Cruise report 64PE406

NESSC East Med

Limassol-Istanbul

Pelagia in Limassol, Cyprus.

January 12th-January 28th

Eastern Mediterranean Sea

Chief Scientist: Marcel van der Meer

Contents

1. Introduction

1.1 Aim and background

This cruise is the first of a series of three cruises funded by the Netherlands Earth System Science Centre (NESSC) a Gravitation grand from the Dutch Ministry of Education, Culture and Science. This first cruise covers the Eastern Mediterranean Sea and mainly consists of a series of stations in an east west transect from Cyprus to Sicily. The second cruise will take place in the Black Sea and therefore this cruise will continue to Istanbul via the coast of Calabria where a piston core will be taken for an Italian research group and the Aegean sea where an additional piston core will be taken to study sapropels. The third and last NESSC cruise will take place in the Western Mediterranean from Sicily to Cadiz, basically creating one large transect through the entire Mediterranean Sea from east to west.

The cruise is carried out by scientists from the NIOZ Royal Netherlands Institute for Sea Research and the University of Utrecht.

Specific goals of the project:

The east west transect in the Mediterranean represents both a salinity and temperature gradient and is very well suited for paleo proxy calibration for these parameters. Especially core top calibrations for various organic and inorganic proxies, linking surface water biological signals to sedimentary information, studying the effect of early diagenesis by going deeper into the sediments and eventually paleo reconstructions based on long sedimentary records. In order to do so we have taken water samples from various depths, focusing on the sea surface, top 200 meters, but including much deeper samples at a few stations for nutrient analysis and to study the biology in these water masses by various methods. The idea was to sample different water depths using a multinet, mainly to look at forminifera and using in situ pumps to look at smaller organisms such as micro algae, bacteria and archaea. At the same time we took multi-core samples to allow us to study the core tops, early diagenesis and piston cores for longer paleo records.

1.2 Scientific crew:

Marcel van der Meer, NIOZ	Chief scientist
Geert-Jan Brummer, NIOZ	Multinet, Plankton pump, piston cores, sediment trap.
Anne Roepert, UU	CTD water filtration for nuts, chlorophyll etc. incl. filtration for nanosims.
Esmee Geerken, NIOZ	Water isotopes (LGR), Vindta, Multinet, Piston Core, core slicing.

Gabriella Weiss, NIOZ	Multi-core, core slicing.
Saara Suominen, NIOZ	In situ pumps.
Pieter Dirksen, student UU, NIOZ	Multinet, Plankton pump, piston core.
Jet Greevink, UU	Multi cores for UU, slicing, plankton pump.
Patrick Laan, NIOZ	LGR, Vindta, Nuts.
Roald van der Heide, Pelagia, NIOZ	Multi beam, 3.5 kHz, in situ pumps, sediment trap etc.

2. NESSC Eastern Mediterranean cruise

Transit

13-01-2016: The containers with equipment were delayed by a few days and arrived on Wednesday morning the 13th just after 10 am local time. We left Limassol and started our transit to Station 1 (E1) at 8 pm local time. During transport water sprayed into the Vindta container and the Vindta had to be cleaned, but short circuited any way after start up. The original Vindta was fixed over a period of a few days using parts from a spare machine.

During our transit we had a short test station (Station 0; 34° 24.68364' N, 33° 6.31482' E) where we tested the CTD and Multinet between 10 and 11pm. After which we continued to Station 1.

2.1 Station 1 (E1)

33° 18.14898' N, 33° 23.71998' E

Water depth 1760m

Multinet

14-01-2016: At 6 am we started with the first deep multinet cast (Station 1, cast 1) on our approach of the Station 1 with a speed of 1.5 knots over water. This first multinet cast took a little over 4 hours after which we learned that the safety was not released and although everything seemed to be working fine from behind the computer, the nets had never opened and closed. In the afternoon after the multibeam cast the multinet was deployed again for the shallow cast, unfortunately the multinet was lost during this cast.

CTD

At 12:30 we started a CTD cast (St. 1, cast 2) and we profiled the entire water column to 1800 meters depth and sampled water from 12 depths, 2 bottles per depth (see CTD sample list, appendix 1).

Multibeam

To get an idea of the seafloor a multibeam map (cast 3) was made from approximately 2.5 miles before to 2.5 miles after Station 1.

Side winch

After the multibeam cast the side winch had to be re-wound using the trip bomb from the piston core. This took several hours but ended in the new cable getting stuck underneath itself around 1800 meters depth and therefore unusable for deeper stations.

Piston core

At the end of the afternoon, still during daylight since it takes 4 people to deploy the piston corer, a piston core (cast 4) was taken with a total length of 9.18 meters. This piston core was taken using the Kley France winch due to issues described above and it took some time to get the Kley France winch up and running.

Multi-core

12 cores were retrieved (cast 5), 6 sliceable and 6 archive cores (1 for Francien Peeterse, UU) of approximately 25 centimeters. 4 cores were sliced, 3 for lipid and DNA analysis to 20 centimeter depth, slices of which were stored in the -80 freezer and 1 to 25 centimeter depth the slices of which were stored in Bengal rose in the fridge (4C). This core changed from brown to grey mud around 23 centimeters depth.

Multicores in the hydraulic slicer.

Vindta/LGR

In the meantime the Vindta had been fixed, but the LGR seems very unstable and will remain like this until the transit from Calabria to Greece when the filter between the injection port and the LGR itself was cleaned. Because of this it was decided to also take discrete samples every hour for later isotope analysis by the LGR. The LGR is equipped with a flow through cell connected to the aqua flow pump in the front of the ship that samples surface water and measures temperature and salinity.

In situ pumps

The first shallow in situ pump cast (6) started around midnight and was followed by two more deeper casts (7 and 8) and resulted in filters (0.3 μm) from 9 depths. Since the in situ pumping took place after the sediment work the ship moved a bit North, upstream from the original position to avoid sampling our own sediments.

Transit

15-01-2016: At 3 pm transit from Station 1 to Station 2 started. During transits surface water was sampled from the deck wash which starts at the same place as the aqua flow pump used for the continues sampling of the LGR. This plankton pump flows through a plankton net place in a cube vessel on the aft deck, the outflow of the vessel is with a hose to the side of the Pelagia and samples were taking every 6 hours.

2.2 Station 2 (E2)

33° 44.06286' N, 30° 36.05364' E

Water depth 2750m

Multi-beam

To get an idea of the seafloor a multibeam map (cast 1) was made from approximately 2.5 miles before to 2.5 miles after Station 2 at 7 am.

CTD

Sampling water from the Niskin bottles on the CTD frame.

At 8 am a CTD cast was taken (St. 2, cast 2) and we profiled the entire water column to 2750 meters depth and sampled water from 18 depths, 2 bottles for 100, 75 and 25 meters water depth, one for all other depths (see CTD sample list, appendix 1). 100, 75 and 25 meter depths were also the in situ pump depths. This way we still have a nutrient profile and carbonate chemistry for the entire water column and enough water for the filtrations and analyses of shallow depths.

In situ pumps

Three pumps (0.7 μm filters) were deployed at 100, 75 and 25 meters using the payout of the winch to determine depth. Unfortunately the pump (pump B) at 100 meters did not pump at all, the internal 9 volt battery did not work. This battery has been replaced in all pumps. Later on it became clear that from pump B the connection between 9 volt battery and the rest is not very sturdy resulting in not functioning of the pump, sometimes spontaneous resetting, but usually the comment that there is not enough power in the main battery pack.

Multi-core

Multicore with Pteropods on top.

12 cores were retrieved (cast 4), 6 sliceable and 6 archive cores of approximately 25 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 (4C). The top of the multi cores were covered with pteropods.

Piston core

At 3 pm a piston core (cast 4) was taken with a total length of 9.97 meters.

Transit

Transit from Station 2 to 3 started at 6 pm, during transit plankton pump samples were taken.

2.3 Station 3 (E3)

34° 6.98688' N, 27° 36.35448' E

Water depth 2494m

17-01-2016: Because of the winds increasing during the day it was decided to start with sediment work, especially the piston core before the wind would become too strong. Unfortunately the waves were already such that we had to decide to skip the piston core.

Multi-core (cast 1)

Several multi cores were empty, probably due to the rough weather and the multi corer not hitting the sediment completely horizontally. There were enough cores to get all the work done, with a few archive cores to take with us as well.

CTD

At 12 a CTD cast was taken (St. 3, cast 2) and we profiled the entire water column to 2450 meters depth and sampled water from 18 depths, 2 bottles for 125, 75 and 25 meters water depth, one for all other depths (see CTD sample list, appendix 1). 125, 75 and 25 meter depths were also the in situ pump depths. This way we still have a nutrient profile and carbonate chemistry for the entire water column and for the filtrations and analyses of shallow depths.

In situ pumps

Three pumps (0.7 μm filters) were deployed (cast 3) at 125, 75 and 25 meters using the payout of the winch to determine depth.

Transit

Transit from Station 3 to Station 4 started at 4:30 pm and due to a storm took about twice as long as expected (approximately 40 hours). On arrival at Station 4 on the morning of 19-01-2016 the sea was still so rough that sampling would be limited to a CTD cast and since we lost a lot of time we decided to skip Station 4 and move on to Station 5 (5E). Even some plankton pump sampling times had to be skipped due to the weather.

2.4 Station 5 (E5)

35° 2.9541' N, 20° 38.64438' E

Water depth 2774m

CTD

20-01-2016, 1 am, a CTD cast was taken (St. 5, cast 1) and we profiled the entire water column to 2900 meters depth and sampled water from 15 depths, 2 bottles for 125, 75 and 25 meters water depth, 3 bottles at 2700 meter, one for all other depths (see CTD sample list, appendix 1). 100, 75 and 25 meter depths were also the in situ pump depths. This way we still have a nutrient profile and carbonate chemistry for the entire water column and for the filtrations and analyses of shallow depths. The 3 bottles at 2700 meter were for refilling the sediment trap sample jars at Station 6.

In situ pumps

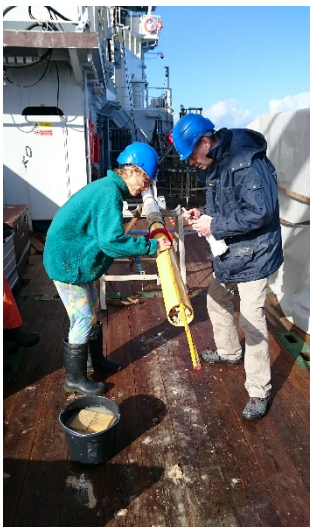
At 4 am a shallow in situ pump (0.7 μm filters) cast was made (cast 2).

Multi core

At 7 am the multi-core was deployed the cores here were relatively short and some cores came up empty. There were enough cores for everyone, but one got spilled in the slicing container which left us one core short, the core for Jet and Caroline, UU, unfortunately. There were enough archive cores.

Piston core

At 9:30 am a piston core (cast 4) was taken with a total length of 10.065 meters.



Cutting the piston core in 1 meter sections.

Transit

Transit to Station 6 started at 12. In order to save time Station 6 (E6) and Station 7 (E7) have been combined.

2.5 Station 6 (E6+E7)

34° 58.1496' N, 18° 6.78468' E

Water depth 3609m

Multibeam

To get a good idea of the seafloor around the sediment trap mooring a multibeam map (cast 1) was made from approximately 2.5 miles before to 2.5 miles after Station 6 with two shorter parallel tracks on both sides. The mooring was placed on a relatively shallow ridge between two deeper areas.

CTD

At 2 am we started a CTD cast (St. 6, cast 1) and we profiled the entire water column to 3600 meters depth and sampled water from 12 depths, 2 bottles per depth (see CTD sample list, appendix 1). These 12 depths were also the in situ pump depths.

Sediment trap

The sediment trap was released at 7:30 and took about 50 minutes to reach the surface. The retrieval of the mooring was went very smooth and while the trap was serviced other deployments continues about a mile North of the sediment trap site to avoid collecting our own sediment waste in the trap. The sediment trap had timed out on several vials of the bottom tray and it took some time to figure out what the problem was. The tray was removed from the trap and taken apart, but no obvious issues were detected. The motor moving the tray was tested and this seemed to have issues with keeping its position. It was decided to bring both the tray and motor back to NIOZ to be serviced and re-deploy the mooring with only one tray with 20 jars sampling each for about 18 days. Next year it might be serviced again and the second tray and motor can be put back on the trap.

Last inspection of the sediment trap before deployment.

The trap was re-deployed on 22-01-2016 at 1 pm.

Piston core

At 10 am the piston core (cast 4) was taken with a total length of 9.68 meters. This was taken just North of the mooring position off the ridge in a deeper flat area.

Multi-core

12 cores were retrieved (cast 5), 6 sliceable and 6 archive cores of approximately 40 centimeters. 4 cores were sliced, 3 for lipid and DNA analysis to 20 centimeter depth, slices of which were stored in the -80 freezer and 1 to 25 centimeter depth the slices of which were stored in Bengal rose in the fridge (4C). This core changed from brown to grey mud and was sampled well into the grey mud.

In situ pumps

There were 4 in situ pump deployments for in 12 depths. Unfortunately in situ pump B had a power issue that could not be solved in time and one depth in the third deployment (1200 meters) was skipped. The pump was checked and worked again for the last deployment, however it was still working when it came on deck (the 2400 meter depth). Apparently the electricity issue had resulted in the pump resetting its operating time from 240 minutes to the default 2501 minutes. The last in situ pump cast (9) ended at 12:15 on 22-01-2016.

Transit

After deploying the sediment trap mooring we left Station 6 at 2:15 pm for the Calabria coast to take a piston core for colleagues from Italy.

2.6 Station 8 OGS (E8)

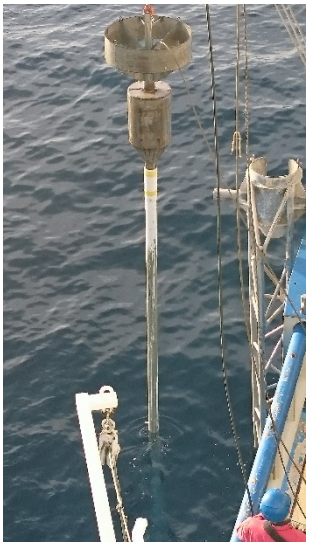
38° 21.92796' N, 16° 40.3638' E

Water depth 210m

Piston core

38° 24.89622' N, 16° 38.74056' E

24-01-2016: Using multibeam and 3.5 kHz system to determine a suitable location for a piston core within area B as assigned by our Italian colleagues we retrieved a piston core of 8.84 meter. This was cut in one meter pieces and stored at 4 degrees.



Bringing the piston core back on deck.

LGR

After cleaning the filter in the sample introduction line to the LGR it seems much more stable.

Transit

Group picture in the Corinth Canal

From the coast of Calabria we transit to the Aegean sea through the Corinth Canal. Early in the morning of Monday 25-01-2016 a pilot took us into the harbor of Corinth. Once at the dock we took the opportunity to “fix” piston core ladder, turn the ladder around relative to the holder of the weight on the dock. We also disposed of our waste. The necessary checks and paper work took some time, so much that we were just too late getting to the entrance of the Canal, a small coaster went in just before us and we had to wait for almost 2 hours for the pilot to get back. The Canal was quite impressive and together we must have taken several hundreds if not thousands of pictures. We arrived at station 9 at 3 am on Tuesday 26-01-2016.

2.7 Station 9, the extra station

38° 24.95838'N, 24° 49.1781' E

Water depth 346 meter

26-01-2016 According to our ships map we were on a relatively shallow ridge approximately 5 miles away from the 500 meter contour line on each side. The sea floor was mapped and showed very little to no topography. After having decided for a site approximately 346 meter deep the CTD was deployed. The schedule at this time (and during the entire cruise) did not allow for extensive mapping of the seafloor.

CTD

Although initially not planned a short CTD cast was requested to an additional Station for some of the water filtration work. It turned into a full CTD water work-up schedule similar to all other stations.

Piston core

At the end of the night, early morning the piston core was deployed and the sequence of events while reaching the sediment was a bit weird. Based on the load on the cable the core reached the sediment just before it triggered and when pulling it up it initially seemed empty, again based on the cable load, but than it did increase suggesting it was in the sediment. There were many people on deck keeping an eye everything detail. Two possible explanations, either the core hit something hard or alternatively it hit the sediment at an angle. The result was a relatively short core that did contain cold water coral remains. Fortunately the piston corer itself was still intact.

Transit

At approximately 6:30 am the Pelagia started steaming for Istanbul again, which will take something like 35 hours.

Pelagia in Istanbul.

3. CTD and water column sampling

Anne Roepert and Saara Suominen

3.1 Materials and Methods

The water column structure at stations 1, 2, 3, 5, 6, and 9, was analyzed and sampled using a conductivity-temperature-depth (CTD) profiler equipped with 24 Niskin bottles. Continuous profiles of key physicochemical parameters of the water column were collected with the sensors on the CTD including a Seabird oxygen electrode: conductivity, temperature, pressure, fluorescence, photosynthetic available radiation (PAR), beam transmission, and dissolved O_2. From the collected data, the following parameters were derived: density (sigma-theta), salinity, potential temperature, depth. The parameters were calibrated using the latest calibration coefficients available, analyzed and binned into 1-meter intervals. Information on the processing of the data (including the used calibrations) is included in the header of each output file.

The collection of water samples with the CTD bottles focused on the mixed layer of the water column, where three key depths were sampled at each station: depth 1 comprised a shallow sample from 25 m depth and depth 3 and 2 were selected according to the position of the thermocline and fluorescence maximum to be at the deep chlorophyll maximum and one intermediate depth.

At the shallow stations (stations 2, 3, 5 and 9), the remaining bottles of the CTD were distributed throughout the water column (18 additional depths, i.e. a total number of 21 depths) and were sampled for nutrients, discrete LGR samples, etc (see Appendix 1 for OCS nutrient sampling). At station 5, deep water (3 CTD bottles at 2738 m depth) was collected for the sediment trap filling at station 6, resulting in a total number of 19 depths sampled at that station. At the deep stations (station 1 and 6), 9 additional depths (i.e. a total number of 12 depths) were sampled for the whole suite of analyses. The sampling scheme of the CTD bottles at all stations is summarized in Table 1.

Table 1 Sampling scheme of the CTD.

