9	Multicore	12	Rhizons	MCPW RH St9-12	927.2		4	
64PE422	9	Multicore	13	Rhizons	MCPW RH St9-13	983.8		4	
64PE421	9	Multicore	14	Rhizons	MCPW RH St9-14	1226.4		4	
64PE420	9	Multicore	15	Rhizons	MCPW RH St9-15	1326.1		4	
64PE419	9	Multicore	16	Rhizons	MCPW RH St9-16	1065.2		4	
64PE418	9	Multicore	17	Rhizons	MCPW RH St9-17	1537.7		4	
64PE417	9	Multicore	18	Rhizons	MCPW RH St9-18	1283.8		4	
64PE416	9	Multicore	19	Rhizons	MCPW RH St9-19	2119.3		4	3
64PE415	9	Multicore	20	Rhizons	MCPW RH St9-20	1891.1		4	3
64PE414	9	Multicore	21	Rhizons	MCPW RH St9-21	1771.5		4	3
64PE413	9	Multicore	22	Rhizons	MCPW RH St9-22	565.9	NO SEPTUM IN CAP	4	
64PE412	9	Multicore	23	Rhizons	MCPW RH St9-23	2173.9		4	3

For slice or depth # see section 12, pore water sampling

Appendix 18: HS station 9 (piston core) and 10

					ANAL		Q2 64PE411 FeVICI BALTIC 2016.ANL				
					RUN		HS-160529-CTD S20_S17-64PE410 PCMC S10R1.RUN				
					DATE		29-5-2016				
					TIME		13:26:31				
					OPER		SO	ERROR MESSAGE WITH RECALCULATION TH			
					COMM		Recalculate from RunHS-160529-CTD S20_S17-64PE41				
					METH		**CALC HS**		DILUTION		
					UNIT		**µmol/L**		FACTOR		
					Baseline				GLOVEBAG		
Cruise No.	**Station No**	**Cast No.**	**Bottle No.**	**Depth (m)**	**Sample ID**				FOR INFO ONLY		
					64PE410						
64PE410	10	2	1	199.8	CTD St10-2-1		0.0				
64PE410	10	2	3	149.7	CTD St10-2-3		0.0				
64PE410	10	4	4	100	CTD St10-4-4		0.0				
Cruise No.	**Station No**	**Cast No.**	**Slice No.**	**Extraction**							
64PE410	10	Pistoncore	1	Centrifuge	PCCen St10-1 AlX10		0.0		10		
64PE410	10	Pistoncore	2	Centrifuge	PCCen St10-2 AlX10		0.0		10		
64PE410	10	Pistoncore	3	Centrifuge	PCCen St10-3 AlX10		0.0		10		
64PE410	10	Pistoncore	4	Centrifuge	PCCen St10-4 AlX10		0.0		10		
64PE410	10	Pistoncore	5	Centrifuge	PCCen St10-5 AlX10		0.0		10		
64PE410	10	Pistoncore	6	Centrifuge	PCCen St10-6 AlX10		0.0		10		
64PE410	10	Pistoncore	7	Centrifuge	PCCen St10-7 AlX10		0.0		10		
64PE410	9	Pistoncore	1	Centrifuge	PCCen St9-1 AlX10		1699.2		10		
64PE410	9	Pistoncore	2	Centrifuge	PCCen St9-2 AlX10		485.2		10		
64PE410	9	Pistoncore	3	Centrifuge	PCCen St9-3 AlX10		37.1		10		
64PE410	9	Pistoncore	4	Centrifuge	PCCen St9-4 AlX10		29.1		10		
64PE410	9	Pistoncore	5	Centrifuge	PCCen St9-5 AlX10		6.1		10		
64PE410	9	Pistoncore	18	Centrifuge	PCCen St9-18AlX10		2.5		10		
64PE410	9	Pistoncore	19	Centrifuge	PCCen St9-19AlX10		0.0		10		
64PE410	9	Pistoncore	40	Centrifuge	PCCen St9-40AlX10		0.0		10		
64PE410	10	Multicore	0	Centrifuge	MCCen St10-0 AlX10		0.0		10		
64PE410	10	Multicore	1	Centrifuge	MCCen St10-1 AlX10		0.0		10		
64PE410	10	Multicore	2	Centrifuge	MCCen St10-2 AlX10		0.0		10		
64PE410	10	Multicore	3	Centrifuge	MCCen St10-3 AlX10		0.0		10		
64PE410	10	Multicore	4	Centrifuge	MCCen St10-4 AlX10		0.0		10		
64PE410	10	Multicore	5	Centrifuge	MCCen St10-5 AlX10		0.0		10		
64PE410	10	Multicore	6	Centrifuge	MCCen St10-6 AlX10		2.5		10		
64PE410	10	Multicore	7	Centrifuge	MCCen St10-7 AlX10		6.0		10		
64PE410	10	Multicore	8	Centrifuge	MCCen St10-8 AlX10		7.7		10		
64PE410	10	Multicore	9	Centrifuge	MCCen St10-9 AlX10		10.2		10		
64PE410	10	Multicore	10	Centrifuge	MCCen St10-10 AlX10		10.5		10		
64PE410	10	Multicore	11	Centrifuge	MCCen St10-11 AlX10		9.1		10		
64PE410	10	Multicore	12	Centrifuge	MCCen St10-12 AlX10		7.6		10		
64PE410	10	Multicore	13	Centrifuge	MCCen St10-13 AlX10		19.9		10		
64PE410	10	Multicore	14	Centrifuge	MCCen St10-14 AlX10		14.7		10		
64PE410	10	Multicore	15	Centrifuge	MCCen St10-15 AlX10		11.8		10		
64PE410	10	Multicore	16	Centrifuge	MCCen St10-16 AlX10		11.8		10		
64PE410	10	Multicore	17	Centrifuge	MCCen St10-17 AlX10		33.2		10		
64PE410	10	Multicore	18	Centrifuge	MCCen St10-18 AlX10		32.3		10		
64PE410	10	Multicore	19	Centrifuge	MCCen St10-19 AlX10		14.4		10		
64PE410	10	Multicore	20	Centrifuge	MCCen St10-20 AlX10		29.0		10		
64PE410	10	Multicore	21	Centrifuge	MCCen St10-21 AlX10		32.1		10		
64PE410	10	Multicore	23	Centrifuge	MCCen St10-23 AlX10		43.6		10		
64PE410	10	Multicore	24	Centrifuge	MCCen St10-24 AlX10		31.1		10		
64PE410	10	Multicore	25	Centrifuge	MCCen St10-25 AlX10		38.8		10		
64PE410	10	Multicore	26	Centrifuge	MCCen St10-26 AlX10		85.2		10		
64PE410	10	Multicore	27	Centrifuge	MCCen St10-27 AlX10		36.2		10		
64PE410	10	Multicore	28	Centrifuge	MCCen St10-28 AlX10		55.5		10		
64PE410	10	Multicore	29	Centrifuge	MCCen St10-29 AlX10		26.1		10		
64PE410	10	Multicore	30	Centrifuge	MCCen St10-30 AlX10		16.6		10		

