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Fischer, G., M. Ba, K. Dehning, J. Hefter, M. Iversen, M. Klann,
N. Nowald, H. Ploug, G. Ruhland, Y. Witte

REPORT AND PRELIMINARY RESULTS OF
R/V POSEIDON CRUISE POS445
Las Palmas – Las Palmas, 19.01.2013 – 01.02.2013

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1. Narrative *(Gerhard Fischer)*

Short cruise report

RV Poseidon left the port of Las Palmas, Gran Canaria, Spain, on January 19th, 2013 at 8:30 pm heading in southwesterly direction to the study area off Cape Blanc, Mauritania (Fig. 1). We planned to perform optical, microbial, biological and geochemical studies of the water column as well as atmospheric studies. Additionally, the exchange of two long-term sediment trap moorings off Cape Blanc (CB and CBi) was scheduled which were deployed during RV Poseidon cruise 425 in January 2012. Furthermore, we intended to deploy a dust-collecting large surface buoy with a 4500 m long deep-moored array close to the mooring CB. We also planned to deploy 2-3 drifting arrays with cylindrical traps in the eutrophic area around site CBi for a few days. Additionally, a particle camera was planned to be launched to measure the distribution and size of marine snow aggregates and other larger particles. These studies were accompanied by roller tank incubation experiments with artificial marine snow aggregates and diatoms. On the way, we sampled mineral dust by large volume filtration using standard dust samplers on the observation deck of the ship. On board the cruise were seven scientists from the University of Bremen (Marum and GeoB), one scientist from the University of Gothenburg (Sweden) and one from the NIOZ (Texel, NL). An observer from Mauritania (IMROP, Nouadhibou) joined the cruise.

During Monday, January 19th, we could deploy the 4500 m long array where the dust buoy was attached to. The buoy deployed close to the long-term mesotrophic sediment trap site CB was equipped with weather instruments and a rotation sampler with 24 filters for the collection of Saharan mineral dust. The next day was reserved for the recovery of the near-by sediment trap mooring array (mesotrophic site CB-23) with two sediment traps of which each had collected a full sample set. Both traps indicated elevated fluxes in winter-springtime, mainly in 2012 after a large dust storm (see report POS 425, Fischer et al. 2012). In the late afternoon, we could redeploy the array with a similar configuration. This sediment trap site has now been served since 1988 with only a short interruption due to logistic reasons.

We then sailed about 125 nm in easterly direction to the eutrophic sediment trap site CBi-10 for water column studies and the exchange of the sediment trap mooring. Due to increasingly bad weather conditions with winds of up to 8 Bft. we continued sailing with a 110 course to the Mauritanian shelf at the 200 m depth contour line. We were able to collect waters from the chlorophyll maximum (ca. 25 m, up to 2 mg Chl mg^{-3}) with the rosette-CTD in the evening of January 23rd for *in situ*-incubations with diatom-rich plankton. Weather conditions remained bad with rough seas and a cross swell in the order of 5 meters during the next day, thus preventing station work. On Friday, January 25th, we were able to deploy the rosette-CTD in about 1500 m and

2100 m water depth and acquire a particle camera profile down to ca. 2000 m. During the night, we sailed approx. 25 nm to the west reaching the depth contour line of about 3200 m, about 15 nm west of the eutrophic mooring site CBi. We conducted a ParCa profile for particle distribution and oceanographic parameters down to 3150 m. On Saturday, January 26th, still at rough weather conditions (6-7 Bft.), we could recover the ca. 1800 m long mooring array CBi-10 equipped with a Multi-Sensor-Platform (MSP) with a ACP (Acoustic Current Profiler), a CTD and a video camera system, the latter monitoring particle size classes and concentrations over an annual cycle. At this eutrophic site, two sediment traps, one with 40 sampling cups were deployed since 2003 to study particle sedimentation. Both traps had worked perfectly.

Station work was followed by the deployment of a 400 m long drifting array DF-5 with three cylindrical traps in 100 m, 200 m and 400 m to study particle formation and degradation and particle settling rates (combined with ParCa profiles) in the epi- and mesopelagic. Each trap consisted of four sampling cylinders, with one filled with special gels to conserve larger and fragile marine snow aggregates. Water sampling continued with two rosettes-CTD's and one ParCa down to about 2600 m. During the following night, we sampled suspended particles in the upper water column with four *in situ*-pumps equipped with different filter pore sizes. On early Sunday morning, January 27th, we recovered the drifting array DF-5 after one night of sedimentation, potentially influenced by zooplankton upward migration and subsequent particle feeding and degradation. After the deployment of a rosette-CTD, another drifting array DF-6 was deployed on late Sunday afternoon, followed by the launching of a ParCa down to 1000 m. We moved back the eutrophic sediment trap site CBi-10 to install the *in situ*-pumps for the sampling of the deeper water column overnight. In the early Monday, January 28th, after recovering the four *in situ*-pumps, we searched for the drifting array DF-6 about 4 nm south and acquired a particle camera profile there. Now the weather conditions improved and wind decreased down to 4-5 Bft., followed by a decrease of the swell. Therefore, we made the successful deployment of the eutrophic mooring CBi-11 equipped with two sediment traps and the platform (MSP) in about 1.5 hours. Close to the position of the drifting array DF-6, a multinet was launched to sample zooplankton (day haul) before picking up DF-6 which provided us with excellent samples of intact marine snow aggregates, again from three depths levels. Around 18:15, we started our passage back to Las Palmas which we reached - due to unexpected favourable weather and wind conditions - in the afternoon of Thursday, January 31st.

In total, we worked on 13 stations in a ca. W-E-transect off Cape Blanc, Mauritania, deploying and recovering four long-term moorings and four drifting arrays. Additionally, we could deploy a 4500 m long array with the dust buoy, sampling dust deposition in the ocean over an annual cycle. The other deployments were: multinet (2x), ParCa-Pro-CTD (6x), rosette-CTD (8x) and the *in situ*-

pumps (3x), in total 28 deployments (see station list attached). On the way, water samples were taken by the ship's pumping systems and dust was sampled using two large dust collectors on the observation deck. We could fulfil most of the planned station work and had a successful cruise, even having continuously rough weather conditions and problems with the automatic steering system of the ship.