Station	Cast	Date	Water depth [m]	Sampling depth [m]		
				samples A - L	samples M	samples N - P
1	2	14-01-2016	1760	25, 49, 74, 100, 150, 200, 302, 504, 807, 1112, 1315, 1720	25, 49, 100	25, 49, 74, 100, 150, 200, 302, 504, 807, 1112, 1315, 1720 (12 depths in total)
2	2	16-01-2016	2750	25, 75, 99	25, 75, 99	25, 49, 75, 99, 150, 201, 252, 302, 403, 504, 605, 706, 806, 1010, 1261, 1515, 1769, 2024, 2278, 2533, 2738 (21 depths in total)
3	2	17-01-2016	2494	25, 75, 125	25, 75, 125	25, 48, 75, 125, 151, 201, 253, 302, 401, 505, 606, 708, 807, 909, 1011, 1263, 1517, 1771, 2024, 2279, 2482 (21 depths in total)
5	1	19/20-01-2016	2774	25, 75, 101	25, 75, 101	25, 51, 75, 101, 151, 201, 252, 301, 402, 505, 757, 1009, 1262, 1516, 2025, 2280, 2534, 2738 (3 bottles), 2781 (19 depths in total)
6	2	21-01-2016	3609	25, 75, 90, 151, 251, 505, 808, 1211, 1820, 2431, 3044, 3606	25, 75, 90	25, 75, 90, 151, 251, 505, 808, 1211, 1820, 2431, 3044, 3606
9	2	26-01-2016	346	3.5, 75, 160	3.5, 75, 160	3.5, 25, 50, 75, 100, 160, 200, 250, 300, 334

3.2 Sampling

The water collected in the CTD bottles at various depths was split up for a suite of analyses, of which only the VINDTA measurements (alkalinity and DIC) were conducted immediately onboard, while all other samples were taken and preserved/stored for later analyses. Table 2 gives an overview of the different sample types taken.

All sample bottles were prewashed for at least 8 hours with 1 M HCl, rinsed three times first with tap water and three times with MQ water. Altogether a 4 ml glass vial (sample A: DIC) and a 12 ml exeteiner (sample B: 13C-DIC), one 250

ml polyethylene bottle, and three two-liter plastic bottles were filled straight from the CTD bottles after rinsing tubing and sample vials three times with sample water. For nanoSIMS filtrations, a 10 L jerry can was filled at depth 1, 2 and 3 from the remaining water in the CTD bottle after rinsing the jerry can three times with sample water.

Table 2 Overview of the types of samples taken from the CTD bottles.

#	Sample	Short description of type of sample	Analysis	Storage
A	DIC	preserved by addition of $HgCl_2$	post-cruise	+ 4 °C
B	13C-DIC	preserved by addition of $HgCl_2$	post-cruise	+ 4 °C
C	Flow Cytometry bacteria/viruses	preserved by addition of 25% glutaraldehyde	post-cruise	- 80 °C
D	Flow Cytometry phytoplankton	preserved by addition of formaline:hexamine	post-cruise	- 80 °C
E	FISH	preserved by addition of formaldehyde, filtered over 0.2 µm polycarbonate filters (25 mm)	post-cruise	- 20 °C
F	δD water	filtered through 0.2 um, filtrate stored	post-cruise	+ 4 °C
G	dissolved N/P	filtered through 0.2 um, filtrate stored	post-cruise	- 20 °C
H	dissolved Si	filtered through 0.2 um, filtrate stored	post-cruise	+ 4 °C
I	DOC	preserved by addition of HCl	post-cruise	+ 4 °C
J	Chlorophyll a	filtered over combusted GFF filters	post-cruise	- 20 °C
K	PON/POP	filtered over pre-weighed combusted GFF filters	post-cruise	- 20 °C
L	POC	filtered over pre-weighed combusted GFF filters	post-cruise	- 20 °C
M	nanoSIMS	filtered over 5 µm and 0.4 µm polycarbonate filters	post-cruise	- 20 °C
N	nutrients	OCS/ Appendix 1	post-cruise	+ 4 /- 20 °C
O	δD and $\delta^{18}O$ water	LGR samples/OCS	post-cruise	+ 4 °C
P	DIC	VINDTA samples	onboard	N.A.

3.3 Detailed description of sample preservation for each type of sample

A. For DIC, 4 ml glass vials were filled straight from CTD bottles and 25 µl of previously prepared saturated Hg Cl_2 solution was immediately added after sampling, and which samples were stored in the fridge.
B. For 13C-DIC samples 12 ml exeteiners were filled completely straight from CTD bottles. 60 µl of previously prepared saturated Hg Cl_2 solution was immediately added after sampling, and samples were stored in the fridge.

C. For preserving bacterial cells and viruses for flow cytometry 1 ml of water was taken from the 250 ml bottles to 2 ml cryo-vials. 20 µl of 25 % EM-grade glutaraldehyde was added and samples were kept in fridge for up to 1 hour, after which they were stored in -80 C. It was not possible to flash freeze the samples because there was no liquid nitrogen on board the vessel.
D. Preservation of phytoplankton for flow cytometry was done by adding 100 µl of formaline:hexamine (18:10 % v:w) to 3.5 ml of sample in 5 ml cryo-vials. Samples were kept in fridge for up to 1 hour, after which they were stored in -80 C. It was not possible to flash freeze the samples because there was no liquid nitrogen on board the vessel.
E. For fluorescence in-situ hybridization (FISH) 30 ml samples were taken in 50 ml falcon tubes from the 250 ml bottles. 4 ml of 36% formaldehyde was added, samples were mixed and kept in the fridge for up to 18 hours. The samples were then filtered on to 25 mm 0.2 m polycarbonate filters mounted onto 25 mm 0.45 µm nitrocellulose support filters. Filters were washed with 10 ml PBS and stored on microscope slides in the freezer.
F. Samples for hydrogen isotopes were filtered through 0.2 µm acrodisc filters into 12 ml exeteiners, after rinsing the syringe, filter and tubes once with sample water. Exeteiners were filled completely to achieve a bubble of water on top.
G. Samples for NOx, NH4 and PO4 were filtered through 0.2 µm acrodisc filters into 5 ml pony vials, after rinsing the syringe, filter and tubes once with sample water. Pony vials were filled so that there was enough space left for expansion caused by freezing. Samples were stored in the freezer.
H. Samples for dissolved silicate were filtered through 0.2 µm acrodisc filters into 5 ml pony vials, after rinsing the syringe, filter and tubes once with sample water. Samples were stored in the fridge.
I. About 20 ml of sample was taken by syringe for DOC analysis. Syringe and glass vials were rinsed with sample before filling. 12 drops of 37 % HCl was added and samples were stored in fridge. Samples were numbered consecutively and a list with the corresponding samples can be found in Appendix 2.
J. Approximately two liters of sample water was filtered through combusted 25 mm GF/F filters to analyze chlorophyll content of water. Filters were stored in pony vials in the freezer. A list of the exact amount of filtered water on each filter can be found in Appendix 3.
K. Approximately two liters of sample were filtered through preweighted 47 mm 0.7 µm GFF filters for analyzing particulate organic nitrogen and phosphorus (PON/POP). Filters were returned to holders and stored in the freezer. A list of exact amounts of filtered water for each filter can be found in Appendix 4.
L. Approximately two liters of sample were filtered through preweighted 47 mm 0.7 µm GFF filters for analyzing particulate organic carbon (POC).

Filters were returned to holders and stored in the freezer. A list of exact amounts of filtered water for each filter can be found in Appendix 5.

M. For nanoSIMS analyses, diatoms and coccoliths were targeted to be sampled. For each depth, three different volumes ranging between approximately 500 ml to 2000 ml were filtered through 25 mm 5 µm polycarbonate filter to target diatoms. The filtrate was collected and three volumes ranging between 10 ml and 2000 ml were filtered through 25 mm 0.4 µm polycarbonate filters mounted onto a 25 mm GFF support filter to target coccoliths. For each depth, the remaining water in the jerry can (between 4 – 7 liters) was filtered over one 47 mm 0.4 µm polycarbonate filter mounted onto a 47 mm GFF support filter as a backup.
N. Samples Appendix 1, OCS
O. Patrick Laan

3.4 Results

Since most samples were taken for post-cruise analysis, only the data from the CTD profiler are shown in this section. Figure 1 – Figure 6 show the CTD depth profiles and Figure 7 and Figure 8 show the T-S diagrams of stations 1, 2, 3, 5, 6, and 9, respectively. Section plots along the transect of cruise 64PE406 including the data of the subsequent cruise, 64PE407 in the Western Mediterranean Sea, are displayed in Figure 9 to Figure 12. These section plots have been created with Ocean Data View 4[1] using DIVA gridding of the downcast data of the CTD profiles.

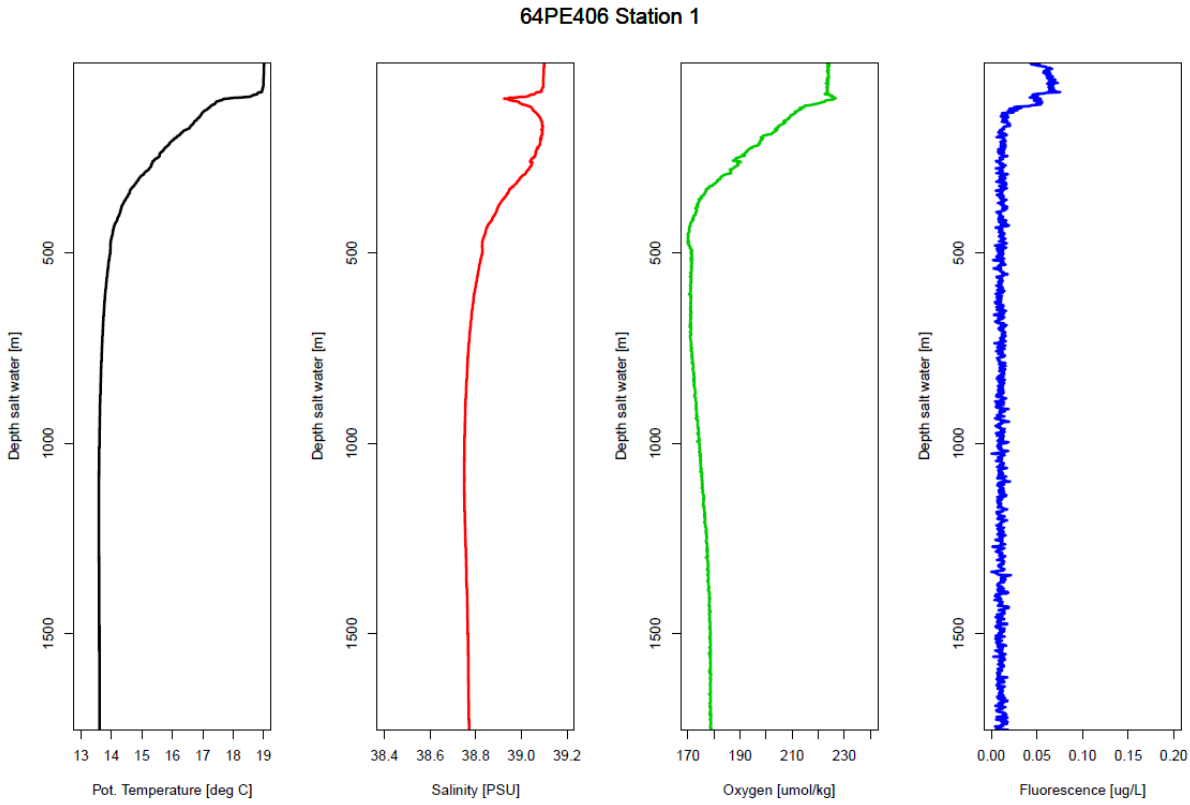


Figure 1 CTD depth profiles of temperature, salinity, oxygen concentration and fluorescence at station 1.

[1] Schlitzer, R. (2014) Ocean Data View. http://odv.awi.de

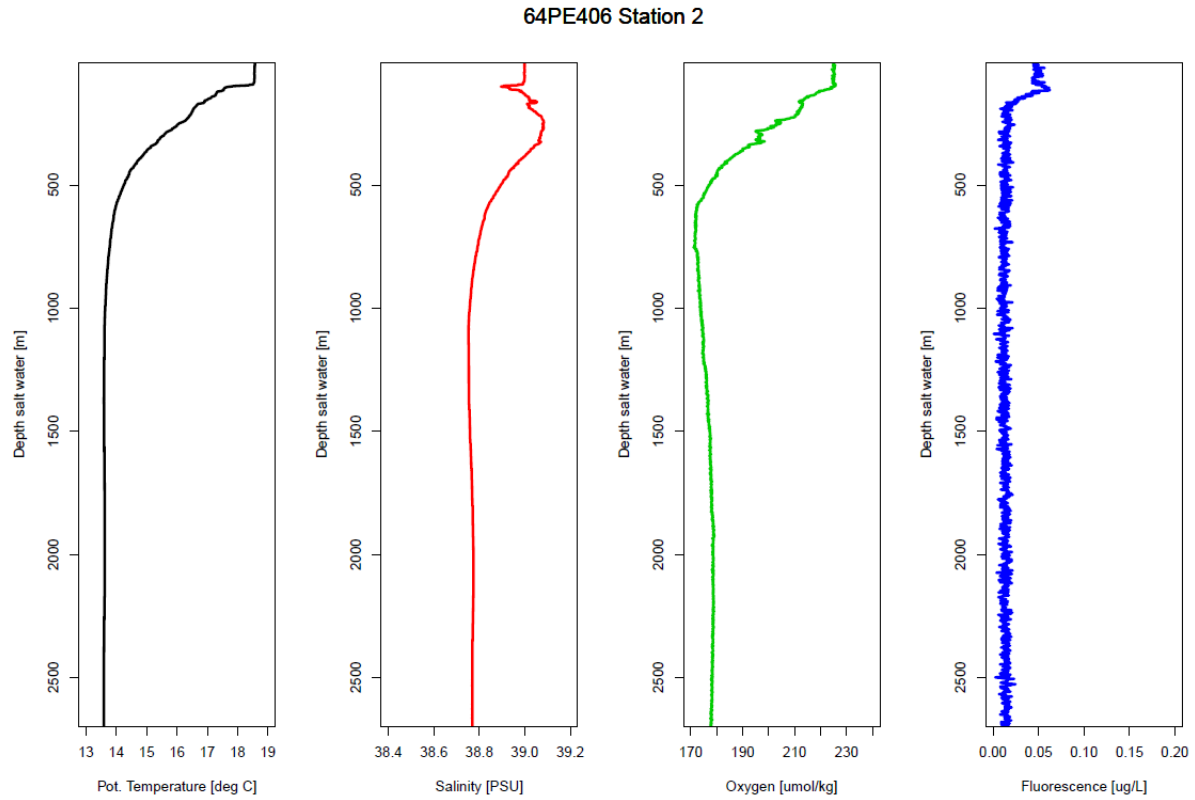


Figure 2 CTD depth profiles of temperature, salinity, oxygen concentration and fluorescence at station 2.

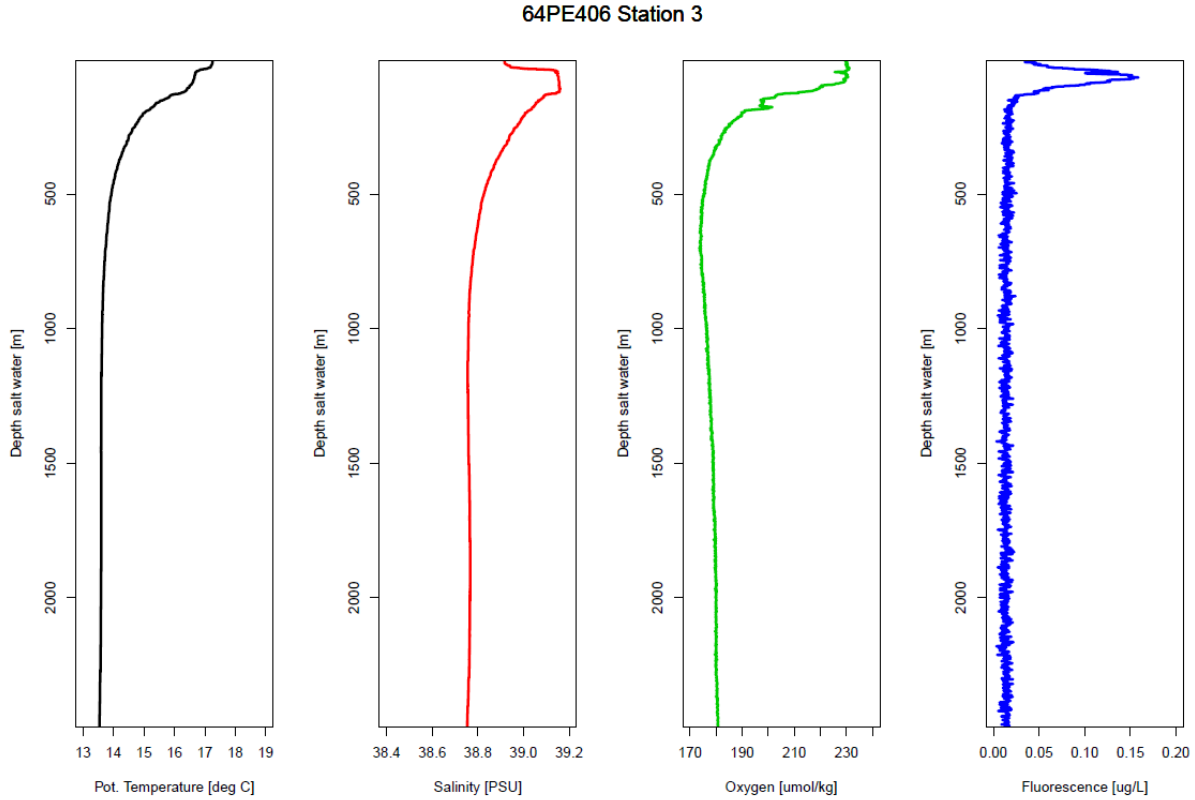


Figure 3 CTD depth profiles of temperature, salinity, oxygen concentration and fluorescence at station 3.