Appendix 19: Theoretical vs actual piston core length

Cruise Pelagia NIOZ BALTIC										
		BALT 001	**BALT 002**	**BALT 003**	**BALT 004**	**BALT 005**	**BALT 006**	**BALT 007**	**BALT 008**	**BALT 009**
		cast 7-2	cast 7-3	cast 7-5	cast 7-6	cast 7-8	cast 9-6	cast 9-10	cast 10-6	cast 10-10
Caracteristics	Water depth (m)	49.00	49.00	49.00	51.00	51.00	75.00	75.00	240.00	240.00
	length of main cable (m)	49.00	49.00	49.00	51.00	51.00	75.00	75.00	232.00	232.00
	length of pipe (m)	13.35	13.35	13.35	13.35	13.35	16.21	16.21	18.71	18.71
	Piston cable (m)	17.95	17.95	17.95	17.95	17.95				
	Trigger arm cable (m)	18.66	18.66	18.66	18.66	18.66	21.53	21.53	24.03	24.03
	Free fall height (m) *A*	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
	rebound compensation (m) *B*	0.11	0.11	0.11	0.11	0.11	0.14	0.14	0.40	0.40
	Loop (m) A+B	3.11	3.11	3.11	3.11	3.11	3.14	3.14	3.40	3.40
	Rate of compensation	100%	100%	100%	100%	100%	100%	100%	100%	100%
Masses (kg)	Bomb	0	0	0	0	0	0	0	0	0
	Corer in water without trigger arm (kN	14.48	14.48	14.48	14.48	14.48	14.48	14.48	14.48	14.48
	Corer in air without trigger arm (kg)	1733	1785	1733	1733	1738	1733	1733	1733	1733
	Corer in air (kg)	1870	1870	1870	1870	1870	1870	1870	1870	1870
	All parts of trigger arm in air (kg)	136	136	136	136	136	136	136	136	136
Sensors	Bomb	30014	30014	30014	30014	30014	30014	30014	30014	30014
	Trigger arm	30013	30013	30013	30013	30013	30013	30013	30013	30013
Core	Measured penetration (m)	13.35	13.35	13.35	13.40	13.50	16.20	16.40	18.50	18.30
	Length of core (m)	12.48	12.22	12.66	11.84	12.40	14.40	14.60	16.77	15.93
	pénétration visuelle (m)	./.	./.	./.	./.	./.	./.	./.	./.	./.
	Rate of sediment in the corer	93.4%	91.5%	94.8%	88.3%	91.8%	88.8%	87.8%	90.6%	87.0%
	Quality level									
Cable	Measured rebound (m)									
	Theorical total rebound (m)									
	Duration of rebound (m)									
	Maximum of cable tension (t)									
		Steel	Steel	Steel	Steel	Steel 14mm	Steel	Steel	Steel	Steel
Remarques		Good core	Good core	Good core	Good core	Good core	Good core	Good core	Good core	Good core
		Soft sediment, w eight drops hard in w inch	Soft sediment	Soft sediment	But low er re-covery. Weight drops hard	Weight drops to hard, so very soft material	Soft sediment w eight drops to hard on w inch	same as 7	But looks like first w ater came in liner may have effect on recovery	Also here it looked like first w ater in liner.

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