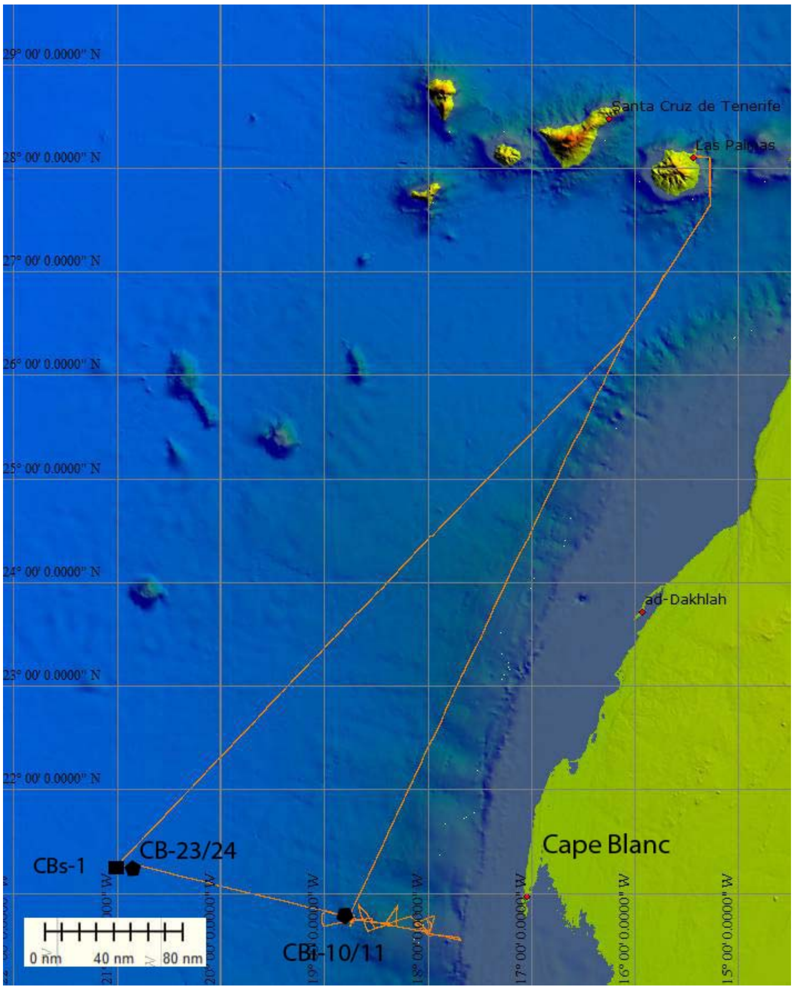


Fig. 1. Track of RV Poseidon cruise 445 (Las Palmas – Las Palmas, 19.1. - 1.2.2013) with the two long-term mooring sites CB (mesotrophic) and CBi (eutrophic). Additionally, a dust buoy attached to a 4500 m long mooring array (CBs-1) was deployed for the seasonal collection of Saharan dust particles settling into the ocean.

2. Preliminary Results

2.1. Atmospheric Sciences

2.1.1. Deployment of the dust-collecting buoy *(Yvo Witte and Götz Ruhland)*

One of the deployments which took place during the Poseidon cruise was the deployment of a surface buoy. This buoy is the result of collaboration between NIOZ and MARUM (J.B. Stuut and G. Fischer) and funded by a MARUM-incentive project as well as part of the NWO-project “TRAFFIC”, and the ERC-project “DUSTTRAFFIC”, all dealing with the transatlantic transport and deposition of Saharan dust. The data resulting from this buoy shall also be used for the MARUM cross-cutting project CCP1. The buoy has a dust-collecting carousel with 24 filters, which rotates on a prescribed time interval similar do the near-by sediment trap mooring CB. If the weather- and sea-state are observed to be right, air is pumped through a filter for 2 hours per day. This way, Saharan dust is sampled from the atmosphere on the same temporal resolution as the sediment traps deployed off Cape Blanc (mesotrophic site CB-24, see Table 11). This sampling scheme will also be synchronised with the ongoing dust collection both in the ocean as well as at the surface along the transatlantic transect at 12°N from Cape Verde to Barbados (the TRAFFIC and DUSTTRAFFIC projects).

The deployment of the buoy took place in the afternoon of January 21st, 2013, around 210 nm west off Cape Blanc, Mauritania (Fig. 2). First, a 4500 m long mooring line was deployed in a water depth of about 4235 m. Having this done, the buoy was attached to the line anchored at 4235 m water depth. The beacon on top makes contact with a satellite a few times a day to report its absolute position. Dust sampling started on 28 January 2013. The projects associated with the dust-collecting buoy currently continue until 2015, until which date ship time has already been secured. It is envisaged to continue the dust collection using buoys and sediment traps after 2015. Over the next few years, the Cape-Blanc buoy will be annually serviced by the NIOZ/MARUM team. This will happen for the first time in November 2013, with the Dutch research vessel RV Pelagia.

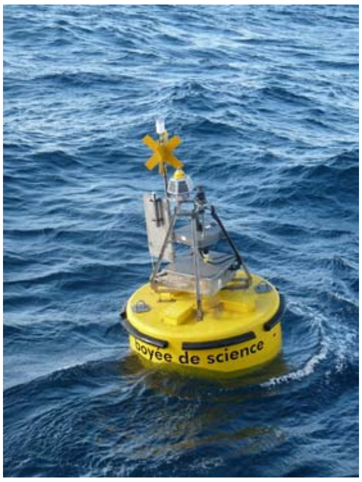


Fig. 2. Dust buoy deployed about 210 nm off Cape Blanc and equipped with instruments for atmospheric measurements (wind direction, wind strength, rain etc.) and the carousel with rotating filters (24) for the seasonal sampling of Saharan dust deposition. Diameter of the buoy is about 5 m.

2.1.2. Sampling of eolian dust *(Jens Hefter and Marco Klann)*

Marine sediments can contain significant and varying amounts of terrigenous materials derived from eolian and fluvial sources as well as from lateral input of resuspended and reworked material from the shelf. One of the targets of the cruise was therefore the sampling of eolian dust derived from the adjacent Saharan desert for (1) inorganic (i.e. mineralogical and grain size composition) and (2) organic geochemical analyses. The results of these analyses will provide a modern framework for the determination of e.g. the past degree of aridity and change of continental climate in the respective source area from marine sediment records. On-shore organic geochemical analyses will focus on plant-wax-derived, long-chain *n*-alkanes, as the carbon and hydrogen isotopic composition of these compounds can carry environmental-specific signals on the type of vegetation cover (C_3/trees vs. C_4/grass plants; $\delta^{13}C$) and precipitation regime (δD) in the source regions.

Separate sampling for inorganic and organic analyses was carried out with two independent dust collectors equipped with cellulose and precombusted glassfiber filters, respectively. The dust samplers were permanently installed on the ships observation deck (Fig. 3). A wind vane with a sensor covering an angle from 270° to 90° relative to the ships heading direction was used to interrupt sampling in case of winds astern from the ship to avoid contamination from the ships chimney (Fig. 3). Eight samples of each type of filter (organic and inorganic geochemical analysis) were taken during transit times and station work (Table 1).