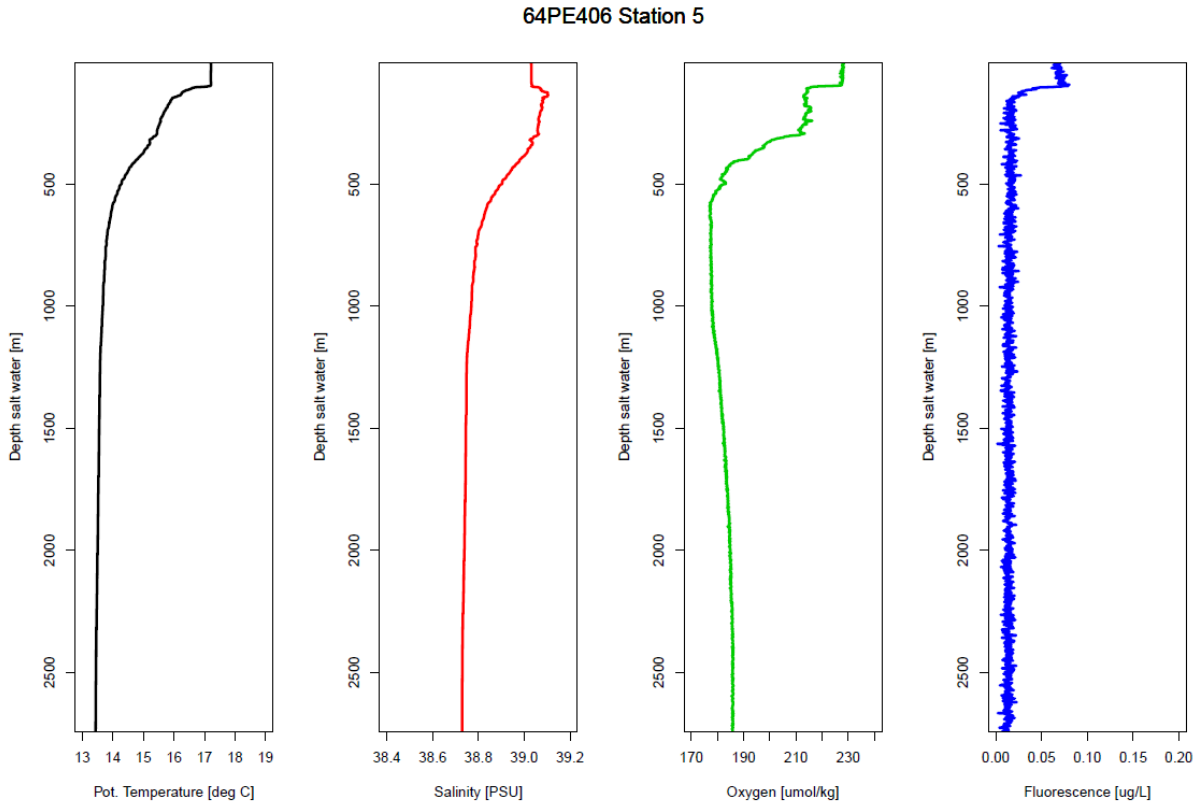


Figure 4 CTD depth profiles of temperature, salinity, oxygen concentration and fluorescence at station 5.

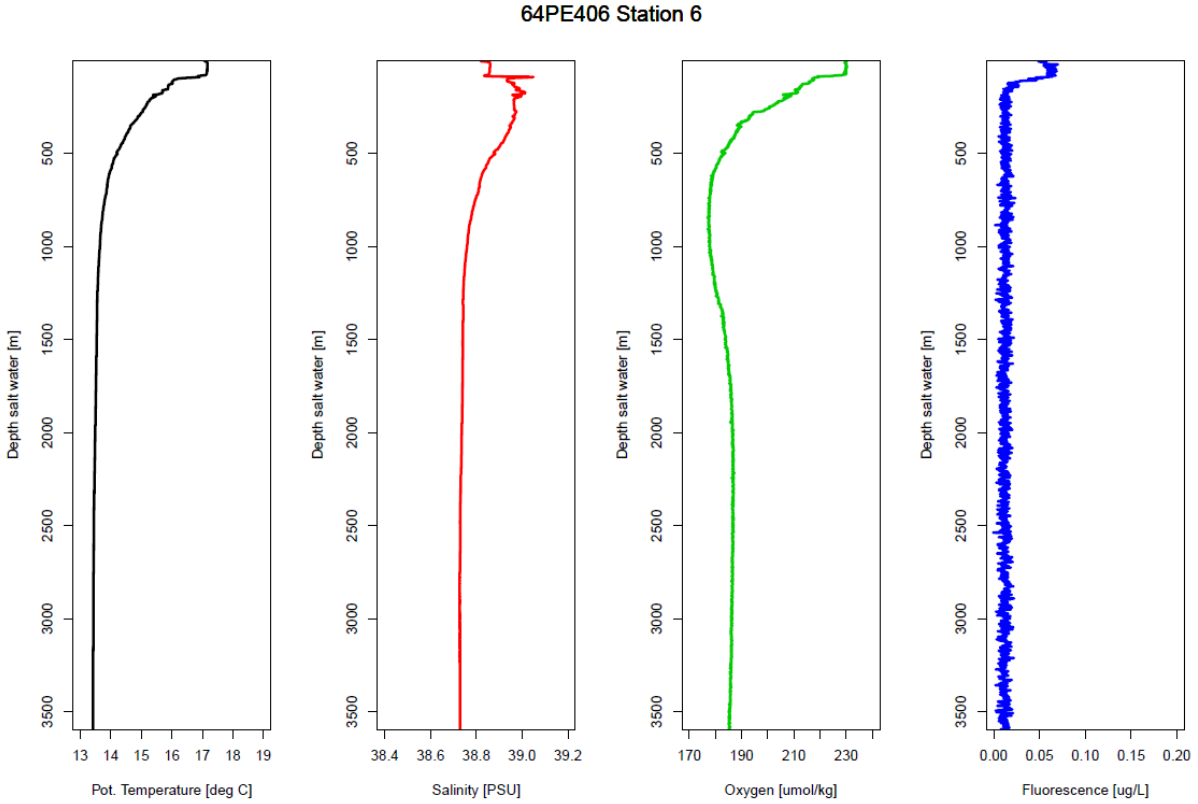


Figure 5 CTD depth profiles of temperature, salinity, oxygen concentration and fluorescence at station 6.

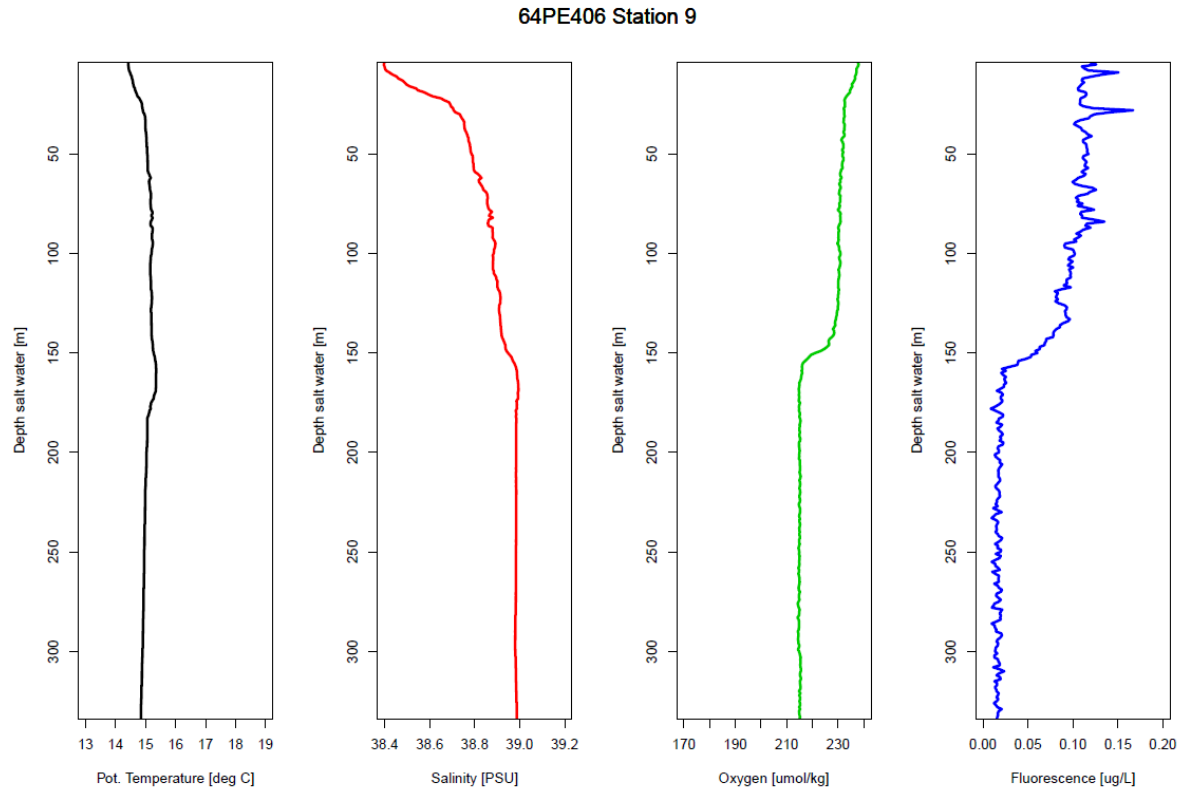


Figure 6 CTD depth profiles of temperature, salinity, oxygen concentration and fluorescence at station 9.

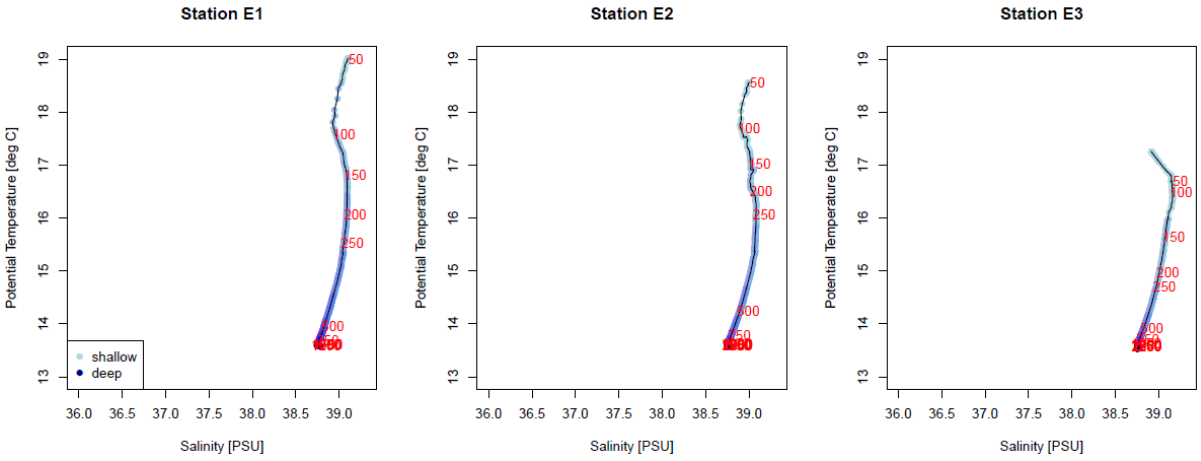


Figure 7 T-S diagrams of stations 1, 2 and 3. Red numbers indicate depth in meter.

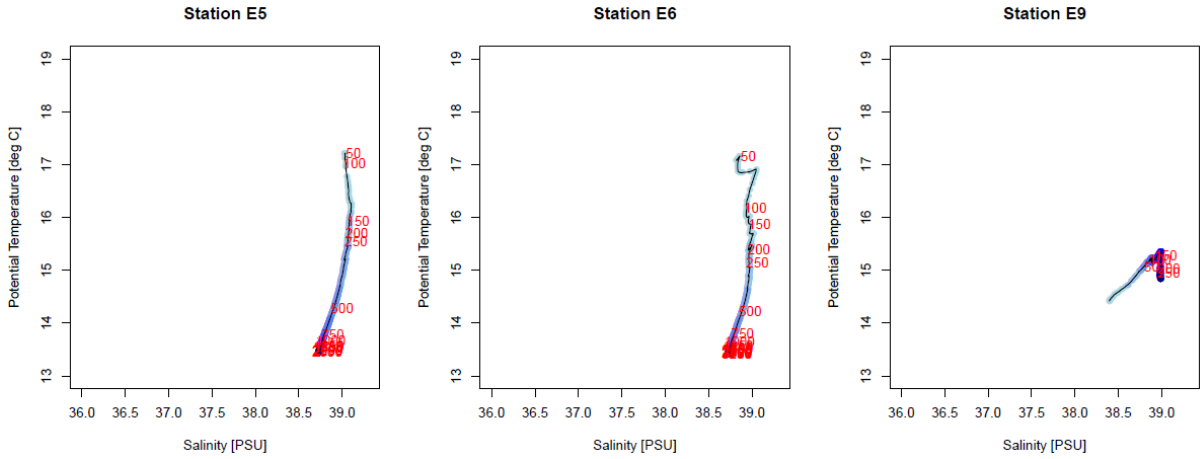


Figure 8 T-S diagrams of stations 5, 6 and 9. Red numbers indicate depth in meter.

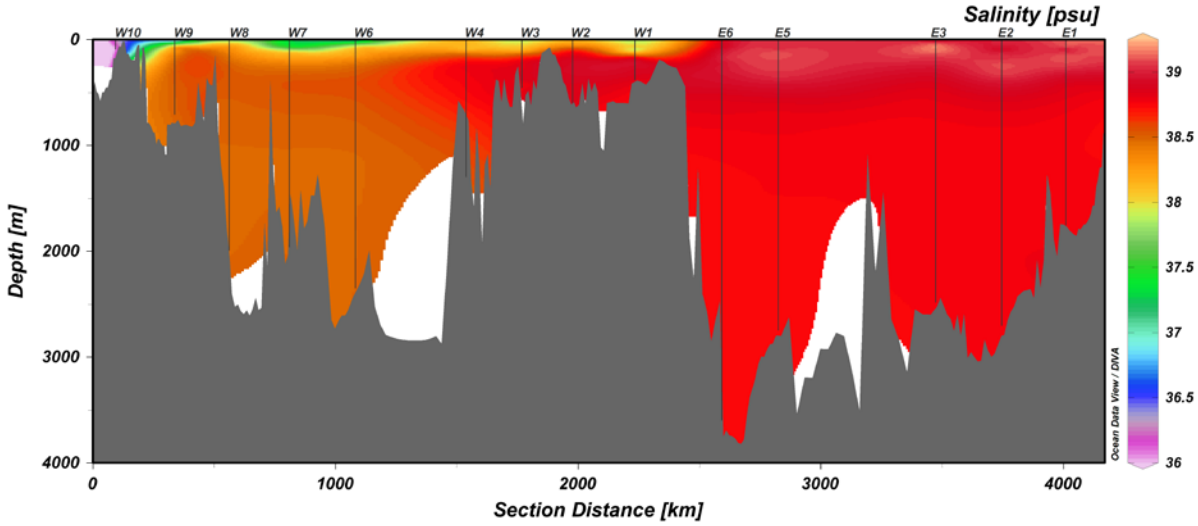


Figure 9 Salinity section plot along the combined transect of cruises 64PE406 and 64PE407.

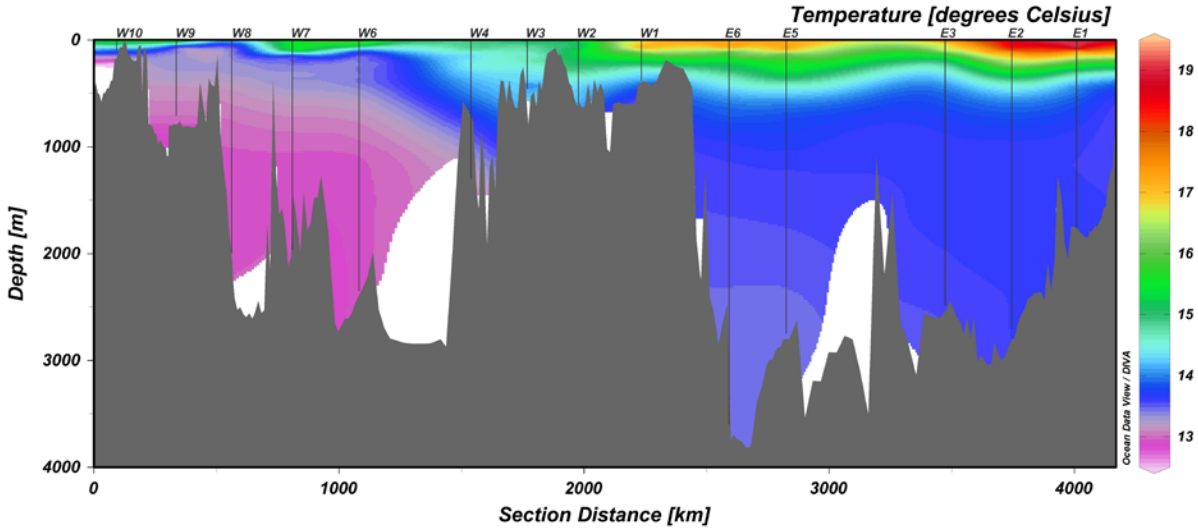


Figure 10 Temperature section plot along the combined transect of cruises 64PE406 and 64PE407.

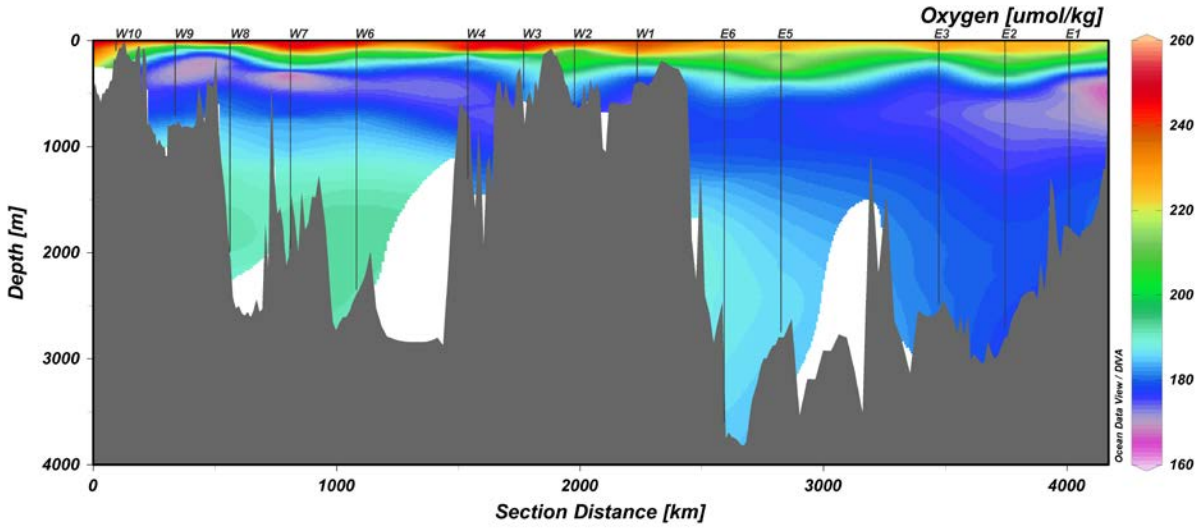


Figure 11 Oxygen concentration section plot along the combined transect of cruises 64PE406 and 64PE407.

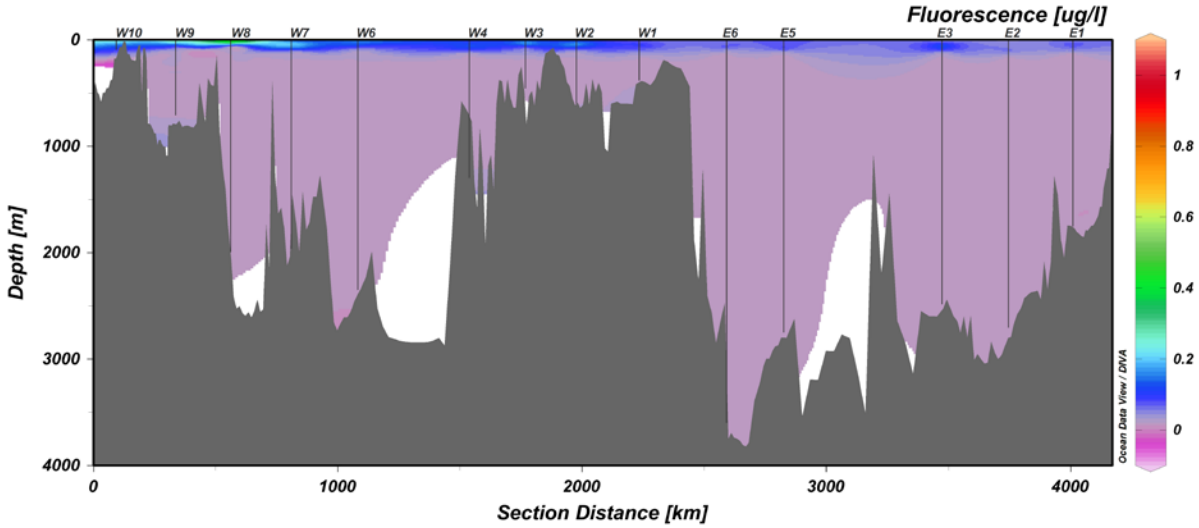


Figure 12 Fluorescence section plot along the combined transect of cruises 64PE406 and 64PE407.

4. Dissolved Inorganic Carbon, Total Alkalinity, dissolved Oxygen and Nutrients

Patrick Laan

4.1 Methodology

Sampling and analysis for carbonate system parameters broadly followed the standard
operating procedures outlined by Dickson et al., 2007. Water samples of 0.5 L were collected from the CTD of every station, at all depths, into borosilicate sample bottles with plastic caps, using tygon tubing. In each profile, a minimum of one duplicate sample was collected at a deep parts of the profile. Sample analysis commenced immediately after collection and analysis of profiles was in all cases completed within 24 hours after sampling. All analyses were performed on a VINDTA 3C (Versatile INstrument for the Determination of Total Alkalinity (A_T), designed and built by Dr. L. Mintrop, Marine Analytics and Data, Kiel, Germany (NIOZ VINDTA #14). This instrument was slightly modified: the peristaltic sample pump was replaced with an overpressure system (~0.5 bar overpressure) and a 1 m long (though coiled) 1/8" stainless steel counter-flow heat exchanger that was placed between the sampling line and the circulation circuit. Also an automated shower rinse step for the A_T was introduced using deionized water. This setup allows for the rapid, convenient and bubble-free loading of the pipettes with sample of 25 ºC (±0.1 ºC), irrespective of the samples' initial temperature. Certified reference material (CRM, Batch #144) obtained from Dr. Andrew Dickson at Scripps Institute of Oceanography (San Diego, California) was used for calibration purposes and quality control for both C_T and A_T.

4.2 Dissolved inorganic carbon (C_T)

Dissolved inorganic carbon (C_T) was determined by coulometric titration. An automated extraction line takes a 20 mL subsample which is subsequently purged of CO_2 in a stripping chamber containing ~1 mL of ~8.5% phosphoric acid (H_3PO_4). A stream of nitrogen carries the CO_2 gas into a coulometric titration cell via a condenser and acid trap, to strip the gas flow of any water. The CO_2 reacts with the cathode solution in the cell to form hydroxyethylcarbamic acid, which is then titrated with hydroxide ions (OH^-) generated by the coulometer. The current of the coulometer is then integrated over the duration of the titration to obtain the total amount of carbon titrated. An ORBO scrubber was installed upstream of the coulometric cell to remove acidic gases. Precision is preliminarily estimated to be ~2.0 µmol/kg.

4.3 Total Alkalinity (A_T)

Determinations of total alkalinity (A_T) were performed by acid titration that

combines
aspects from both the commonly used ‘closed cell' method and the ‘open cell’ method, following the VINDTAs standard settings. A single 2 L batch of acid of 0.1M and salinity 35 was prepared to be used by both VINDTAs. This acid was stirred for 2 minutes prior to the beginning of each run of analyses to ensure it was thoroughly homogenized. Potential drift in acid strength due to HCl-gas loss to acid vessel headspace is not accounted for. Precision is preliminarily estimated to be ~1.5 µmol/kg.

4.4 Results

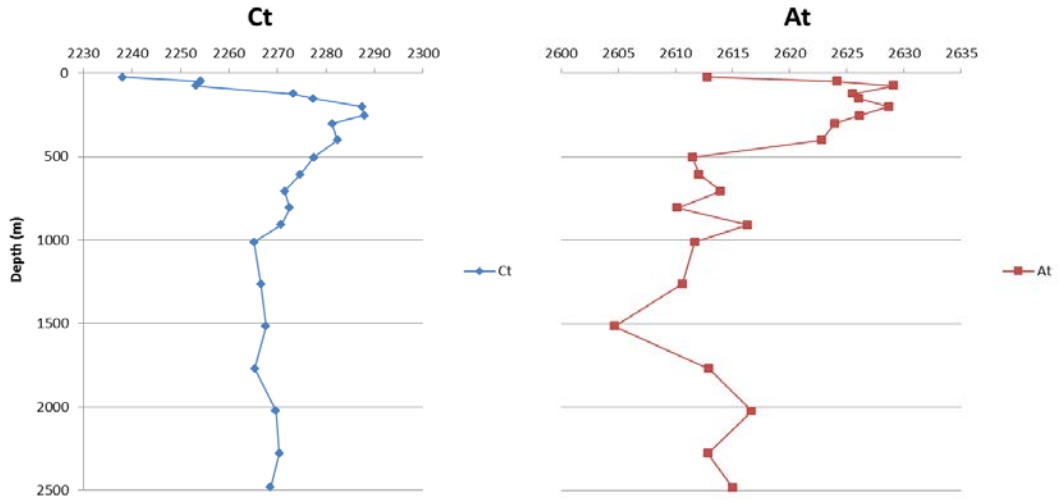


Figure 1: Depth profiles of Ct and At of station S3C2, unprocessed data.

4.5 Dissolved oxygen

Dissolved oxygen was sampled from three depths from 4 of the CTD stations to ascertain the calibration of the oxygen sensor fixed to the CTD frame itself. The samples will be analyzed in the home laboratory using a refined protocol of the spectrophotometric Winkler approach.

4.6 Dissolved nutrients

Samples for nutrients were collected from the same depths as C_T and A_T. The samples were collected in 60ml high-density polyethylene syringes with a three way valve to make it possible to sample air and contamination free water from the Niskin bottles of the Rosette. The syringes with a three way valve were first rinsed three times with a small amount of the sample taken directly from CTD-rosette bottles before being completely filled. After sampling on deck, the samples were processed immediately in the lab; samples were filtered over 0.2µm Two vials made out of high density polyethylene, also known as ‘pony-

vials', were used for storing NH4 and NO3 plus NO2 and PO4 as one sample and the other for storing the Si sample.

The samples will be analyzed after the cruise.

References

Dickson, A.G., Sabine, C.L. and Christian, J.R. (Eds.) 2007. Guide to best practices for ocean CO_2 measurements. PICES Special Publication 3, 191 pp.

5. 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. At stations 2, 3, and 4 the three pumps were deployed in one cast to the three upper sampling depths. At station 1, pumps were deployed at nine depths in three separate casts, and in station 6 pumps were deployed at 12 depths in four different casts. The weather was calm except for stations 3 and 4 that had considerable waves. However the stabilizer on the cable was assumed to cancel a part of the vertical movement of the pumps. An example of the program used for each pump is shown in table 1. The three shallow depths were filtered on pre-ashed 142 mm 0,7 um glass fiber filters. At station 1 and 7 all depths were filtered on pre-ashed 142 mm 0,3 um glass fiber filters. All deployments except two ended with the time limit being reached, with about 300 liters sampled in one hour, and about 1200 liters sampled in four hours. At station 4 depth 75 m and at station 6 depth 75 m the minimum flow rate was reached with pump AA, resulting in the filtration of 249 and 248 liters according to the flow meter. Filters were collected immediately after pumps were brought up, photographed if possible, folded once, wrapped in two layers of aluminum 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.

Table 3. An example of programmed parameters for pump deployment. All pumps were programmed similarly except for time limit (60 minutes in shallow depths) and scheduled start.

Cruise	64PE406	
	Station 6 cast 7	
Sample volume	10000	[liters]
Initial flow rate	6000	[ml/min]
Minimum flow rate	4000	[ml/min]
Time limit	240	[minutes]
Pump data period	1	[minutes]
Scheduled start	01/21/2016	16:55:00

Throughout the cruise there were electronical problems with the pump B, resulting in the loss of samples from station 2 depth 100 m, station 6 depth 1200 m and possible contamination at station 6 depth 2380 m, because the pump kept pumping on the way up. This was caused by its rebooting the pumping time during programming and can possibly be avoided in the future. After station 2 the 9 V backup battery was changed in all pumps and after station 6 it was noticed that there was an issue with one connection in the

electric board. At station 6 cast 6 depth 90 m the data file was lost and the flow rate not recorded and therefore the flow through was estimated by dividing the flow rate of two deployments with the amount of hours pumped. This may cause a small deviance from the actual, but is considered insignificant in proportion to the total amount of litres filtered. At the deepest cast in station 6, pumping was done 20 meters higher (2380, 2980, 3530) than CTD sampling (2400, 3000, 3550), because otherwise the CTD which was used as a weight for the cable would have been at risk of hitting the sea floor.

After the cruise all pumps were rinsed outside with fresh water and pumps A and 3 also inside by reverse pumping a bucket of fresh water. Continuing problems with pump B stopped it from being rinsed on the inside at the time. Filters will be used for molecular and organic geochemical analysis at the NIOZ. Table two shows the conditions of each deployment and photographs of filters are in fig 1-5.

Table 4. 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	Pumping time	Computer (L)	Read before (L)	Read after (L)	calculated liters
14/01/2016	Station 1, cast 7	Pump 3	25	20.45 - 21.45	1 hour	291.82	50001	50310	309.0
0.3 µm		Pump BB	75			291.82	69563	69912	349.0
		Pump AA	100			291.81	46040	46399	359.0
15/01/2016	Station 1, cast 8	Pump 3	150	01.45 - 05.45	4 hours	1167.24	50310	51606.0	1296.0
0.3 µm		Pump AA	300			1112.82	46399	47606	1207.0
		Pump BB	500			1167.25	69912.0	71219	1307.0
ALL BATTERIES CHANGED									
15/01/2016	Station 1, cast 9	Pump 3	800	07.20 - 11.20	4 hours	1167.26	51606	52919	1313.0
0.3 µm		Pump AA	1300			1165.80	47606.0	48898	1292.0
		Pump BB	1700			1167.25	71219	72526	1307.0
ALL BATTERIES CHANGED									
16/01/2016	Station 2 cast 3	Pump 3	25	9.30 - 10.30	1 hour	283.85	52919	53207	288.0
0.7 µm		Pump AA	75			280.22	48898	49195	297.0
		Pump BB	100						
BACKUP BATTERY CHANGED FOR ALL PUMPS									
17/01/2016	Station 3 cast 3	Pump BB	25	13.15-14.15	1 hour	291.78	72528	72804	276.0
0.7 µm		Pump AA	75			286.74	49195	49490	295.0
		Pump 3	100			291.81	53207	53535	328.0
20/01/2016	Station 4 Cast 5.2	Pump BB	25	03.15-04.15	1 hour	291.8	72804	73109	305.0
0.7 µm		Pump AA	75			223.31	49490	49739	249.0
		Pump 3	100			290.98	53535	53845	310.0
21/01/2016	Station 6 Cast 6	Pump BB	25	16.00-17.00	1 hour	291.78	73109	73402	293.0
0.3 µm		Pump AA	75			241.77	49739	49987	248.0
		Pump 3	90			291.78	53845.0		323.4
ALL BATTERIES CHANGED									
21/01/2016	Station 6 Cast 7	Pump BB	150	16.55-20.55	4 hours	1167.24	73402	74673	1271.0
0.3 µm		Pump AA	250			1155.87	49987.0	51242	1255.0
		Pump 3	500			1167.26		55462	1293.0
ALL BATTERIES CHANGED									
22/01/2016	Station 6 Cast 8	Pump 3	800	23.10-03.10	4 hours	1167.24	55462	56773	1311.0
0.3 µm		Pump AA	1800			1167.23	51242.0	52531	1289.0
		Pump BB	-						
ALL BATTERIES CHANGED									
22/01/2016	Station 6 Cast 9	Pump BB	2380	05.30-10.17	4 hours	1395.98	74673	76218	1545.0
0.3 µm		Pump AA	2980	05.30-09.30		1167.23	52531	53799	1268.0
		Pump 3	3530	05.30-09.30		1167.23	56773	58059	1286.0

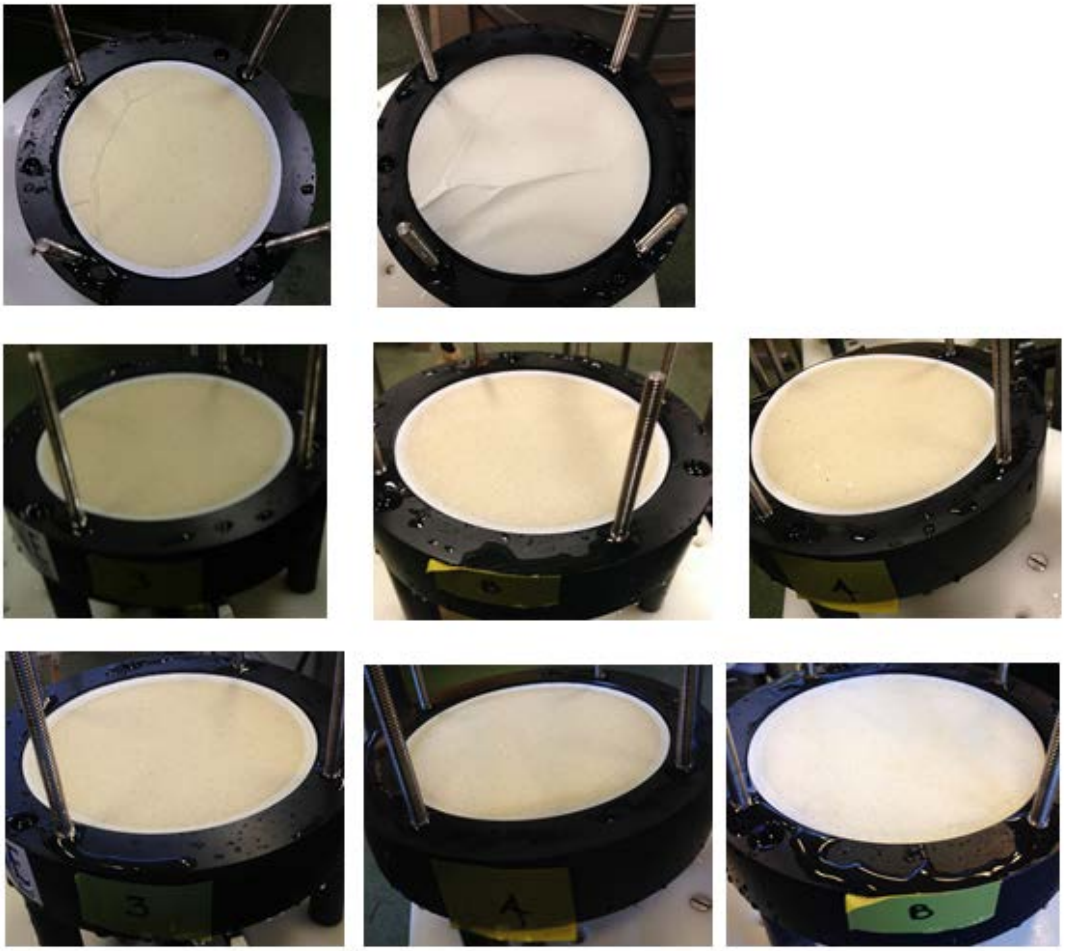


Figure 13. Pictures of filters from station one reading from left to right: 25 m, 75 m, 150 m, 300 m, 500 m, 800 m, 1300 m, 1700 m.