Fig. 3. Change of large filters for the sampling of eolian dust at the observation deck of RV Poseidon (photo from POS cruise 425).

Table 1. List of dust samples collected during POS 445.

Filter No.		Date 2013	Time UTC	Position		Ship		Wind	
				Long (°W)	Lat (°N)	Heading	Knots	Direction (rel.)	Speed (m/s)
1	Start	21. 01.	8:47	20°34.497	21°42.875	219	9.8	238	10.08
	Stop	22. 01.	18:23	20°49.310	21°16.510	104	8.0	321	11.06
2	Start	22. 01.	18:46	20°46.281	21°15.770	105	8.0	318	11.11
	Stop	23. 01.	20:55	17°41.296	20°33.317	318	2.0	10	12.91
3	Start	23. 01.	20:55	17°41.296	20°33.317	318	2.0	10	12.91
	Stop	24. 01.	19:28	18°01.772	20°39.727	318	6.5	50	14.01
4	Start	24. 01.	19:28	18°01.772	20°39.727	318	6.5	50	14.01
	Stop	25. 01.	18:31	18°32.789	20°44.077	24	0.8	2	13.22
5	Start	25. 01.	18:31	18°32.789	20°44.077	24	0.8	2	13.22
	Stop	26. 01.	19:16	18°42.991	20°47.225	0	1.2	357	11.73
6	Start	26. 01.	19:16	18°42.991	20°47.225	0	1.2	357	11.73
	Stop	27. 01.	18:52	18°49.146	20°43.957	33	1.1	355	11.01
7	Start	27. 01.	19:10	18°44.048	20°44.120	37	0.9	355	10.39
	Stop	28. 01.	19:07	18°44.622	20°49.318	30	7.1	359	6.43
8	Start	28. 01.	19:07	18°44.622	20°49.318	30	7.1	359	6.43
	Stop	30. 01.	08:53	16°42.305	25°07.265	21	7.2	32	7.36

2.2. Marine Microbiology

2.2.1 Experimental studies on the biological carbon pump *(Morten Iversen and Helle Ploug)*

Diatom blooms and subsequent aggregate formation play a significant role in the biological carbon sequestration by the ocean and export of fixed CO_2 as organic matter to the deep ocean and sediments, i.e., the biological carbon pump. This project aims at new understanding and quantification of the processes controlling aggregate formation, and degradation in chain-forming diatoms using novel techniques. Combining microsensor and nanoscale Secondary Ion Mass Spectrometry (nanoSIMS) techniques we will aim to directly quantify:

- the degradation rates of diatom aggregates and transfer of carbon and nutrients from aggregates to attached and free-living bacteria, respectively,
- to which extent motile bacteria can cover their carbon and nutrient demand by exploitation of ephemeral nutrient patches associated with sinking aggregates.

Aggregation and degradation processes

Sea water from the depth of fluorescence maximum (F-max, 13 m depth) at station GeoB 17103-1 was incubated in roller tanks to study its aggregation potential and the degradation rates of aggregated material. We measured size, sinking velocity and O_2-fluxes to the aggregates using O_2-microsensors and a flow system for sinking velocity measurements. The aggregate sizes varied between 0.5 mm and 2.0 mm whereas their sinking velocities varied between 50 m d^{-1} and 200 m d^{-}

[1]. Samples to measure DOC production and nutrients were furthermore collected from the bulk as well as from aggregates which were incubated individually in rotating vials. For this purpose, we constructed a special incubator on board the ship. Aggregates were afterwards fixed with paraformaldehyde, washed, and filtered onto GTTP filters for later examination of attached bacteria. Water from the chlorophyll maximum (F-max: 13 m depth) was filtered at the same station for later construction of clone libraries and construction of probes to identify the bacteria attached on aggregates.

Colonization and degradation of fresh organic nutrient sources

We added tracers of axenic diatoms, *Skeletonema costatum* (Fig. 3) labeled with ^{13}C and ^{15}N to sea water from the chlorophyll-fluorescence maximum (F-max= 18 m depth) and to water from 400 m depth at station GeoB 17108-3. The water was subsequently incubated in roller tanks to study its aggregation potential and the degradation rates of aggregated material as described above.

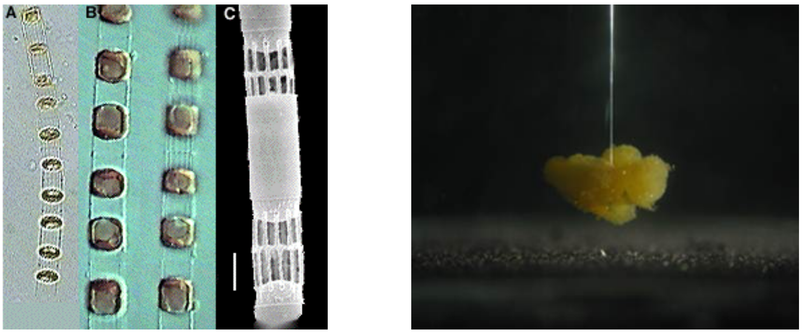


Fig. 3. The diatom *Skeletonema costatum*, (Photo: SMHI) (left)

The vertical flow system in which size, sinking velocity, and O_2 fluxes to (diatom-) aggregates can be measured simultaneously (right)

(from Ploug and Jørgensen, 1999).

During time series, we furthermore sampled aggregates and water which were fixed with PFA, washed and filtered onto GTTP filters for later analysis using secondary ion mass spectrometry (HISH-nanoSIMS) to simultaneously determine identity and activity of attached bacteria (Musat et al., 2008, 2010). Additionally, we filtered water GTTP filters to construct a clone library from 13 m, 400 m, and 800 m water depth.

2.3. Marine Zoology

2.3.1 Mesozooplankton collected with the multinet

(Marco Klann, Morten Iversen and Gerhard Fischer)

We used a multiple net from HYROBIOS, Kiel, fitted with five nets of 200µm mesh size to sample mesozooplankton in various depth ranges from the water column in the Cape Blanc area. We used standard collection depths of 1000-600, 600-300, 300-150, 150-80 and 80-0 m (Table 2). Due to rough seas and windy weather conditions almost throughout the cruise, only two profiles were successfully taken and enough material was collected to analyse species, numbers and distribution of important zooplankton species in the water column. We planned to perform day-and-night hauls to account for dial vertical migration of the various species. Together with plenty of hauls during Poseidon cruise 425 in January 2012, we plan to investigate the importance of zooplankton (e.g. copepods, euphausiids, appendicularia) for particle degradation in the upper water column, mainly in the epi- and mesopelagic.

Table 2. Samples taken with the multiple plankton net (multinet, MN) equipped with nets of 200 µm mesh size. Standard sampling depths with the five nets were: 1) 1000-600, 2) 600-300, 3) 300-150, 4) 150-80 and 5) 80-0 m.