Figure 14, Pictures of filters from station 2, depths 25 m and 75 m

Figure 15, Pictures of filters from station 3, depths 25 m , 75 m and 100 m

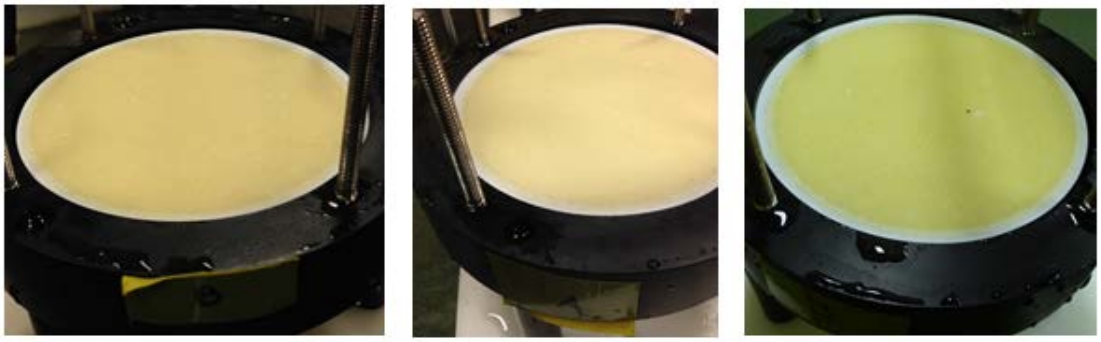


Figure 16, Pictures of filters from station 4, depths 25 m, 75 m and 100 m

Figure 17, Pictures of filters from station 6, depths 250 m and 500 m

6. MULTICORES

Gabriella Weiss

The multicorer was deployed successfully at every station, with the exception of station 5; three cores came up empty and a fourth was lost during removal from the corer. Due to weather, the multicorer was not redeployed. For all stations, bottom water was removed from four cores prior to slicing at 1cm resolution. Three cores were sliced and stored in geochemical bags at -80C, and one core was sliced, preserved in pots of Bengal rose and stored at 4C. Two unsliced cores were stored for UU, one at 4C and one at -20C, without draining the bottom water. The remaining cores were stored as unsliced archive cores, with bottom water removed, at 4C.

At station 1, cores were ~30cm in length. Three cores sliced and stored at -80C were sliced until 20cm. The core sliced for preservation in Bengal rose was sliced until ~30cm. Bottom water was drained from the remaining six cores which were stored as archive cores at 4C.

At station 2, cores were ~30cm. The top two thirds of the core was light brown clay and switched to a darker sapropel layer for the remainder of the core. Many pteropods were present throughout, being especially abundant on the very top layer. Two cores were stored for UU and five were stored at archive cores.

At station 3, cores were slightly less than 20cm in length. Pteropods were especially abundant throughout all of the cores. The last cm of the fourth core (preserved in Bengal rose) was the top of a sapropel layer.

Station 4 was skipped due to bad weather.

Cores from station 5 were slightly less than 20cm in length and three cores came up empty, likely a result of strong waves. A fourth core was lost during removal from the multicorer. For this reason, only three archive cores were stored from this station and one core was frozen for UU. The sediment was very thick clay, making it difficult to separate at 1cm resolution, especially after the first 5cm. The top was light brown clay, switching to darker brown about one-third of the way down, and the bottom few cm consisted of grey clay.

At station 6, cores were ~40cm in length. The sediment was very light brown clay for the top ~10cm, then switched to dark brown clay that was less dense and sticky. The top few cm were very fluffy and watery. Thin, dark, sapropel-like layers measuring much less than 1cm were dispersed throughout the cores. Two cores were stored for UU and six were stored as archive cores.

7. Freeze cores

Jet Greevink

Storage of cores at -20°C cruise 64PE406

At stations 2, 3, 5 and 6, one Multicore was put in a freezer at -20°C. The core was capped at the top and bottom, any remaining water was not removed before freezing. The core was stored vertically inside a crate within the freezer. The cores were frozen for at least 24 hours. Subsequently, hot water was poured on the outside of the core in order to remove the frozen sediments from the PVC tube. The core was then rinsed with water and photographed. The core was then placed in a plastic bag, flushed with nitrogen gas, and then taped shut. Finally this plastic bag was placed in an aluminum bag and was again flushed with nitrogen gas. Finally, the core was stored in a freezer at -20°C.

8. Piston coring

Esmee Geerken

Piston cores were planned for each station of cruise 64PE406. The cores will be used to apply novel salinity proxies -which will be further calibrated using water column and core top samples collected during this cruise- down core and validate their use as a paleo-reconstruction tool. It is expected to encounter sapropel layers in the Eastern Mediterranean basin, formed during periods of less saline surface water and anoxic bottom water, providing a salinity gradient against which proxies can be tested.

8.1 Sample strategy

A Piston corer with a 12 meter yellow liner (thickness 6 mm, diameter 110 mm) was deployed at each station after a multibeam survey to select the best coring location. The liner was cut in sections of 1 meter, starting from the core bottom. Sections were stored in the Reefer at 4°C. Core lengths and comments can be found in the table below.

Station	Core length (m)	Comments
E1	9.18	
E2	9.97	
E3	x	Piston core skipped due to storm
E4	x	Station skipped due to storm
E5	10.65	
E6	9.68	
E7	x	Merged with station 6
E8	8.84	
E9	1.78	Cold water coral, black particles in sediment, liner imploded at the top (above sediments)

9. Plankton pump

Pieter Dirksen

The procedure involved sampling a continuous flow of water through a hose, which was filtered through a net of 100 micro meters. All matter larger than this size was caught in the net. In 6 hours, approximately 50 cubes of water would pass the screen. Every day at 6:00, 12:00, 18:00 and 24:00, the filter was emptied and cleaned. The sample was then flushed with miliQ, and stored in a plastic bag at a temperature of -80 degrees Celsius. The bags were labelled with the cruise name 64PE406 and numbers PP1 to PP.

Continuous GPS data are coupled to time, temperature, salinity and fluorescence data and can be linked to the 6 hour intervals, in order to track changes in the planktonic population of the Eastern Mediterranean.

10. Liquid Water Isotope Analyzer (LWIA-LGR)

Esmee Geerken and Patrick Laan

Seawater δ18O and δD were measured along the entire transect of cruise 64PE406 using the Liquid Water Isotope Analyzer (LWIA-LGR). Discrete samples were collected every hour between station E1 and E6 and every 6 hours between station E6 and final destination Istanbul. This data will be used to study the deviating Meteoric Waterline of the evaporative Eastern Mediterranean basin. Furthermore, the seawater δ18O measurements will be compared to the chemistry of foraminiferal calcite, measured from specimens collected along the transect by plankton pump, to disentangle salinity and δ18O. δD measurements will also be used for the calibration of the haptophyte-alkenone salinity proxy.

10.1 Setup

The LWIA was connected to a GCPAL auto sampler with 3 trays for standards and sample vials. A flow cell was constructed at the location of the fourth tray and connected to the aquaflow system of the vessel.

10.2 Sample strategy

Discrete samples were collected in 2,0 ml LGR vials, filled up to the top to avoid evaporation. Samples were taken at each station from each CTD depth (see CTD chapter for depths) and in hourly intervals from the aquaflow system.

The isotopic composition of the seawater was measured in situ along the transit, using the flow cell. After warming up for >4 hours to a temperature of ±46.88 °C and ±1.18 Torr, the reproducibility was tested using the Bidest standard. Hereafter, the international measurement standards VSWOW2, SLAP2 and GISP were measured. The standards used in the transit sample run cover the isotopic range expected in the Eastern Mediterranean basin (see table below). The isotope values for some of the in house standards still have to determined at the NIOZ.

Standard	δD	δ18O
LGR5	-9,2	-2,69
NSW BGC	5	To be determined ±0,7
SW35	T.b.d.	T.b.d. ±3
Bidest BGC		
T4	t.b.d.	t.b.d

During the transits the following sample scheme was followed:

Standard	Sample	Injections
T4		PPPMMMMMM
NSW		PPPMMMMMM
SW35		PPPMMMMMM
	Bidest	PPPMMMMMM
	Flowcell1	PPPMMMMMM
	Flowcell2	PPPMMMMMM
	LGR5	PPPMMMMMM
	Flowcell3	PPPMMMMMM
	Flowcell4	PPPMMMMMM
T4		PPPMMMMMM
	Bidest	PPPMMMMMM
	Flowcell1	PPPMMMMMM
	Flowcell2	PPPMMMMMM
	LGR5	PPPMMMMMM
	Flowcell3	PPPMMMMMM
	Flowcell4	PPPMMMMMM
NSW		PPPMMMMMM
	Bidest	PPPMMMMMM
	Flowcell1	PPPMMMMMM
	Flowcell2	PPPMMMMMM

	LGR5	PPPMMMMMM
	Flowcell3	PPPMMMMMM
	Flowcell4	PPPMMMMMM
SW35		
Etc.		
T4		PPPMMMMMM
NSW		PPPMMMMMM
SW35		PPPMMMMMM

1. Bidest and LGR5 standards were selected as 'sample', in order to be able to run it before and after seawater injections to avoid excessive salt precipitation and improve the precision.
2. The whole standard set was measured at beginning and end of sample list, in between one of the standards was measured after 6 samples (including bidest and LGR5).
3. 3 prep injections (P, not used because of memory effect) and 6 measurement (M) injections were processed for every sample/standard measurement.
4. The injection needle was cleaned with milli-Q regularly to avoid excessive salt precipitation.
5. The injection septum was replaced every day to avoid salt related problems.
6. The international standards VSMOW2, SLAP2 and GISP were regularly measured at stations.

10.3 Preliminary results

Unfortunately, reproducibility was poor up to station E8. Therefore it was decided to take discrete seawater samples from the aquaflow system throughout the entire transect, to be measured afterwards at the NIOZ. It was suspected that the instability was caused by the rough conditions at sea, or even due to damage during container transport, which was notable from damage to parts of the container furniture. Towards the end of the transect it was discovered that the 10 µm filter at the back of the LWIA was covered with precipitated salt. Cleaning this filter greatly improved reproducibility. An example of the uncorrected raw data for δ18O and δD over a transit of 20.5 hours after cleaning the filter is shown below.

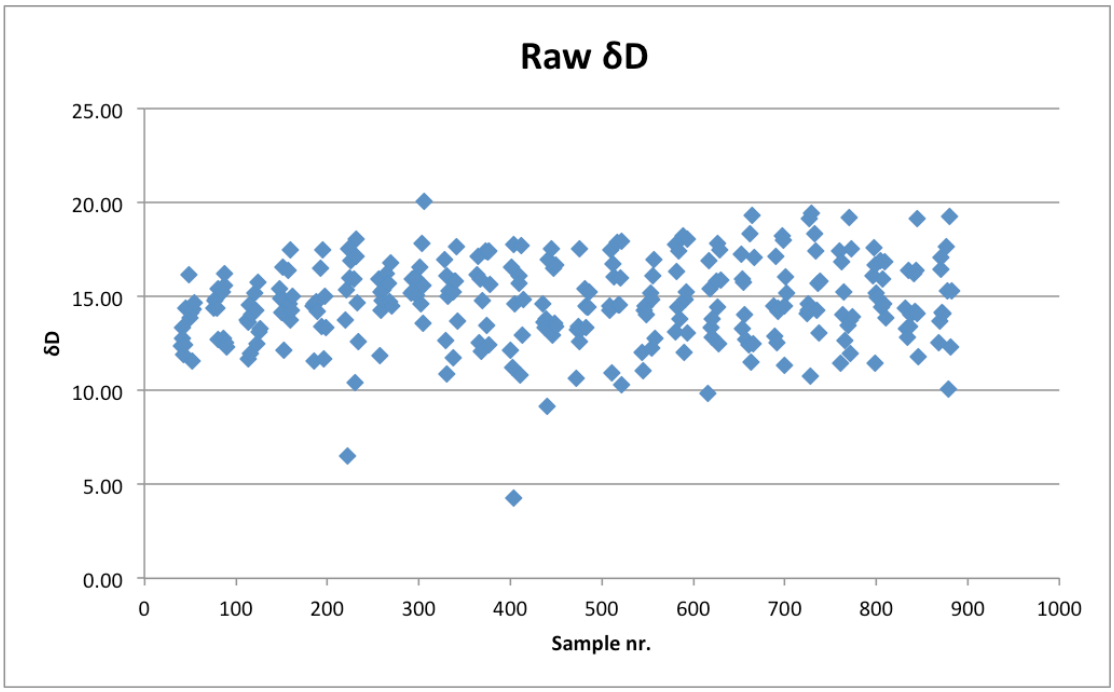


Figure 18. Raw, uncorrected δD values for transit time 24/01/2016 08:44 until 25/01/2016 05:14

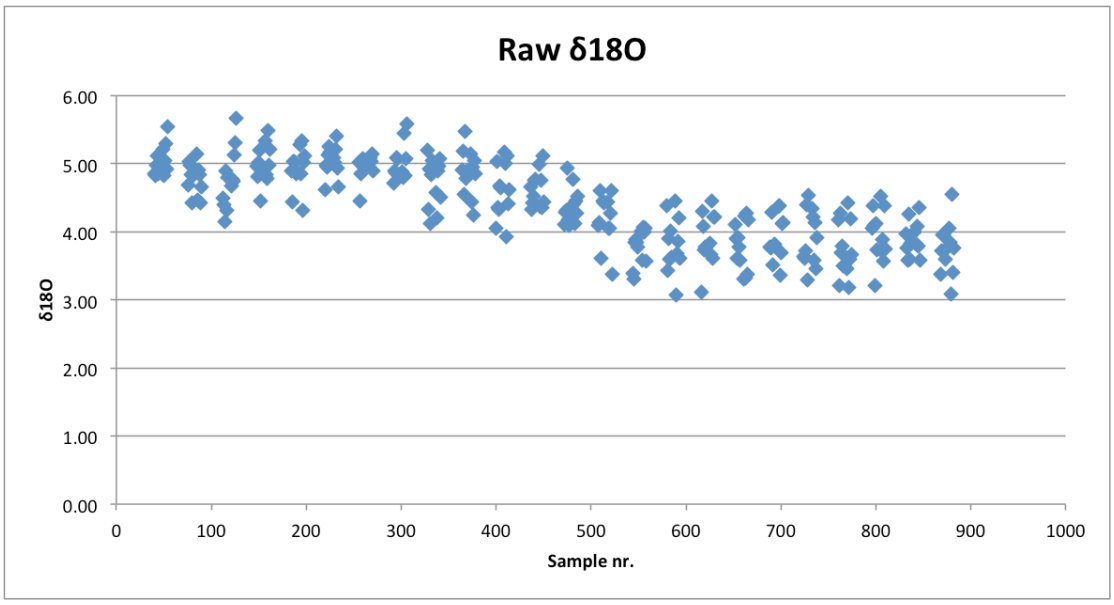


Figure 19. Raw, uncorrected δ18O values for transit time 24/01/2016 08:44 until 25/01/2016 05:14

11. MedTrap sediment trap mooring:

MedTrap 2015 Recovery and MedTrap2016 Deployment

Geert-Jan A. Brummer and Roald v.d. Heide

In order to determine the flux, composition and ecological impact of Saharan dust in the oceans (DUSTTRAFFIC program; ERC, J.-B. Stuut) a sediment trap mooring was deployed in the central Mediterranean, around 35°N, 18°E ("MedTrap").

The MedTrap program started in 2013, near a site previously occupied for nearly a decade by G. de Lange of Utrecht University. During cruise 64PE406, the mooring was serviced for the second time, following its first servicing by Rick Hennekam on 25-08-2015. The mooring consists of a single sediment trap with a baffled collecting area of 0.5 m^2 and provided with two rotating carousels each containing 20 collecting bottles (KUM K/MT 320). The mooring was provided with two IXSEA release gears holding the anchor as well as a XEOS beacon at the top of the string. Total string length amounted to 1078m, with the sediment trap at 1000m above the seafloor (bottom depth 3360m).

Recovery of MedTrap 2015 started in the morning of 21-01-2016 under perfect weather conditions. After successful acoustic communication with both release gears, the mooring at 34°57.993N, 18°02.294E was released at 13:00hrs from 3386m depth, surfaced after 32 minutes (ca. 80m/minute) and was on deck within the hour in a smooth operation. The XEOS beacon (Barcode 34609) appeared fully functional and was dismounted, as were both motors and controller unit of the trap.

Upon closer inspection, it appeared that the lower carousel had successfully collected the particle flux as programmed for the initial 15 sample intervals of 8 days each. However, rotation had stopped at bottle 16, meaning that the four subsequent intervals (bottle 16 to 20) were all included in the same bottle and thus represented a single 40 day interval. This was confirmed by the sample yield in the bottles as well as by the read out of the motor (see table 1). The upper carousel had completed its programmed rotation schedule until interrupted by the recovery on 21-01-2016, i.e. from bottle 21 to bottle 25. For sample yields, see table 2.

Inspection of the lower carousel showed that it was hard to rotate it manually, as opposed to the upper carousel. The lower carousel was dismounted from the trap, disassembled, cleaned and lubricated using PTFE spray, but it was still hard to rotate. The springs pressing the bottles to the rotating wheel in the lower carousel are different from the ones that present in the upper carousel and seemed to be stronger. The high resistant caused the gray PVC ring to be pressed outwards where it is driven by the small white turning wheel. With the upper motor (2) connected to the lower carousel (1) performance improved, although the mechanical resistance remained high. However, the lower motor (1) connected to the lower carousel (1) stopped too early every rotation step and manual calibration did not help either: the shaft ended at a different position after every rotation.

In order to redeploy the sediment trap successfully for another year of collection, we decided to dismounted the lower carousel (1) and motor (1) entirely and take it to NIOZ for closer

inspection. Instead, we connected upper motor (2) and upper carousel (2) to plug 1 of the controller. No 6-pin Subcon dummy plugs were available so the other motor cable was connected to plug 2 but with a Subcon mini 6-pin male dummy plug on the other end. It should also be noted that during MedTrap2013, it was the upper carousel and not the lower one that jammed (bottle #29).

Having only one carousel available for sampling also meant changing the sampling schedule for the third deployment (MedTrap 2016), as the number of sample bottles available was reduced by half. We decided to start on the 24th of January 2016 00:15:00 (dd mm yy hh:mm:ss, UTC), i.e. adding on to the sample schedule of the previous deployment (MedTrap2015, bottle 26). Instead of 6-day sampling intervals, we programmed the sediment trap for 18-day sampling intervals, ending the sampling program on the13th of January 2017 (closing bottle #20). The

Group 2 (for the dismounted carousel) was programmed, but can be neglected (see file: 2016_MED_deploy_20_bottles.sch; table 2).

All 20 sample bottles of MedTrap2015 were stored at 4°C, while the remaining 20 bottles that did not sample, were re-used for the MedTrap2016 deployment. Only the batteries of the XEOS beacon were replaced.

MedTrap2016 was successfully redeployed on the 22th of January, 12:09:33hrs PM (GMT) at 34°57.8263N, 18°02.1554E at a bottom depth of 3353m.

Table 1. MedTrap2016 rotation schedule

Number on caroussel	MedTrap 2015 Bottle number	Date/Time GMT end	Date/Time GMT start	collecting time (days)	Extra information:		
1	Empty	Lower caroussel and motor were removed and taken to NIOZ because of malfunctioning					
2	1	Lower caroussel and motor were removed and taken to NIOZ because of malfunctioning					
3	2	Lower caroussel and motor were removed and taken to NIOZ because of malfunctioning					
4	3	Lower caroussel and motor were removed and taken to NIOZ because of malfunctioning					
5	4	Lower caroussel and motor were removed and taken to NIOZ because of malfunctioning					
6	5	Lower caroussel and motor were removed and taken to NIOZ because of malfunctioning					
7	6	Lower caroussel and motor were removed and taken to NIOZ because of malfunctioning					
8	7	Lower caroussel and motor were removed and taken to NIOZ because of malfunctioning					
9	8	Lower caroussel and motor were removed and taken to NIOZ because of malfunctioning					
10	9	Lower caroussel and motor were removed and taken to NIOZ because of malfunctioning					
11	10	Lower caroussel and motor were removed and taken to NIOZ because of malfunctioning					
12	11	Lower caroussel and motor were removed and taken to NIOZ because of malfunctioning					
13	12	Lower caroussel and motor were removed and taken to NIOZ because of malfunctioning					
14	13	Lower caroussel and motor were removed and taken to NIOZ because of malfunctioning					
15	14	Lower caroussel and motor were removed and taken to NIOZ because of malfunctioning					
16	15	Lower caroussel and motor were removed and taken to NIOZ because of malfunctioning					
17	16	Lower caroussel and motor were removed and taken to NIOZ because of malfunctioning					
18	17	Lower caroussel and motor were removed and taken to NIOZ because of malfunctioning					
19	18	Lower caroussel and motor were removed and taken to NIOZ because of malfunctioning					
20	19	Lower caroussel and motor were removed and taken to NIOZ because of malfunctioning					
21	20	Lower caroussel and motor were removed and taken to NIOZ because of malfunctioning					
1	Extension tube	10 minutes after last action of caroussel 1 (lower), caroussel 2 comes to action					
2	21	24-01-16 12:15 AM	11-02-16 12:15 AM	18.00			
3	22	11-02-16 12:15 AM	29-02-16 12:15 AM	18.00			
4	23	29-02-16 12:15 AM	18-03-16 12:15 AM	18.00			
5	24	18-03-16 12:15 AM	5-04-16 12:15 AM	18.00			
6	25	5-04-16 12:15 AM	23-04-16 12:15 AM	18.00			
7	26	23-04-16 12:15 AM	11-05-16 12:15 AM	18.00			
8	27	11-05-16 12:15 AM	29-05-16 12:15 AM	18.00			
9	28	29-05-16 12:15 AM	16-06-16 12:15 AM	18.00			
10	29	16-06-16 12:15 AM	4-07-16 12:15 AM	18.00			
11	30	4-07-16 12:15 AM	22-07-16 12:15 AM	18.00			
12	31	22-07-16 12:15 AM	9-08-16 12:15 AM	18.00			
13	32	9-08-16 12:15 AM	27-08-16 12:15 AM	18.00			
14	33	27-08-16 12:15 AM	14-09-16 12:15 AM	18.00			
15	34	14-09-16 12:15 AM	2-10-16 12:15 AM	18.00			
16	35	2-10-16 12:15 AM	20-10-16 12:15 AM	18.00			
17	36	20-10-16 12:15 AM	7-11-16 12:15 AM	18.00			
18	37	7-11-16 12:15 AM	25-11-16 12:15 AM	18.00			
19	38	25-11-16 12:15 AM	13-12-16 12:15 AM	18.00			
20	39	13-12-16 12:15 AM	31-12-16 12:15 AM	18.00			
21	40	31-12-16 12:15 AM	18-01-17 12:15 AM	18.00			

Table 2. MedTrap2015 results

Caroussel 1=lower, 2=upper	Number on caroussel	MedTrap 2015 Bottle number	Date/Time GMT end	Date/Time GMT start	collecting time (days)	catch qualitative	Extra information:
1	1	Empty	25-08-2015 at 17:30	27-08-2015 at 00:05			Second carousel (upper) is set to the position of the Funnel extension, so caroussel 1 is filled.
1	2	1	27-08-2015 at 00:05	02-09-2015 at 00:05	6.00	1	
1	3	2	02-09-2015 at 00:05	08-09-2015 at 00:05	6.00	1	
1	4	3	08-09-2015 at 00:05	14-09-2015 at 00:05	6.00	2	
1	5	4	14-09-2015 at 00:05	20-09-2015 at 00:05	6.00	3	
1	6	5	20-09-2015 at 00:05	26-09-2015 at 00:05	6.00	4	
1	7	6	26-09-2015 at 00:05	02-10-2015 at 00:05	6.00	5	
1	8	7	02-10-2015 at 00:05	08-10-2015 at 00:05	6.00	6	
1	9	8	08-10-2015 at 00:05	14-10-2015 at 00:05	6.00	7	
1	10	9	14-10-2015 at 00:05	20-10-2015 at 00:05	6.00	7	
1	11	10	20-10-2015 at 00:05	26-10-2015 at 00:05	6.00	7	
1	12	11	26-10-2015 at 00:05	01-11-2015 at 00:05	6.00	6	
1	13	12	01-11-2015 at 00:05	07-11-2015 at 00:05	6.00	6	
1	14	13	07-11-2015 at 00:05	13-11-2015 at 00:05	6.00	6	
1	15	14	13-11-2015 at 00:05	19-11-2015 at 00:05	6.00	5	
1	16	15	19-11-2015 at 00:05	25-11-2015 at 00:05	6.00	4	
1	17	16	25-11-2015 at 00:05	01-12-2015 at 00:05	30.00	10	caroussel stuck, integrating collection to end of schedule, i.e. to 25-12-2015 at 00:05
1	18	17	01-12-2015 at 00:05	07-12-2015 at 00:05	0	0	no collection; caroussel stuck on bottle 16; sample bottle re-used for MedTrap2016
1	19	18	07-12-2015 at 00:05	13-12-2015 at 00:05	0	0	no collection; caroussel stuck on bottle 16; sample bottle re-used for MedTrap2016
1	20	19	13-12-2015 at 00:05	19-12-2015 at 00:05	0	0	no collection; caroussel stuck on bottle 16; sample bottle re-used for MedTrap2016
1	21	20	19-12-2015 at 00:05	25-12-2015 at 00:05	0	0	no collection; caroussel stuck on bottle 16; sample bottle re-used for MedTrap2016
2	1	Extension tube t	25-08-2015 at 17:30	25-12-2015 at 00:15			10 minutes after last action of caroussel 1 (lower), caroussel 2 comes to action
2	2	21	25-12-2015 at 00:15	31-12-2015 at 00:15	6.00	5	
2	3	22	31-12-2015 at 00:15	06-01-2016 at 00:15	6.00	5	
2	4	23	06-01-2016 at 00:15	12-01-2016 at 00:15	6.00	3	
2	5	24	12-01-2016 at 00:15	18-01-2016 at 00:15	6.00	5	
2	6	25	18-01-2016 at 00:15	24-01-2016 at 00:15	2.47		collection interrupted by recovery on 21-01-2016, 12:09
2	7	26	24-01-2016 at 00:15	30-01-2016 at 00:15	void	0	void; sample bottle re-used for MedTrap2016
2	8	27	30-01-2016 at 00:15	05-02-2016 at 00:15	void	0	void; sample bottle re-used for MedTrap2016
2	9	28	05-02-2016 at 00:15	11-02-2016 at 00:15	void	0	void; sample bottle re-used for MedTrap2016
2	10	29	11-02-2016 at 00:15	17-02-2016 at 00:15	void	0	void; sample bottle re-used for MedTrap2016
2	11	30	17-02-2016 at 00:15	23-02-2016 at 00:15	void	0	void; sample bottle re-used for MedTrap2016
2	12	31	23-02-2016 at 00:15	29-02-2016 at 00:15	void	0	void; sample bottle re-used for MedTrap2016
2	13	32	29-02-2016 at 00:15	06-03-2016 at 00:15	void	0	void; sample bottle re-used for MedTrap2016
2	14	33	06-03-2016 at 00:15	12-03-2016 at 00:15	void	0	void; sample bottle re-used for MedTrap2016
2	15	34	12-03-2016 at 00:15	18-03-2016 at 00:15	void	0	void; sample bottle re-used for MedTrap2016
2	16	35	18-03-2016 at 00:15	24-03-2016 at 00:15	void	0	void; sample bottle re-used for MedTrap2016
2	17	36	24-03-2016 at 00:15	30-03-2016 at 00:15	void	0	void; sample bottle re-used for MedTrap2016
2	18	37	30-03-2016 at 00:15	05-04-2016 at 00:15	void	0	void; sample bottle re-used for MedTrap2016
2	19	38	05-04-2016 at 00:15	11-04-2016 at 00:15	void	0	void; sample bottle re-used for MedTrap2016
2	20	39	11-04-2016 at 00:15	17-04-2016 at 00:15	void	0	void; sample bottle re-used for MedTrap2016
2	21	40	17-04-2016 at 00:15	End of times	void	0	void; sample bottle re-used for MedTrap2016

Appendix 1, Nuts samples

STATION	Bottle	PrDM	Sal00	Potemp	Ox Mm/Kg	Ct	At	NUTS	O2	1	2	3	4
S1C2	1	1721	38.77	13.60	178.821	x	x	x					
S1C2	2	1721	38.77	13.60	178.418								
S1C2	3	1315	38.76	13.59	177.999	x	x	x					
S1C2	4	1315	38.76	13.59	178.056								
S1C2	5	1111	38.75	13.59	175.954	x	x	x					
S1C2	6	1112	38.75	13.59	175.771								
S1C2	7	808	38.76	13.66	172.217	x	x	x					
S1C2	8	808	38.76	13.66	172.706								
S1C2	9	505	38.82	13.94	171.831	x	x	x					
S1C2	10	505	38.82	13.94	171.962								
S1C2	11	303	38.98	14.85	181.534	x	x	x					
S1C2	12	302	38.98	14.85	181.52								
S1C2	13	201	39.08	16.09	198.588	x	x	x					
S1C2	14	201	39.08	16.09	198.302								
S1C2	15	151	39.08	16.82	208.712	x	x	x					
S1C2	16	150	39.08	16.82	208.836								
S1C2	17	100	38.95	17.57	224.638	x	x	x					
S1C2	18	100	38.95	17.57	224.504								
S1C2	19	74	39.08	18.89	223.934	x	x	x					
S1C2	20	74	39.08	18.89	223.043								
S1C2	21	49	39.10	19.01	223.887	x	x	x					
S1C2	22	49	39.10	19.01	224.299								
S1C2	23	25	39.10	19.01	224.48	x	x	x					
S1C2	24	25	39.10	19.01	224.13								
S2C2	1	2738	38.77	13.59	177.961	x	x	x					
S2C2	2	2533	38.77	13.59	178.439	x	x	x					
S2C2	3	2278	38.77	13.60	179.293	x	x	x					
S2C2	4	2024	38.77	13.61	179.261	x	x	x					
S2C2	5	1769	38.77	13.61	178.943	x	x	x					
S2C2	6	1515	38.76	13.59	178.126	x	x	x					
S2C2	7	1261	38.75	13.60	176.901	x	x	x					
S2C2	8	1010	38.76	13.63	174.846	x	x	x					
S2C2	9	807	38.78	13.73	173.724	x	x	x					
S2C2	10	706	38.80	13.81	172.472	x	x	x					
S2C2	11	605	38.83	13.95	172.89	x	x	x					
S2C2	12	504	38.88	14.19	176.873	x	x	x					
S2C2	13	403	38.97	14.64	184.676	x	x	x					
S2C2	14	302	39.06	15.43	196.382	x	x	x					
S2C2	15	252	39.08	15.99	203.275	x	x	x					
S2C2	16	201	39.05	16.47	211.78	x	x	x					
S2C2	17	151	39.01	17.02	214.629	x	x	x					
S2C2	18	99	38.89	17.93	226.532								
S2C2	19	99	38.89	17.93	226.725	x	x	x					
S2C2	20	75	38.88	18.02	227.526								

S2C2	21	75	38.88	18.02	227.482	x	x	x					
S2C2	22	49	38.99	18.51	225.974	x	x	x					
S2C2	23	25	38.99	18.52	225.81	x	x	x					
S2C2	24	25	38.99	18.52	225.927								
S3C2	1	2482	38.75	13.54	180.6	x	x	x					
S3C2	2	2279	38.76	13.57	180.444	x	x	x					
S3C2	3	2024	38.77	13.58	180.567	x	x	x					
S3C2	4	1771	38.76	13.59	180.07	x	x	x					
S3C2	5	1517	38.76	13.59	179.665	x	x	x					
S3C2	6	1263	38.76	13.60	178.517	x	x	x					
S3C2	7	1011	38.76	13.62	176.878	x	x	x					
S3C2	8	909	38.76	13.64	175.959	x	x	x					
S3C2	9	807	38.77	13.68	175.515	x	x	x					
S3C2	10	708	38.78	13.73	174.609	x	x	x					
S3C2	11	606	38.80	13.80	175.088	x	x	x					
S3C2	12	505	38.82	13.90	175.646	x	x	x					
S3C2	13	401	38.87	14.14	177.631	x	x	x					
S3C2	14	302	38.93	14.48	182.197	x	x	x					
S3C2	15	253	38.98	14.73	185.246	x	x	x					
S3C2	16	201	39.01	15.05	190.858	x	x	x					
S3C2	17	151	39.06	15.52	195.861	x	x	x					
S3C2	18	125	39.12	15.97	205.965								
S3C2	19	124	39.12	15.98	205.622	x	x	x					
S3C2	20	76	39.16	16.62	226.48								
S3C2	21	76	39.16	16.62	226.927	x	x	x					
S3C2	22	49	39.13	16.65	223.576	x	x	x					
S3C2	23	25	39.00	17.08	231.034	x	x	x					
S3C2	24	25	39.00	17.08	230.897								
S5C5	1	2781	38.73	13.43	185.869	x	x	x					
S5C5	2	2738	38.73	13.43	185.839	x	x	x					
S5C5	3	2738	38.73	13.43	186.021	x	x	x					
S5C5	4	2738	38.73	13.43	186.084	x	x	x					
S5C5	5	2534	38.73	13.45	186.069	x	x	x					
S5C5	6	2280	38.73	13.47	186.415	x	x	x					
S5C5	7	2025	38.74	13.49	185.559	x	x	x					
S5C5	8	1516	38.75	13.55	183.205	x	x	x					
S5C5	9	1262	38.75	13.58	181.33	x	x	x					
S5C5	10	1009	38.77	13.67	178.746	x	x	x					
S5C5	11	757	38.79	13.76	178.21	x	x	x					
S5C5	12	505	38.90	14.27	182.713	x	x	x					
S5C5	13	402	38.97	14.71	187.714	x	x	x					
S5C5	14	301	39.04	15.31	206.511	x	x	x					
S5C5	15	252	39.06	15.51	213.562	x	x	x					
S4C5	16	201	39.07	15.69	215.638	x	x	x					
S5C5	17	151	39.08	15.96	213.579	x	x	x					
S5C5	18	102	39.04	16.97	224.629								

S5C5	19	101	39.04	16.98	224.026	x	x	x					
S5C5	20	76	39.03	17.20	228.055								
S5C5	21	76	39.03	17.20	228.177	x	x	x					
S5C5	22	51	39.03	17.19	228.004	x	x	x					
S5C5	23	26	39.03	17.20	228.216	x	x	x					
S5C5	24	25	39.03	17.20	228.48								
S6C6	1	3606	38.73	13.42	185.554	x	x	x					
S6C6	2	3607	38.73	13.42	185.575								
S6C6	3	3044	38.73	13.43	186.865	x	x	x					
S6C6	4	3043	38.73	13.43	186.867								
S6C6	5	2431	38.73	13.45	187.802	x	x	x					
S6C6	6	2432	38.73	13.45	187.726								
S6C6	7	1821	38.74	13.51	186.932	x	x	x					
S6C6	8	1820	38.74	13.51	187.165								
S6C6	9	1212	38.74	13.57	181.426	x	x	x					
S6C6	10	1211	38.74	13.57	181.386								
S6C6	11	807	38.78	13.74	178.291	x	x	x					
S6C6	12	808	38.78	13.74	178.35								
S6C6	13	505	38.87	14.14	182.921	x	x	x					
S6C6	14	504	38.87	14.14	183.031								
S6C6	15	252	38.97	15.11	200.976	x	x	x					
S6C6	16	251	38.97	15.11	201.037								
S6C6	17	151	38.98	15.85	212.27	x	x	x					
S6C6	18	151	38.98	15.85	212.381								
S6C6	19	90	38.92	16.76	222.556	x	x	x					
S6C6	20	90	38.91	16.76	222.93								
S6C6	21	75	38.87	17.20	229.632	x	x	x					
S6C6	22	75	38.87	17.20	229.331								
S6C6	23	25	38.87	17.21	230.075	x	x	x					
S6C6	24	25	38.87	17.21	230.071								

Appendix 2, DOC/TOC samples

Date	Vial #	Station	Cast	Depth #	Bottle #	Depth (m)
1/15/2016	1	1	2	1	23+24	25
	2	1	2	2	21+22	49
	3	1	2	3	19+20	74
	4	1	2	4	17+18	100
	5	1	2	5	15+16	150
	6	1	2	6	13+14	201
	7	1	2	7	11+12	303
	8	1	2	8	9+10	505
	9	1	2	9	7+8	808
	10	1	2	10	5+6	1111
	11	1	2	11	3+4	1315
	12	1	2	12	1+2	1721
1/16/2016	13	2	2	1	23+24	25
	14	2	2	2	20+21	75
	15	2	2	3	18+19	99
1/17/2016	16	3	2	1	23+24	25
	17	3	2	2	20+21	76
	18	3	2	3	18+19	125
1/20/2016	19	5	1	1	23+24	25
	20	5	1	2	20+21	76
	21	5	1	3	18+19	101
1/21/2016	22	6	2	1	23+24	25
	23	6	2	2	21+22	75
	24	6	2	3	19+20	90
	25	6	2	4	17+18	151
	26	6	2	5	15+16	252
	27	6	2	6	13+14	505
	28	6	2	7	11+12	807
	29	6	2	8	9+10	1212
	30	6	2	9	7+8	1821
	31	6	2	10	5+6	2431
	32	6	2	11	3+4	3044
	33	6	2	12	1+2	3606
1/26/2016	34	9	2	1	12+13	3.5
	35	9	2	2	8+9	75
	36	9	2	3	5+6	160