Station No.	**Date**	**Time**	**Latitude**	**Longitude**	**Water depths**	**Remarks**
GeoB-No.	**2013**	**MN at depth**				
		UTC	**N**	**W**	**m**	
17102-1	21.1.	18:41	21°15,83’	20°54,38’	4174	Standard
17113-1	28.1.	16:33	20°42,11’	18°44,86’	2779	Standard

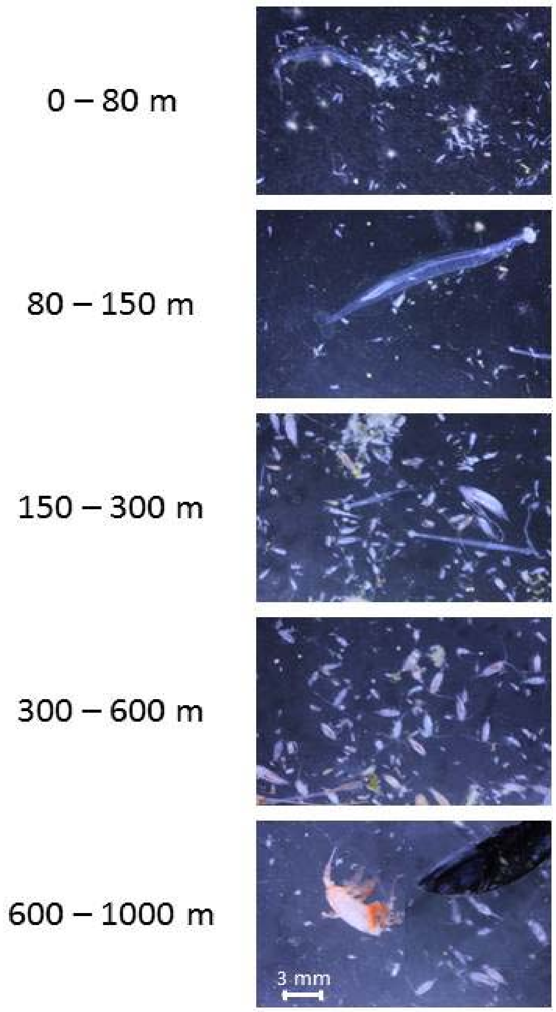


Fig. 4. Haul with the multinet at site GeoB 17113-1 (trap site CBi-10/11). (scale bar in e:)
a: the net haul between 80 and 0 m shows a dominance of small calanoid copepods. Further, though not zooplankton, we collected high abundance of puff colonies of the cyanobacteria *Trichodesmium* sp..

b: between 150 and 80 m small copepods continued to dominate the zooplankton. Additionally, large chaetognatha started to appear and the cyanobacteria were absent.

c: between 300 and 150 m chaetognatha and large calanoid copepods were abundant together with small calanoid copepods.

d: the depths between 600 and 300 m were similar to the depth between 300 and 150 m (c) , though the small calanoid copepods seemed less and the large calanoid copepods more abundant.

e: between 1000 and 600 m very large calanoid copepods, amphipods, and small fish were collected. Generally, the abundance of calanoid copepods was low, with a dominance of large individuals.

During the day plankton net haul using the multinet, we observed a vertical distribution of the zooplankton organisms with a dominance of small calanoid copepod species in the upper 80 m of the water column and a gradual increase in species and a decrease zooplankton abundance with increasing water depths. At depths between 80 and 150 m, carnivorous predators such as chaetognatha appeared and the abundance of small calanoid copepods decreased. At depths between 150 and 600 m, we observed an increase abundance of large calanoid copepods and at depths below 600 m we observed the presence of both fish larvae and amphipods.

2.4. Organic Biogeochemistry

2.4.1. Composition, alteration, lateral transport and sources of particulate organic matter *(Jens Hefter)*

Organic matter compositions from sediment traps as well as core tops document relationships and interactions between marine production, particulate organic matter (POM) flux and composition and final burial in sediments. Recent studies, however, emphasize that lateral transport (advection) and alteration/degradation of POM in the water column have an additional strong imprint on the POM flux. Results from POM samples of the study area taken in previous years during several expeditions (MSM 11-2/2009, POS 396/2010, MSM 18-1/2011, POS 425/2012) have indicated significant variations in the composition and abundance of lipid biomarkers and Intact Polar Lipids (IPL´s) of POM throughout the water-column, especially in the Bottom and Intermediate Nepheloid Layers (BNL, INL) and in comparison to particles from the over-/underlaying waters.

Table 3. Particulate organic matter (POM)-samples taken with *in situ*-pumps (ISP), two stacked filters (0.7 and 0.4 µm) at each depth.

GeoB No.	Date 2013	Lat N [1]	Long W [1]	sampling depth m	volume filtered l
17102-4	21. 01.	21° 15,83	20° 54,34	40	638.73
17102-4	21. 01.	21° 15,83	20° 54,34	150	958.67
17102-4	21. 01.	21° 15,83	20° 54,34	400	1022.30
17102-4	21. 01.	21° 15,83	20° 54,34	1000	958.67
17108-6	27. 01.	20° 47,23	18° 42,99	40	559.88
17108-6	27. 01.	20° 47,23	18° 42,99	100	627.56
17108-6	27. 01.	20° 47,23	18° 42,99	200	8.0[2]
17108-6	27. 01.	20° 47,23	18° 42,99	400	958.67
17110-1	27. 01.	20° 47,20	18° 42,94	800	1332.76
17110-1	27. 01.	20° 47,20	18° 42,94	1600	1135.98
17110-1	27. 01.	20° 47,20	18° 42,94	2000	1319.99
17110-1	27. 01.	20° 47,20	18° 42,94	2350	986.16

[1]position when final depth was reached [2]pump failure

To complement and confirm these previous results, POM-samples from different water depths were collected during this cruise using various collection devices. Large volumes of water samples (up to ca. 1300 l, Table 3) were directly filtered with four *in situ*-pumps (ISP, McLane Large Volume

Water Transfer System, WTS-LV-4/-8) on 142 mm GF/F filters. In order to obtain information for a possible effect of size fractionation on the lipid composition, we employed for the first time a sequential filtration by using a stack of filters (0.7 and 0.4 µm pore size) with the ISP´s.

A first visual comparison of the two different size fractions collected on the filters within the size fraction from 0.4 to 0.7 µm indicated that additional sample material could be obtained, that otherwise would have escaped later on-shore analysis (Fig. 5).

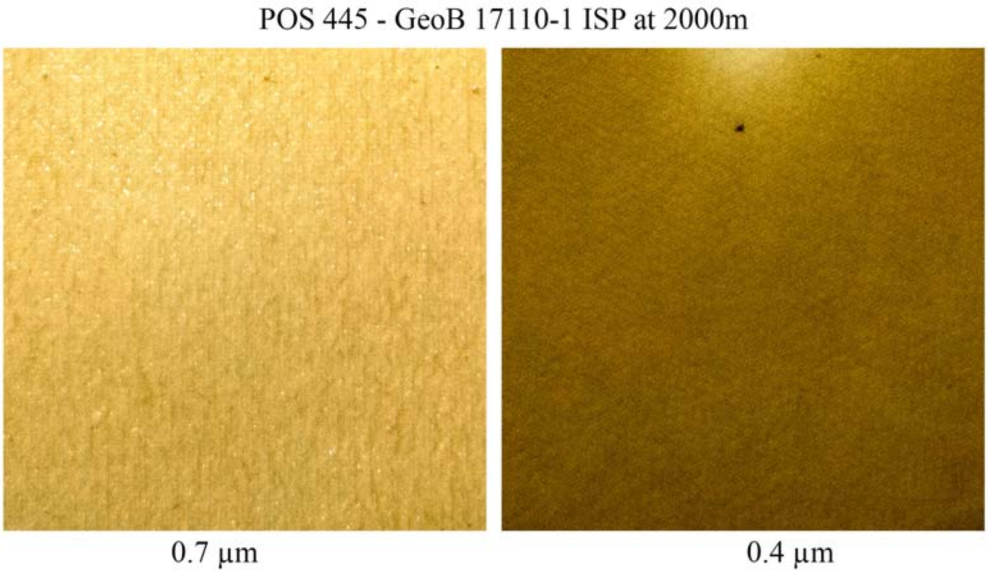


Fig.5. Examples for particulate material collected with an *in situ*-pump (ISP) using stacked filters of different pore sizes (0.7 and 0.4 µm). Pictures show a ca. 5x5 cm area of each filter. Filtered water volume was about 1320 l.

Additional POM-samples were collected from water taken from the 10 l-Niskin-bottles of the CTD-rosette system and subsequent hand-filtration on 142 mm / 0.7 µm GF/F filters (Table 4). In order to obtain larger volumes, several bottles (3-5) filled at the same water depths were combined. Supplementary surface water samples (ca. 2.5 m, Table 5) from various day- and night-times were obtained using the ship´s seawater inlet system and direct filtration on 142 mm / 0.7 µm GF/F filters. In order to obtain information on the microbial community structure at the genetic level, subsamples from Niskin-bottles (1-5 l, Table 6) were filtered using 47 mm / 0.22 µm polycarbonate filter for on-shore DNA-analyses.

Table 4. Particulate organic matter (POM)-samples taken with Niskin bottles, on-board filtration (0.7 µm).

GeoB No.	**Date 2013**	**Lat N [1]**	**Long W [1]**	**sampling depth m**	**volume filtered l**
17103-1	23. 01.	20° 33,26	17° 41,21	18	26.0
17104-1	24. 01.	20° 37,14	17° 59,37	40	26.9
17104-1	24. 01.	20° 37,14	17° 59,37	400	54.0
17104-1	24. 01.	20° 37,14	17° 59,37	740	24.4
17105-1	25. 01.	20° 42,01	18° 23,05	24	44.5
17105-1	25. 01.	20° 42,01	18° 23,05	1500	31.0
17106-1	25. 01.	20° 44,09	18° 32,79	40	28.1
17106-1	25. 01.	20° 44,09	18° 32,79	300	46.7
17106-1	25. 01.	20° 44,09	18° 32,79	1350	34.0

[1]position when final depth was reached

Table 5. Particulate organic matter (POM)-surface water samples (ca. 2.5 m), on-board filtration (0.7 µm).

related station	**Date 2013**	**Time UTC**	**Lat N [1]**	**Long W [1]**	**volume filtered l**
GeoB 17102	21. 01.	10:30	21° 15,82	20° 54,31	74
transit	22. 01.	15:00	21° 16,04	20° 51,77	60
transit	22. 01.	16:30	21° 16,04	20° 51,77	101*
transit	22. 01.	17:15	21° 16,93	20° 50,31	96
transit	23. 01.	14:25	20° 42,08	18° 23,48	83
transit	23. 01.	19:40	20° 34,20	17° 46,69	69
standby	24. 01.	12:20	20° 42,98	18° 6,69	80
transit	25. 01.	12:10	20° 46,84	18° 18,33	71.68*
GeoB 17108	26. 01.	15:00	20° 46,61	18° 43,69	55
GeoB 17108-6	27. 01.	0:45	20° 47,22	18° 42,99	75
GeoB 17112-1	28. 01.	14:30	20° 46,49	18° 44,25	93

* filtered with 0.4µ

Table 6. Water samples taken with Niskin bottles, on-board filtration (0.22 µm) for DNA analysis.

GeoB No.	**Date 2013**	**Lat N [1]**	**Long W [1]**	**sampling depth m**	**volume filtered l**
17102-3	21. 01.	21° 15,83	20° 54,35	40	2.5
17102-3	21. 01.	21° 15,83	20° 54,35	150	5.0
17102-3	21. 01.	21° 15,83	20° 54,35	400	5.0
17102-3	21. 01.	21° 15,83	20° 54,35	1000	5.0
17104-1	24. 01.	20° 37,14	17° 59,37	40	1.5
17104-1	24. 01.	20° 37,14	17° 59,37	400	3.0
17104-1	24. 01.	20° 37,14	17° 59,37	740	3.0
17105-1	25. 01.	20° 42,01	18° 23,05	24	1.5
17105-1	25. 01.	20° 42,01	18° 23,05	1500	2.5
17106-1	25. 01.	20° 44,09	18° 32,79	40	1.0
17106-1	25. 01.	20° 44,09	18° 32,79	300	3.0
17106-1	25. 01.	20° 44,09	18° 32,79	1350	2.9
17108-4	26. 01.	20° 47,25	18° 42,97	40	1.5
17108-4	26. 01.	20° 47,25	18° 42,97	100	3.5
17108-4	26. 01.	20° 47,25	18° 42,97	200	4.5
17108-4	26. 01.	20° 47,25	18° 42,97	400	4.5
17108-4	26. 01.	20° 47,25	18° 42,97	800	4.0
17108-4	26. 01.	20° 47,25	18° 42,97	1000	4.3
17108-4	26. 01.	20° 47,25	18° 42,97	1400	4.5
17108-4	26. 01.	20° 47,25	18° 42,97	1600	4.0
17108-4	26. 01.	20° 47,25	18° 42,97	1800	4.5
17108-4	26. 01.	20° 47,25	18° 42,97	2000	4.5
17108-4	26. 01.	20° 47,25	18° 42,97	2350	4.5
17108-4	26. 01.	20° 47,25	18° 42,97	2600	4.5

[1]position when final depth was reached

All filters were stored frozen (-20°C) on board immediately after recovery and transported frozen back to the home laboratory for future analyses. These will include organic matter/lipid extraction, separation of distinct compound classes (e.g. fatty acids, archaebacterial GDGT´s, intact polar lipids / IPL´s, etc.) and compound identification / quantification by using gas chromatography (GC), gas chromatography / mass spectrometry (GC/MS) as well as liquid chromatography / mass spectrometry (HPLC/MS).