Appendix 3, Chlorophyll *a* samples

Date	Station	Depth #	Bottle #	Depth (m)	Filtered (ml)	label	
1/15/2016	1	1	23+24	25	1755		
	1	2	21+22	49	1735		
	1	3	19+20	74	2050		
	1	4	17+18	100	1000	filter1	
	1	4	17+18	100	1000	filter2	
	1	5	15+16	150	1930		
1/16/2016	2	1	23+24	25	2055	st2 depth1	
	2	2	20+21	75	2210	st2 depth2	
	2	3	18+19	99	2060	st2 depth3	
1/17/2016	3	1	23+24	25	1000	st3 c2 depth25 = 1	spilled a bit
	3	2	20+21	76	1920	st3 c2 depth 2	
	3	3	18+19	125	1870	st3 c2 depth 3	
1/20/2016	5	1	23+24	25	1895	st4 cast 5.2 depth 1	
	5	2	20+21	76	1890	st4 cast 5.2 depth 2	
	5	3	18+19	101	1980	st4 cast 5.2 depth 3	
1/21/2016	6	1	23+24	25	2038	st6 depth 1	
	6	2	21+22	75	1975	st6 depth 2	
	6	3	19+20	90	1935	st6 depth 3	
	6	4	17+18	151	1985	st6 depth 4	
	6	5	15+16	252	2010	st6 depth 5	
	6	6	13+14	505	2015	st6 depth 6	
	6	7	11+12	807	1980	st6 depth 7	
	6	8	9+10	1212	1998	st6 depth 8	
	6	9	7+8	1821	1965	st6 depth 9	
	6	10	5+6	2431	2080	st6 depth 10	
	6	11	3+4	3044	2000	st6 depth 11	
	6	12	1+2	3606	1982	st6 depth 12	
1/26/2016	9	1	12+13	3.5	2045	st9 depth1	
	9	2	8+9	75	2050	st9 depth2	
	9	3	5+6	160	2075	st9 depth3	

Appendix 4, PON / POP samples

Date	Station	Depth #	Bottle #	Depth (m)	filter weight	filtered	label
1/15/2016	1	1	23+24	25	0.1308	2270	1-2 PO1.1
	1	2	21+22	49	0.1315	2250	1-2 PO1.2
	1	3	19+20	74	0.1348	2310	1-2 PO1.3
	1	4	17+18	100	0.1303	2310	1-2 PO1.4
	1	5	15+16	150	0.1295	2310	1-2 PO1.5
	1	6	13+14	201	0.1314	2310	1-2 PO1.6
	1	7	11+12	303	0.1311	2125	1-2 PO1.7
	1	8	9+10	505	0.1303	2310	1-2 PO1.8
	1	9	7+8	808	0.1313	2330	1-2 PO1.9
	1	10	5+6	1111	0.1307	2300	1-2 PO1.10
	1	11	3+4	1315	0.1301	2290	1-2 PO1.11
	1	12	1+2	1721	0.1302	2220	1-2 PO1.12
1/16/2016	2	1	23+24	25	0.1311	2235	st2 PO1'
	2	2	20+21	75	0.131	2015	st2 PO2'
	2	3	18+19	99	0.1306	2000	st2 PO3'
1/17/2016	3	1	23+24	25	0.1312	2095	st3 PO1'
	3	2	20+21	76	0.1361	2135	st3 PO2'
	3	3	18+19	125	0.1312	2150	st3 PO3'
1/20/2016	4	1	23+24	25	0.1314	2160	st4 cast 5.2 PO1'
	4	2	20+21	76	0.132	2085	st4 cast 5.2 PO2'
	4	3	18+19	101	0.1171	1842.5	st4 cast 5.2 PO3'
1/21/2016	6	1	23+24	25	0.1327	2155	st6 PO1'
	6	2	21+22	75	0.1334	2050	st6 PO2'
	6	3	19+20	90	0.1351	2185	st6 PO3'
	6	4	17+18	151	0.1315	2125	st6 PO4'
	6	5	15+16	252	0.131	2185	st6 PO5'
	6	6	13+14	505	0.1331	1970	st6 PO6'
	6	7	11+12	807	0.1305	2055	st6 PO7'
	6	8	9+10	1212	0.1322	2050	st6 PO8'
	6	9	7+8	1821	0.1321	2085	st6 PO9'
	6	10	5+6	2431	0.1307	2130	st6 PO10'
	6	11	3+4	3044	0.1319	2045	st6 PO11'
	6	12	1+2	3606	0.1311	2100	st6 PO12'
1/26/2016	9	1	12+13	3.5	0.1311	2160	st9 PO1'
	9	2	8+9	75	0.1314	2135	st9 PO2'
	9	3	5+6	160	0.1319	2125	st9 PO3'

Appendix 5, POC samples

Date	Station	Depth #	Bottle #	Depth (m)	filter weight	filtered	label
1/15/2016	1	1	23+24	25	0.1238	2135	st1 PO1
	1	2	21+22	49	0.1304	2130	st1 PO2
	1	3	19+20	74	0.1315	2280	st1 PO3
	1	4	17+18	100	0.1319	2250	st1 PO4
	1	5	15+16	150	0.1302	2200	st1 PO5
	1	6	13+14	201	0.1292	2000	st1 PO6
	1	7	11+12	303	0.1323	1909	st1 PO7
	1	8	9+10	505	0.1335	2240	st1 PO8
	1	9	7+8	808	0.1332	2310	st1 PO9
	1	10	5+6	1111	0.131	2310	st1 PO10
	1	11	3+4	1315	0.1309	2240	st1 PO11
	1	12	1+2	1721	0.1304	2310	st1 PO12
1/16/2016	2	1	23+24	25	0.1297	2180	st2 depth 1 PO1
	2	2	20+21	75	0.1256	2210	st2 depth 2 PO2
	2	3	18+19	99	0.1316	2125	st2 depth 3 PO3
1/17/2016	3	1	23+24	25	0.1352	2115	st3 PO1
	3	2	20+21	76	0.1339	2150	st3 PO2
	3	3	18+19	125	0.1309	2115	st3 PO3
1/20/2016	5	1	23+24	25	0.1318	2065	st4 cast5.2 PO1
	5	2	20+21	76	0.1298	2095	st4 cast5.2 PO2
	5	3	18+19	101	0.1326	2095	st4 cast5.2 PO3
1/21/2016	6	1	23+24	25	0.1295	2118	st6 c2 PO1
	6	2	21+22	75	0.1311	2197	st6 c2 PO2
	6	3	19+20	90	0.1318	2070	st6 c2 PO3
	6	4	17+18	151	0.1373	2115	st6 c2 PO4
	6	5	15+16	252	0.1309	1910	st6 c2 PO5
	6	6	13+14	505	0.1308	2120	st6 c2 PO6
	6	7	11+12	807	0.1322	1692	st6 c2 PO7
	6	8	9+10	1212	0.1314	2253	st6 c2 PO8
	6	9	7+8	1821	0.1333	2255	st6 c2 PO9
	6	10	5+6	2431	0.1304	2200	st6 c2 PO10
	6	11	3+4	3044	0.1311	2225	st6 c2 PO11
	6	12	1+2	3606	0.1305	2225	st6 c2 PO12
1/26/2016	9	1	12+13	3.5	0.1319	2182	st9 PO1
	9	2	8+9	75	0.1307	2185	st9 PO2
	9	3	5+6	160	0.1309	2140	st9 PO3

Appendix 6, Casino events abstract

Date	Time	Latitude (deg. min.milli)	Longitude (deg. min.milli)	Phase name	Phase type	Type	Device name	Device code	Action name	Action code	Operation Id	Station number	Strate
13/01/2016	18:02:42	N 34° 38.96718'	E 33° 1.18884'	TRANSIT1	TRANSIT	PHA							
13/01/2016	19:04:30	N 34° 32.98722'	E 33° 4.51134'			OBS							
13/01/2016	20:00:43	N 34° 24.68364'	E 33° 6.31482'	STATION 0	STATION	PHA							
13/01/2016	20:12:47	N 34° 24.64092'	E 33° 6.38838'			OPE	CTD	CTD	Begin	BEGIN	406CTD1	0	0_1
13/01/2016	20:21:16	N 34° 24.55002'	E 33° 6.32988'			OPE	CTD	CTD	Bottom	BOT	406CTD1	0	0_1
13/01/2016	20:23:23	N 34° 24.53586'	E 33° 6.35784'			OPE	CTD	CTD	End	END	406CTD1	0	0_1
13/01/2016	20:47:37	N 34° 23.9976'	E 33° 6.7719'			OPE	MultiNet	MULNET	Begin	BEGIN	406MULNET1	0	0_2
13/01/2016	21:00:52	N 34° 23.61984'	E 33° 7.0986'			OPE	MultiNet	MULNET	Start Heave	HEAV	406MULNET1	0	0_2
13/01/2016	21:03:47	N 34° 23.53776'	E 33° 7.16628'			OPE	MultiNet	MULNET	End	END	406MULNET1	0	0_2
13/01/2016	21:04:01	N 34° 23.53068'	E 33° 7.1709'	TRANSIT2	TRANSIT	PHA							
14/01/2016	4:15:50	N 33° 18.14898'	E 33° 23.71998'	STATION 1	STATION	PHA							
14/01/2016	4:25:00	N 33° 18.16032'	E 33° 23.53308'			OPE	MultiNet	MULNET	Begin	BEGIN	406MULNET2	Station1_1	
14/01/2016	5:07:02	N 33° 18.0915'	E 33° 22.4931'			OPE	MultiNet	MULNET	Start Heave	HEAV	406MULNET2	Station1_1	
14/01/2016	7:35:13	N 33° 17.89104'	E 33° 18.28842'			OPE	MultiNet	MULNET	End	END	406MULNET2	Station1_1	
14/01/2016	10:29:07	N 33° 17.92332'	E 33° 19.44696'			OPE	CTD	CTD	Begin	BEGIN	406CTD2	1	1_2
14/01/2016	11:01:21	N 33° 17.97834'	E 33° 19.46754'			OPE	CTD	CTD	Bottom	BOT	406CTD2	1	1_2
14/01/2016	12:02:40	N 33° 18.00204'	E 33° 19.46466'			OPE	CTD	CTD	End	END	406CTD2	1	1_2
14/01/2016	12:51:41	N 33° 18.08634'	E 33° 22.86834'			OPE	Multibeam	EM302	Begin	BEGIN	406EM3021	1	1_3
14/01/2016	13:36:43	N 33° 18.00864'	E 33° 18.04386'			OPE	Multibeam	EM302	End	END	406EM3021	1	1_3
14/01/2016	14:57:19	N 33° 17.99988'	E 33° 19.58682'			OPE	Pistoncorer	PC110	Bottom	BOT	406PC1101	1	1_4
14/01/2016	17:29:09	N 33° 17.99694'	E 33° 19.58406'			OPE	Multi Corer	MC12	Bottom	BOT	406MC121	1	1_5
14/01/2016	18:28:08	N 33° 17.91258'	E 33° 19.4106'			OPE	MultiNet	MULNET	Begin	BEGIN	406MULNET3	1	1_6
14/01/2016	18:36:21	N 33° 17.96004'	E 33° 19.21086'			OPE	MultiNet	MULNET	Start Heave	HEAV	406MULNET3	1	1_6
14/01/2016	18:58:20	N 33° 18.16902'	E 33° 18.53382'			OPE	MultiNet	MULNET	End	END	406MULNET3	1	1_6
14/01/2016	20:12:22	N 33° 19.10466'	E 33° 19.29966'			OPE	In Situ Pump	MCLANE	Begin	BEGIN	406MCLANE1	1	1_7
14/01/2016	22:03:44	N 33° 19.03614'	E 33° 19.29768'			OPE	In Situ Pump	MCLANE	End	END	406MCLANE1	1	1_7
14/01/2016	23:29:32	N 33° 19.101'	E 33° 19.37208'			OPE	In Situ Pump	MCLANE	Begin	BEGIN	406MCLANE2	1	1_8
15/01/2016	4:14:29	N 33° 19.0086'	E 33° 19.25736'			OPE	In Situ Pump	MCLANE	End	END	406MCLANE2	1	1_8
15/01/2016	6:19:16	N 33° 19.02378'	E 33° 19.27314'			OPE	In Situ Pump	MCLANE	Begin	BEGIN	406MCLANE3	1	1_9
15/01/2016	12:03:19	N 33° 19.03902'	E 33° 19.30062'			OPE	In Situ Pump	MCLANE	End	END	406MCLANE3	1	1_9
15/01/2016	12:03:34	N 33° 19.03872'	E 33° 19.30116'	TRANSIT3	TRANSIT	PHA							
16/01/2016	2:59:38	N 33° 44.06286'	E 30° 36.05364'	STATION 2	STATION	PHA							
16/01/2016	3:00:14	N 33° 44.07756'	E 30° 35.9919'			OPE	Multibeam	EM302	Begin	BEGIN	406EM3022	2	2_1
16/01/2016	5:28:09	N 33° 46.14204'	E 30° 30.41334'			OPE	Multibeam	EM302	End	END	406EM3022	2	2_1
16/01/2016	6:10:24	N 33° 45.04224'	E 30° 31.30368'			OPE	CTD	CTD	Begin	BEGIN	406CTD3	2	2_2
16/01/2016	6:58:32	N 33° 45.04194'	E 30° 31.31082'			OPE	CTD	CTD	Bottom	BOT	406CTD3	2	2_2
16/01/2016	8:23:17	N 33° 45.05826'	E 30° 31.26972'			OPE	CTD	CTD	End	END	406CTD3	2	2_2
16/01/2016	9:19:33	N 33° 45.07338'	E 30° 31.28838'			OPE	In Situ Pump	MCLANE	Begin	BEGIN	406MCLANE4	2	2_3
16/01/2016	11:21:51	N 33° 45.06456'	E 30° 31.30668'			OPE	In Situ Pump	MCLANE	End	END	406MCLANE4	2	2_3
16/01/2016	12:18:59	N 33° 45.06516'	E 30° 31.30548'			OPE	Multi Corer	MC12	Bottom	BOT	406MC122	2	2_4
16/01/2016	14:06:53	N 33° 45.06438'	E 30° 31.30002'			OPE	Pistoncorer	PC110	Bottom	BOT	406PC1102	2	2_5
16/01/2016	15:21:53	N 33° 45.0384'	E 30° 31.2627'	TRANSIT4	TRANSIT	PHA							
17/01/2016	7:33:14	N 34° 6.98688'	E 27° 36.35448'	STATION 3	STATION	PHA							