2.5. Optical studies

2.5.1. Particle abundance and particle size spectra acquired with the profiling camera system ParCa-Pro *(Nico Nowald)*

System description

ParCa-Pro (Fig. 6) is a vertically profiling camera system for the optical acquisition of particulate matter in the water column. ParCa-Pro consists of a Kodak ProBack, 16 Megapixel digitalisation device mounted behind the optics of an analogue Photosea, 60 mm middle format camera. A strobe, mounted perpendicular to the optical axis of the camera provides a collimated light beam of 12 cm width, illuminating a sample volume of 12 l of seawater.

Fig. 6. Profiling particle camera system *ParCa-Pro* during a deployment. One the right side of the frame, the CTD-oxygen-chlorophyll-fluorescence and turbidity profiler can be recognized.

The camera is equipped with a micro controller and a SBE 36 telemetry unit for full control during the deployment via the ships coaxial wire. The camera is triggered at given depth intervals, usually 10 m, by the pressure sensor of a SBE-19-CTD, that collects oceanographic data during the deployment of the camera. ParCa-Pro can be deployed to a depth of 4000 m. The system is powered by a 24V/38Ah DSPL battery and overall weight of the system is 250 kg. A detailed station list of ParCa-Pro deployments along Poseidon cruise 445 is given in Table 7.

Table 7. List of ParCa-Pro profiling stations. A CTD-chlorophyll-oxygen-turbidity probe (#2069, Marum) was attached to the ParCa-Pro system (see chapter 2.6.1).

Number	**GeoB #**	**Date 2013**	**Deploy. time at depth UTC**	**Lat**	**Long**	**Water depth m**	**Profiling depth/ wire length m**	**Drifting trap#**
1	17102-2	21.1.	20.46	21°15.82N	20°54.39W	4181	1000	
2	17106-2	25.1.	21:23	20°44.09N	18°32.78W	2069	1980	
3	17107-1	26.1.	09:53	20°49.81N	19°00.02W	3185	3150	
4	17108-5	26.1.	23:08	20°47.23N	18°42.97W	2670	2600	DF 5 deployment
5	17109-4	27.1.	20:41	20°44.15N	18°44.05W	2804	1000	DF 5 recovery, DF 6 deployment
6	17111-1	28.1.2013	09:38	20°42.84N	18°44.44W	2769	1000	DF 6 recovery

Preliminary results

ParCa-Pro was deployed on 6 stations (Fig. 7) to acquire abundances and sizes of marine particles in the water column. The datasets are applied to model particle fluxes and degradation rates of organic matter. The concentration profiles are also used to locate suitable sampling depths, like distinct particle maxima, for the CTD-Rosette and the *in situ*-pumps. Four camera profiles were deployed along an East-West transect to track changes in the particle concentration with decreasing distance to the coast. Particle profiles were also acquired at stations where the free drifting traps (see Table 7) where deployed and recovered. The camera data will be used to calculate particle fluxes that will be compared with flux rates derived from the drifting traps (chapter 2.7.1).

The ParCa profiles GeoB 17102-1, GeoB 17107-1, GeoB 17108-5 and GeoB 17106-2 were acquired along an East-West transect in water depths between 4000 m (GeoB 17102-1) and 2000 m (GeoB 17106-2) (Fig. 8). Due to the high amount of particulate matter in the water column that caused strong reflections of the strobes light, images taken in the first 80 m were over-exposed and could not be used for the analysis. In the concentration profiles of station GeoB 17107-1 and GeoB 17108-5, a subsurface particle maximum is seen in water depths of 250 m and 350 m, respectively. This particular maximum was also detected in camera station GeoB 17106-2 in 300 m depth, but is not visible in the plot due to the high particle count in this profile and the resulting scaling of the x-axis. It is also not seen in the most western camera station, GeoB 17102-1. The signal may be caused by material that is laterally advected from the coast towards the open ocean and it is most likely, that it does not reach the most distal site of the camera transect. The most prominent signal in the concentration profiles however, is located in water depths between 1000 m and 1700 m. A huge midwater particle maximum was detected in all profiles except GeoB 17102-1, because of its profiling depth of only 1000 m. This particular midwater maximum was detected during several previous cruises in the past (POS 365, 396 and 402). The signal is most likely created by the lateral advection of material from the continental slope towards the open ocean.

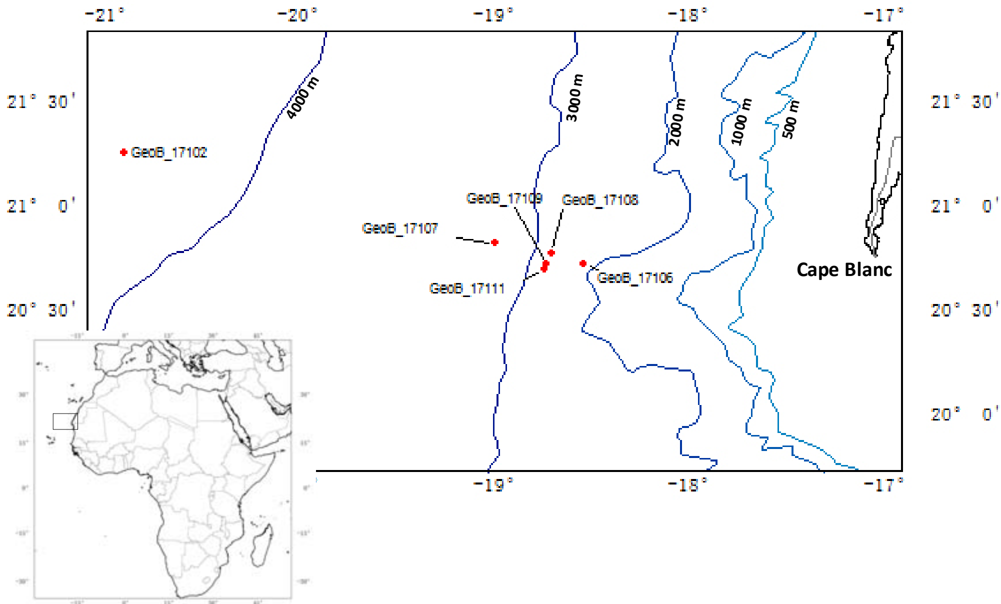
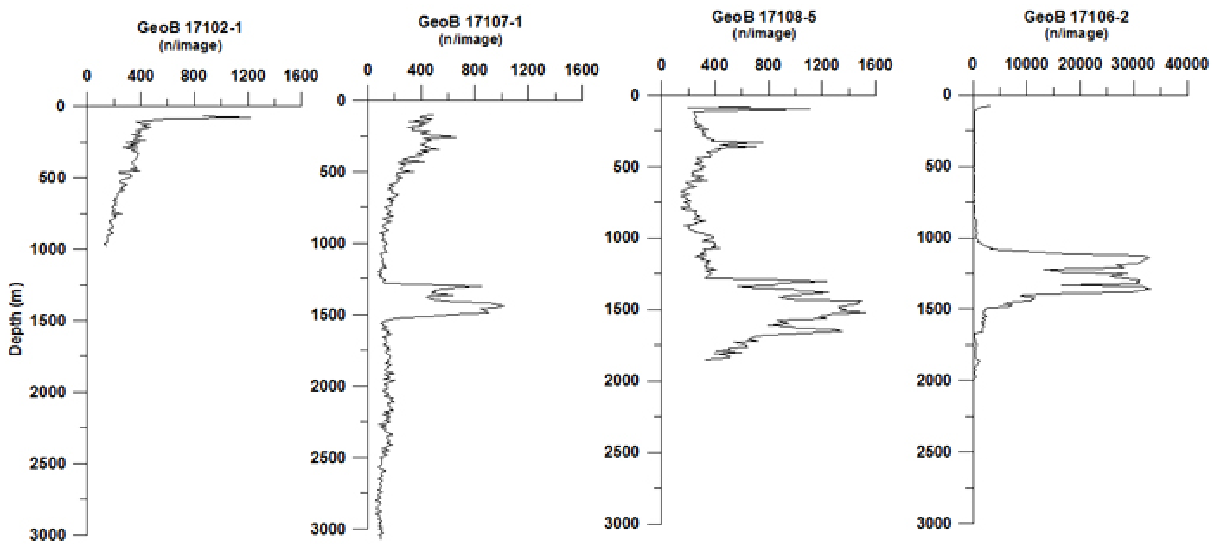


Fig. 7. Station map of camera profiles acquired with ParCa-Pro during the cruise off Cape Blanc, Mauritania.



W E

Fig. 8. West-east transect of particle concentration profiles acquired with ParCa-Pro. Besides in the surface waters, higher particle numbers can be found in ca. 300-400 m (Intermediate Nepheloid Layer) and between about 1000 and 1700 m, the latter originating on the NW African continental margin.

Camera profiles GeoB 17109-4 and GeoB 17111-1 were taken where the free drifting traps were recovered and deployed (Fig. 9). A subsurface maximum was described for the three camera stations GeoB 17107-1, GeoB 17108-5 and GeoB 17106-2. The same signal is also well visible at the drifting trap locations in depths around 350 m. The deepest cylindrical trap of the drifting arrays is situated in 400 m water depth.

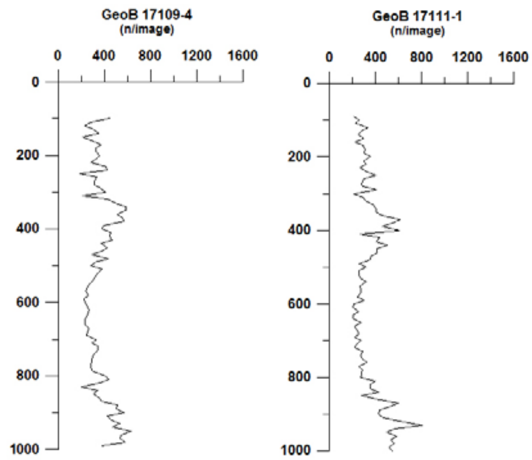


Fig. 9. Detailed particle profiles using ParCa-Pro, taken at the deployment and recovery site of the free drifting traps DF-6.

2.5.2 Video records with the Multi-Sensor-Platform (MSP) *(Nico Nowald)*

The Multi-Sensor-Platform (MSP) is a hexagonal, glass fibre reinforced plastic frame with a height of 2.3 m and a diameter of 1 m. The device is moored within the eutrophic mooring array CBi in a water depth of around 1200 m (Table 11). It is equipped with two scientific devices. The first sensor is a Falmouth Scientific-CTD with an acoustic current meter (ACM) and the second is a Sony HDTV video camera. Every 6h, the CTD is recording one set of data of oceanographic parameters such as temperature, conductivity, current direction or current speed. The HDTV video camera is used to acquire a time series of particle abundances and particle sizes. The system consists of the camera itself, an electronic pod that controls and powers the 50 Hz strobe head and a 12V/38 Ah DSPL battery (Fig. 10). The camera is recording a video sequence of 20 seconds every third day over a period of a year. The sequences are recorded on a Mini DV tape with a recording time of 60 minutes. Between the 23rd January 2012 and 1st October 2012 the camera recorded 85 single sequences that will be analysed at MARUM, University Bremen. The FSI-CTD collected data between the 23rd January 2012 and the 26th January 2013 resulting in a total of 1481 measurements.

During the deployment period (Fig. 11), salinity ranges between a minimum of 34.8 ‰ and a maximum of 35.8 ‰. The temperature measurements show values between 5.9°C and 6.7°C. According to the mooring depth, temperature and salinity values, the MSP is most likely located within the AAIW water mass. Average current speed is around 4 cm s^{-1} with highest values of around 12 cm s^{-1}. Highest current velocities correspond well with the increased salinity and temperature values in late March and are predominantly coming from northerly directions. A detailed analysis and comparison with the video material will be carried out at MARUM-University of Bremen.

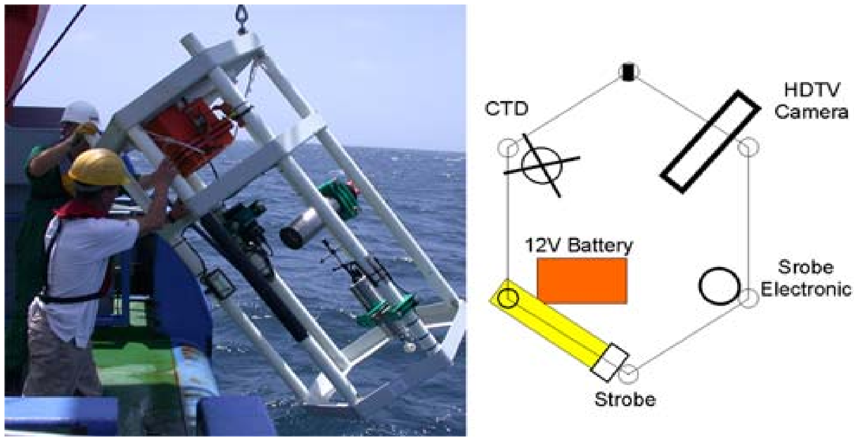


Fig.10. Left: Deployment of the Multi-Sensor-Platform (MSP) during RV Poseidon cruise 365.Right: Top view of the devices installed in the MSP.