17/01/2016	8:48:03	N 34° 7.00542'	E 27° 35.00376'			OPE	Multi Corer	MC12	Bottom	BOT	406MC123	3	3_1
17/01/2016	9:47:57	N 34° 7.00188'	E 27° 34.98768'			OPE	CTD with samples	CTDBOT	Begin	BEGIN	406CTDBOT1	3	3_2
17/01/2016	10:34:37	N 34° 6.93942'	E 27° 34.96464'			OPE	CTD with samples	CTDBOT	Bottom	BOT	406CTDBOT1	3	3_2
17/01/2016	12:02:17	N 34° 6.9123'	E 27° 34.98018'			OPE	CTD with samples	CTDBOT	End	END	406CTDBOT1	3	3_2
17/01/2016	13:01:28	N 34° 6.9504'	E 27° 34.9167'			OPE	In Situ Pump	MCLANE	Begin	BEGIN	406MCLANE5	3	3_3
17/01/2016	14:30:17	N 34° 6.99642'	E 27° 35.0112'			OPE	In Situ Pump	MCLANE	End	END	406MCLANE5	3	3_3
17/01/2016	14:34:00	N 34° 6.97734'	E 27° 35.0106'	TRANSIT5	TRANSIT	PHA							
19/01/2016	23:07:39	N 35° 2.9541'	E 20° 38.64438'	STATION 5	STATION	PHA							
19/01/2016	23:23:22	N 35° 3.03324'	E 20° 37.96644'			OPE	CTD	CTD	Begin	BEGIN	406CTD4	5	5_1
20/01/2016	0:12:53	N 35° 3.00816'	E 20° 38.02182'			OPE	CTD	CTD	Bottom	BOT	406CTD4	5	5_1
20/01/2016	1:50:32	N 35° 3.06216'	E 20° 38.03376'			OPE	CTD	CTD	End	END	406CTD4	5	5_1
20/01/2016	2:43:49	N 35° 2.99244'	E 20° 37.9959'			OPE	In Situ Pump	MCLANE	Begin	BEGIN	406MCLANE6	5	5_2
20/01/2016	4:35:04	N 35° 2.98638'	E 20° 37.98006'			OPE	In Situ Pump	MCLANE	End	END	406MCLANE6	5	5_2
20/01/2016	5:39:04	N 35° 2.99838'	E 20° 38.00604'			OPE	Multi Corer	MC12	Bottom	BOT	406MC124	5	5_3
20/01/2016	7:49:58	N 35° 3.00258'	E 20° 38.00376'			OPE	Pistoncorer	PC110	Bottom	BOT	406PC1103	5	5_4
20/01/2016	9:18:12	N 35° 2.96058'	E 20° 38.39316'	TRANSIT6	TRANSIT	PHA							
21/01/2016	0:21:55	N 34° 58.1496'	E 18° 6.78468'	STATION 6	STATION	PHA							
21/01/2016	0:30:47	N 34° 58.06368'	E 18° 5.29176'			OPE	Multibeam	EM302	Begin	BEGIN	406EM3023	6	6_1
21/01/2016	1:06:55	N 34° 58.18974'	E 18° 1.63644'			OPE	Multibeam	EM302	Course Change	COCH	406EM3023	6	6_1
21/01/2016	1:23:29	N 35° 0.03372'	E 18° 1.82292'			OPE	Multibeam	EM302	Course Change	COCH	406EM3023	6	6_1
21/01/2016	2:08:43	N 34° 55.9041'	E 18° 2.70366'			OPE	Multibeam	EM302	End	END	406EM3023	6	6_1
21/01/2016	2:15:33	N 34° 55.72398'	E 18° 2.73702'			OPE	CTD	CTD	Begin	BEGIN	406CTD5	6	6_2
21/01/2016	3:19:34	N 34° 55.72494'	E 18° 2.72094'			OPE	CTD	CTD	Bottom	BOT	406CTD5	6	6_2
21/01/2016	4:53:14	N 34° 55.7325'	E 18° 2.7495'			OPE	CTD	CTD	End	END	406CTD5	6	6_2
21/01/2016	6:07:28	N 34° 57.89124'	E 18° 2.3718'			OPE	Mooring	MOOR	Recovery	REC	406MOOR1	6	6_3
21/01/2016	6:11:19	N 34° 57.912'	E 18° 2.406'			OPE	Mooring	MOOR	Recovery	REC	406MOOR1	6	6_3
21/01/2016	6:12:39	N 34° 57.92034'	E 18° 2.41464'			OPE	Mooring	MOOR	Recovery	REC	406MOOR1	6	6_3
21/01/2016	8:24:11	N 34° 58.7967'	E 18° 2.13402'			OPE	Pistoncorer	PC110	Bottom	BOT	406PC1104	6	6_4
21/01/2016	12:12:14	N 34° 58.77078'	E 18° 2.12886'			OPE	Multi Corer	MC12	Bottom	BOT	406MC125	6	6_5
21/01/2016	13:35:00	N 34° 58.773'	E 18° 2.11878'			OPE	In Situ Pump	MCLANE	Begin	BEGIN	406MCLANE7	6	6_6
21/01/2016	15:10:55	N 34° 58.77708'	E 18° 2.14254'			OPE	In Situ Pump	MCLANE	End	END	406MCLANE7	6	6_6
21/01/2016	16:29:14	N 34° 58.7514'	E 18° 2.12172'			OPE	In Situ Pump	MCLANE	Begin	BEGIN	406MCLANE8	6	6_7
21/01/2016	21:19:42	N 34° 58.78578'	E 18° 2.1177'			OPE	In Situ Pump	MCLANE	End	END	406MCLANE8	6	6_7
21/01/2016	22:34:36	N 34° 58.77042'	E 18° 2.10588'			OPE	In Situ Pump	MCLANE	Begin	BEGIN	406MCLANE9	6	6_8
22/01/2016	3:54:14	N 34° 58.7622'	E 18° 2.13216'			OPE	In Situ Pump	MCLANE	End	END	406MCLANE9	6	6_8
22/01/2016	4:09:23	N 34° 58.7769'	E 18° 2.11392'			OPE	In Situ Pump	MCLANE	Begin	BEGIN	406MCLANE10	6	6_9
22/01/2016	10:37:01	N 34° 58.80246'	E 18° 2.15622'			OPE	In Situ Pump	MCLANE	End	END	406MCLANE10	6	6_9
22/01/2016	12:09:33	N 34° 57.82626'	E 18° 2.15538'			OPE	Mooring	MOOR	Deployment	DEP	406MOOR2	6	6_10
22/01/2016	12:10:36	N 34° 57.84576'	E 18° 2.1708'	TRANSIT7	TRANSIT	PHA							
23/01/2016	12:52:02	N 38° 21.92796'	E 16° 40.3638'	STATION 8	STATION	PHA							
23/01/2016	12:52:36	N 38° 21.98088'	E 16° 40.34412'			OPE	Multibeam	EM302	Begin	BEGIN	406EM3024	8	8_1
23/01/2016	13:47:00	N 38° 25.86984'	E 16° 38.10498'			OPE	Multibeam	EM302	End	END	406EM3024	8	8_1
23/01/2016	14:25:44	N 38° 24.89622'	E 16° 38.74056'			OPE	Pistoncorer	PC110	Bottom	BOT	406PC1105	8	8_2
23/01/2016	15:09:01	N 38° 24.83508'	E 16° 38.97006'	TRANSIT8	TRANSIT	PHA							
26/01/2016	1:04:37	N 38° 24.95838'	E 24° 49.1781'	STATION 9	STATION	PHA							
26/01/2016	1:08:32	N 38° 25.3779'	E 24° 49.3809'			OPE	Multibeam	EM302	Begin	BEGIN	406EM3025	9	9_1
26/01/2016	1:55:00	N 38° 28.50264'	E 24° 49.83618'			OPE	Multibeam	EM302	End	END	406EM3025	9	9_1

26/01/2016	2:00:49	N 38° 28.55724'	E 24° 49.91964'			OPE	CTD	CTD	Begin	BEGIN	406CTD6	9	9_2
26/01/2016	2:12:51	N 38° 28.5522'	E 24° 49.94274'			OPE	CTD	CTD	Bottom	BOT	406CTD6	9	9_2
26/01/2016	2:42:13	N 38° 28.5585'	E 24° 49.91316'			OPE	CTD	CTD	End	END	406CTD6	9	9_2
26/01/2016	3:43:12	N 38° 28.55994'	E 24° 49.93626'			OPE	Pistoncorer	PC110	Bottom	BOT	406PC1106	9	9_3
26/01/2016	4:29:00	N 38° 28.61124'	E 24° 50.09106'	TURNING1	TURNING	PHA							
26/01/2016	4:30:00	N 38° 28.70574'	E 24° 50.18358'	TURNING2	TURNING	PHA							
27/01/2016	10:12:58	N 40° 58.77018'	E 28° 53.61828'	CALL1	CALL	PHA							

Appendix 7, Nuts Si results

Sample number based on CTD bottle!

64PE406

ANAL	NIOZ NUTS 4Ch Si.ANL
RUN	160311-Si-64PE406_64PE407-RUN2R1.RUN
DATE	11-Mar-2016
TIME	09:19:06
OPER	SO
COMM	Recalculate from Run160311-Si-64PE406_64PE407-RUN2
METH	**Si**
UNIT	**µmol/L**
Sample ID	Results 1
64PE406 CTD Station 1	
406 CTD St1-1-23	0.800
406 CTD St1-1-21	0.791
406 CTD St1-1-19	0.787
406 CTD St1-1-17	0.837
406 CTD St1-1-15	1.095
406 CTD St1-1-13	1.924
406 CTD St1-1-11	4.703
406 CTD St1-1-09	7.962
406 CTD St1-1-07	9.199
406 CTD St1-1-05	9.332
406 CTD St1-1-03	9.175
406 CTD St1-1-01	9.075
64PE406 CTD Station 2	
406 CTD St2-1-22	0.742
406 CTD St2-1-17	0.887
406 CTD St2-1-16	1.086
406 CTD St2-1-15	1.744
406 CTD St2-1-14	2.737
406 CTD St2-1-13	5.073
406 CTD St2-1-12	6.712
406 CTD St2-1-11	7.911
406 CTD St2-1-10	8.521
406 CTD St2-1-09	8.762
406 CTD St2-1-08	9.164
406 CTD St2-1-07	9.246
406 CTD St2-1-06	9.173
406 CTD St2-1-05	9.084
406 CTD St2-1-04	8.999
406 CTD St2-1-03	8.939
406 CTD St2-1-02	8.896
406 CTD St2-1-01	8.944
64PE406 CTD Station 3	
406 CTD St3-1-23	0.949
406 CTD St3-1-22	1.208
406 CTD St3-1-21	1.253
406 CTD St3-1-19	2.094
406 CTD St3-1-17	2.767
406 CTD St3-1-16	3.582
406 CTD St3-1-15	4.596

406 CTD St3-1-14	5.440
406 CTD St3-1-13	6.750
406 CTD St3-1-12	7.788
406 CTD St3-1-11	8.247
406 CTD St3-1-10	8.800
406 CTD St3-1-09	8.875
406 CTD St3-1-08	8.987
406 CTD St3-1-07	9.088
406 CTD St3-1-06	9.096
406 CTD St3-1-05	8.980
406 CTD St3-1-04	8.877
406 CTD St3-1-03	8.835
406 CTD St3-1-02	8.836
406 CTD St3-1-01	8.678

64PE406 CTD Station 4

406 CTD St4-1-23	0.860
406 CTD St4-1-22	0.851
406 CTD St4-1-21	0.853
406 CTD St4-1-19	0.916
406 CTD St4-1-17	1.474
406 CTD St4-1-16	1.609
406 CTD St4-1-15	1.878
406 CTD St4-1-14	2.314
406 CTD St4-1-13	4.691
406 CTD St4-1-12	5.936
406 CTD St4-1-11	7.678
406 CTD St4-1-10	8.378
406 CTD St4-1-09	8.318
406 CTD St4-1-08	8.215
406 CTD St4-1-07	7.883
406 CTD St4-1-06	7.765
406 CTD St4-1-05	7.702
406 CTD St4-1-02	7.604
406 CTD St4-1-01	7.767

64PE406 CTD Station 5

406 CTD St5-1-23	0.829
406 CTD St5-1-21	0.832
406 CTD St5-1-19	0.894
406 CTD St5-1-17	1.234
406 CTD St5-1-15	2.198
406 CTD St5-1-13	5.648
406 CTD St5-1-11	7.673
406 CTD St5-1-09	8.302
406 CTD St5-1-07	7.531
406 CTD St5-1-05	7.461
406 CTD St5-1-03	7.506
406 CTD St5-1-01	7.579

64PE406 CTD Station 9

406 CTD St9-1-13	1.359
406 CTD St9-1-11	1.344
406 CTD St9-1-10	1.360
406 CTD St9-1-09	1.380
406 CTD St9-1-07	1.394

406 CTD St9-1-05	1.840
406 CTD St9-1-04	2.177
406 CTD St9-1-03	2.296
406 CTD St9-1-02	2.330
406 CTD St9-1-01	2.381

For Reference Only

Japan Reference Material

RMNS BY-1235 1DAY OPEN	1.759
RMNS BY-1235 1DAY OPEN	1.754
RMNS BY-1235 1DAY OPEN	1.745
RMNS BY-1235 1DAY OPEN	1.747
RMNS BY-1235 1DAY OPEN	1.746
RMNS BY-1235 1DAY OPEN	1.746

NIOZ Reference Cocktail

COCKTAIL1008X250	14.211
COCKTAIL1008X250	14.229
COCKTAIL1008X250	14.222
COCKTAIL1008X250	14.248
COCKTAIL1008X250	14.214
COCKTAIL1008X250	14.275
COCKTAIL1008X250	14.208
COCKTAIL1008X250	14.199
COCKTAIL1008X250	14.193
COCKTAIL1008X250	14.193
COCKTAIL1008X250	14.198
COCKTAIL1008X250	14.229
COCKTAIL1008X250	14.286
COCKTAIL1008X250	14.155
COCKTAIL1008X250	14.192
COCKTAIL1008X250	14.203

Appendix 8, Nuts N and P results

Sample number based on CTD bottle!

ANAL	LOW NUTS 4channel.ANL				
RUN	160311MED64PE406AR1.RUN				
DATE	11-3-2016				
TIME	10:50				
OPER	KB				
COMM	Recalculate from Run160311MED64PE406A.run				
METH	**PO4**	**NH4**	**NO3+NO2**	**NO2**	**NO3**
UNIT	**µmol/L**	**µmol/L**	**µmol/L**	**µmol/L**	**µmol/L**
64PE406 ST1-					
23	**0.006**	**0.20**	**0.03**	**0.008**	**0.019**
21	**0.002**	**0.18**	**0.03**	**0.006**	**0.020**
19	**0.003**	**0.22**	**0.06**	**0.020**	**0.040**
17	**0.003**	**0.16**	**0.25**	**0.097**	**0.157**
15	**0.017**	**0.18**	**1.07**	**0.014**	**1.054**
13	**0.039**	**0.16**	**2.35**	**0.009**	**2.336**
11	**0.153**	**0.15**	**4.97**	**0.007**	**4.959**
9	**0.230**	**0.19**	**6.22**	**0.005**	**6.215**
7	**0.235**	**0.17**	**5.96**	**0.002**	**5.959**
5	**0.214**	**0.20**	**5.55**	**0.003**	**5.549**
3	**0.203**	**0.19**	**5.35**	**0.003**	**5.351**
1	**0.194**	**0.15**	**5.12**	**0.006**	**5.109**
ST2-22	**0.002**	**0.16**	**0.00**	**0.006**	**0.000**
17	**0.006**	**0.12**	**0.50**	**0.020**	**0.481**
16	**0.011**	**0.16**	**1.18**	**0.011**	**1.165**
15	**0.024**	**0.11**	**2.10**	**0.009**	**2.089**
14	**0.066**	**0.14**	**3.35**	**0.009**	**3.345**
13	**0.162**	**0.12**	**5.15**	**0.006**	**5.142**
12	**0.208**	**0.14**	**5.85**	**0.004**	**5.848**
11	**0.231**	**0.15**	**6.16**	**0.000**	**6.158**
10	**0.235**	**0.13**	**6.16**	**0.003**	**6.160**
9	**0.226**	**0.13**	**5.97**	**0.001**	**5.964**
8	**0.227**	**0.14**	**5.75**	**0.003**	**5.749**
7	**0.209**	**0.13**	**5.47**	**0.002**	**5.465**
6	**0.203**	**0.16**	**5.32**	**0.002**	**5.316**
5	**0.193**	**0.13**	**5.19**	**0.004**	**5.187**
4	**0.190**	**0.25**	**5.13**	**0.003**	**5.124**
3	**0.181**	**0.23**	**5.15**	**0.003**	**5.144**
2	**0.181**	**0.19**	**5.06**	**0.005**	**5.051**
1	**0.178**	**0.22**	**5.12**	**0.005**	**5.114**
ST3-23	**0.000**	**0.12**	**0.02**	**0.005**	**0.010**

22	**0.001**	**0.13**	**0.40**	**0.028**	**0.371**
21	**0.003**	**0.15**	**0.25**	**0.023**	**0.231**
19	**0.012**	**0.13**	**2.03**	**0.031**	**1.994**
17	**0.048**	**0.12**	**3.16**	**0.011**	**3.151**
16	**0.113**	**0.14**	**4.20**	**0.008**	**4.191**
15	**0.145**	**0.13**	**4.91**	**0.006**	**4.901**
14	**0.180**	**0.13**	**5.35**	**0.004**	**5.347**
13	**0.212**	**0.12**	**5.82**	**0.004**	**5.815**
12	**0.224**	**0.12**	**5.96**	**0.002**	**5.961**
11	**0.227**	**0.14**	**5.97**	**0.003**	**5.969**
10	**0.228**	**0.13**	**5.92**	**0.002**	**5.913**
9	**0.212**	**0.13**	**5.80**	**0.003**	**5.797**
8	**0.217**	**0.14**	**5.68**	**0.001**	**5.674**
7	**0.209**	**0.13**	**5.55**	**0.005**	**5.549**
6	**0.202**	**0.20**	**5.42**	**0.004**	**5.416**
5	**0.193**	**0.14**	**5.21**	**0.004**	**5.204**
4	**0.187**	**0.21**	**5.17**	**0.005**	**5.164**
3	**0.182**	**0.13**	**5.07**	**0.005**	**5.062**
2	**0.181**	**0.20**	**5.09**	**0.004**	**5.086**
1	**0.179**	**0.15**	**5.05**	**0.005**	**5.045**
ST4-23	**0.002**	**0.12**	**0.10**	**0.019**	**0.078**
22	**0.002**	**0.13**	**0.10**	**0.019**	**0.084**
21	**0.000**	**0.13**	**0.10**	**0.017**	**0.087**
19	**0.003**	**0.13**	**0.27**	**0.025**	**0.247**
17	**0.027**	**0.30**	**1.79**	**0.015**	**1.771**
16	**0.028**	**0.17**	**1.88**	**0.013**	**1.868**
15	**0.038**	**0.13**	**2.13**	**0.012**	**2.121**
14	**0.063**	**0.15**	**2.77**	**0.012**	**2.761**
13	**0.145**	**0.12**	**4.79**	**0.007**	**4.779**
12	**0.196**	**0.22**	**5.46**	**0.008**	**5.448**
11	**0.213**	**0.14**	**5.80**	**0.006**	**5.797**
10	**0.211**	**0.14**	**5.59**	**0.003**	**5.590**
9	**0.184**	**0.13**	**5.32**	**0.003**	**5.316**
8	**0.183**	**0.16**	**5.15**	**0.002**	**5.150**
7	**0.166**	**0.15**	**4.96**	**0.005**	**4.951**
6	**0.167**	**0.18**	**4.98**	**0.005**	**4.974**
5	**0.158**	**0.18**	**4.91**	**0.003**	**4.906**
3	**0.156**	**0.15**	**4.81**	**0.004**	**4.807**
2	**0.155**	**0.16**	**4.79**	**0.002**	**4.789**
1	**0.162**	**0.13**	**4.90**	**0.006**	**4.898**
ST5-23	**0.006**	**0.10**	**0.02**	**0.008**	**0.012**
21	**0.004**	**0.12**	**0.04**	**0.009**	**0.028**
19	**0.003**	**0.12**	**0.37**	**0.024**	**0.346**
17	**0.013**	**0.13**	**1.55**	**0.011**	**1.537**
15	**0.058**	**0.15**	**3.28**	**0.005**	**3.272**

13	**0.193**	**0.13**	**5.53**	**0.008**	**5.519**
11	**0.213**	**0.16**	**5.75**	**0.001**	**5.744**
9	**0.195**	**0.17**	**5.34**	**0.001**	**5.340**
7	**0.168**	**0.13**	**4.88**	**0.004**	**4.880**
5	**0.157**	**0.18**	**4.82**	**0.005**	**4.815**
1	**0.157**	**0.18**	**4.79**	**0.008**	**4.784**
ST9-13	**0.006**	**0.14**	**0.44**	**0.084**	**0.359**
11	**0.010**	**0.13**	**0.63**	**0.073**	**0.552**
10	**0.012**	**0.16**	**0.68**	**0.082**	**0.594**
9	**0.010**	**0.15**	**0.76**	**0.088**	**0.671**
7	**0.017**	**0.19**	**0.84**	**0.097**	**0.738**
5	**0.044**	**0.18**	**1.82**	**0.029**	**1.793**
4	**0.064**	**0.18**	**2.21**	**0.010**	**2.200**
3	**0.067**	**0.17**	**2.27**	**0.009**	**2.265**
2	**0.074**	**0.20**	**2.32**	**0.013**	**2.307**
1	**0.077**	**0.16**	**2.34**	**0.011**	**2.332**
RMNS BY	**0.032**	**1.29**	**0.04**	**0.027**	**0.010**
RMNS BY	**0.032**	**1.29**	**0.04**	**0.027**	**0.014**
COCK1008X250	**0.878**	**0.09**	**13.90**	**0.002**	**13.898**
COCK1008X250	**0.888**	**0.09**	**13.91**	**0.004**	**13.907**
COCK1008X250	**0.896**	**0.09**	**13.92**	**0.003**	**13.915**