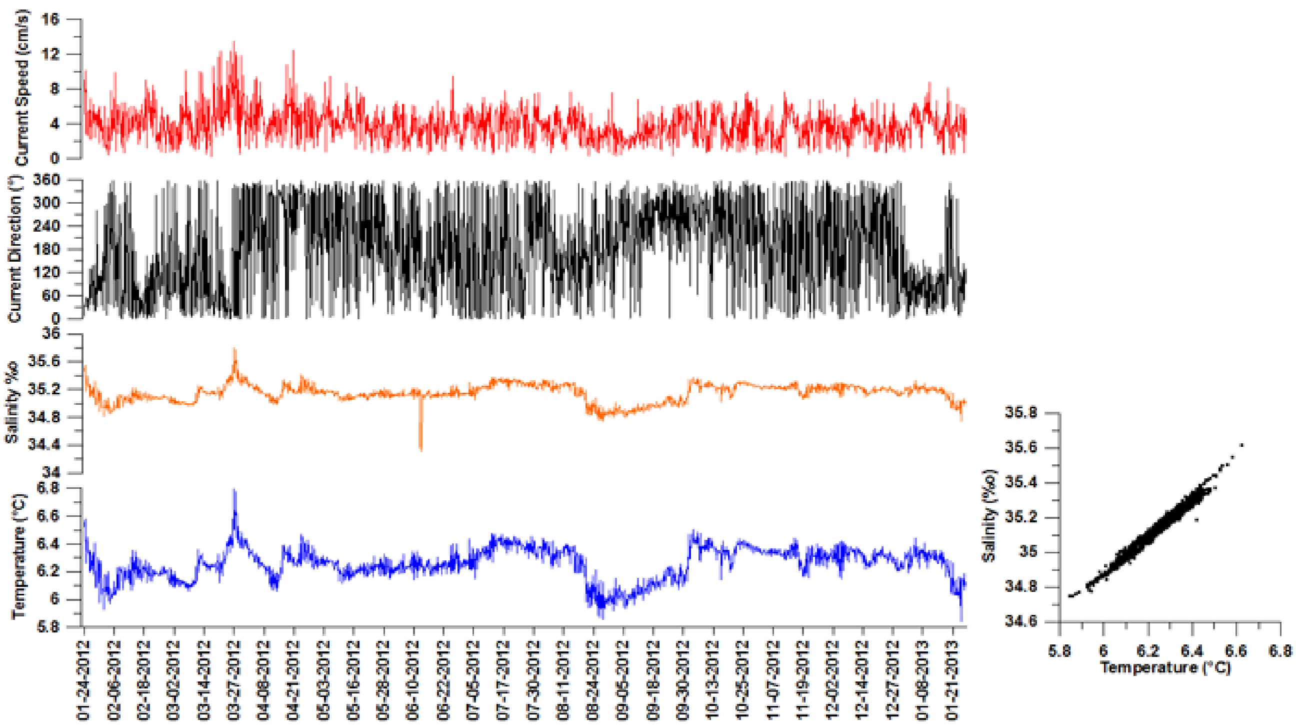


Fig. 11. Data set of current speed, current direction, temperature and salinity acquired from CTD sensor installed in the Multi-Sensor-Platform (MSP). According to the salinity/temperature scatter plot shown in the lower right corner, the MSP is located within the Antarctic Intermediate Water (AAIW).

2.6. Oceanography

2.6.1 CTD-O_2-chlorophyll-fluorescence-turbidity probe (SBE-19)

(Nico Nowald and Gerhard Fischer)

Six CTD/O_2/chlorophyll-fluorescence-turbidity profiles were taken with a self-contained SBE-19 profiler equipped with a conductivity-temperature-depth probe plus oxygen sensor, a CHELSEA-fluorometer and a WETLAPS turbidity sensor. This CTD was attached to the frame of the ParCa-Pro system (Fig. 6, chapter 2.5.1) and was deployed six times during the cruise (Table 8, station list). The data were removed immediately after recovery of the system and standard downcast plots were made. Data were compared to the measurements with the SBE 9 plus-CTD (8 profiles were acquired, see station list) attached to the shipboard rosette with Niskin bottles. It which was also equipped with a chlorophyll fluorescence, turbidity and oxygen sensors calibrated prior to the cruise. Salinity and temperature data fitted well between the two CTD systems. The oxygen values of the SBE-9 Plus were higher than of the SBE-19 profiler, where the oxygen sensor was altered.

Our major interest was on the turbidity records of the water column in the area of the continental slope of Mauritania, where particles are transported offshore into the open ocean. From previous studies, surface, intermediate, mid-water and a bottom-near particle layers were expected (e.g. Karakas et al., 2006). Generally, particle characteristics of larger sized particles are preferentially recorded with the ParCa-Pro system (chapter 2.5.1), whereas the finer particle sizes should be seen with the turbidity sensor. Nevertheless, an overlap of both size classes obviously occurs, as seen by the comparison of turbidity profiles from the CTD deployments (Fig. 12) and the ParCa-Pro results of particle abundance (Fig. 8). Two deeper-water particle layers were found (Fig. 12), both originating from the continental margin of NW Africa. There were partly found in earlier studies and have been investigated in detail by ROMS modelling studies (e.g. Karakas et al. 2006). However, the interaction of suspended with sinking particles collected with the sediment traps is still unclear.

Table 8. List of CTD-O_2-chlorophyll-fluorescence-turbidity profiles taken with the SBE-19 profiler attached to the ParCa-Pro system (see chapter 2.5.1).

GeoB station #	Date 2013	Time UTC	Lat N	Long W	Water depth m	Deployment depth/ wire length (m)
17102-2	21.01	20:46	21°15,82’	20°54,39’	4181	1000
17106-2	25.01	21:23	20°44,09’	18°32,78’	2069	1980
17107-1	26.01	09:35	20°49,81’	19°00,02’	3185	3150
17108-3	26.01	23:08	20°47,23’	18°42,97’	2670	2600
17109-4	27.01	20:41	20°44,15’	18°44,05’	2804	1000
17111-1	28.01	09:38	20°42,84’	18°44,44’	2769	1000

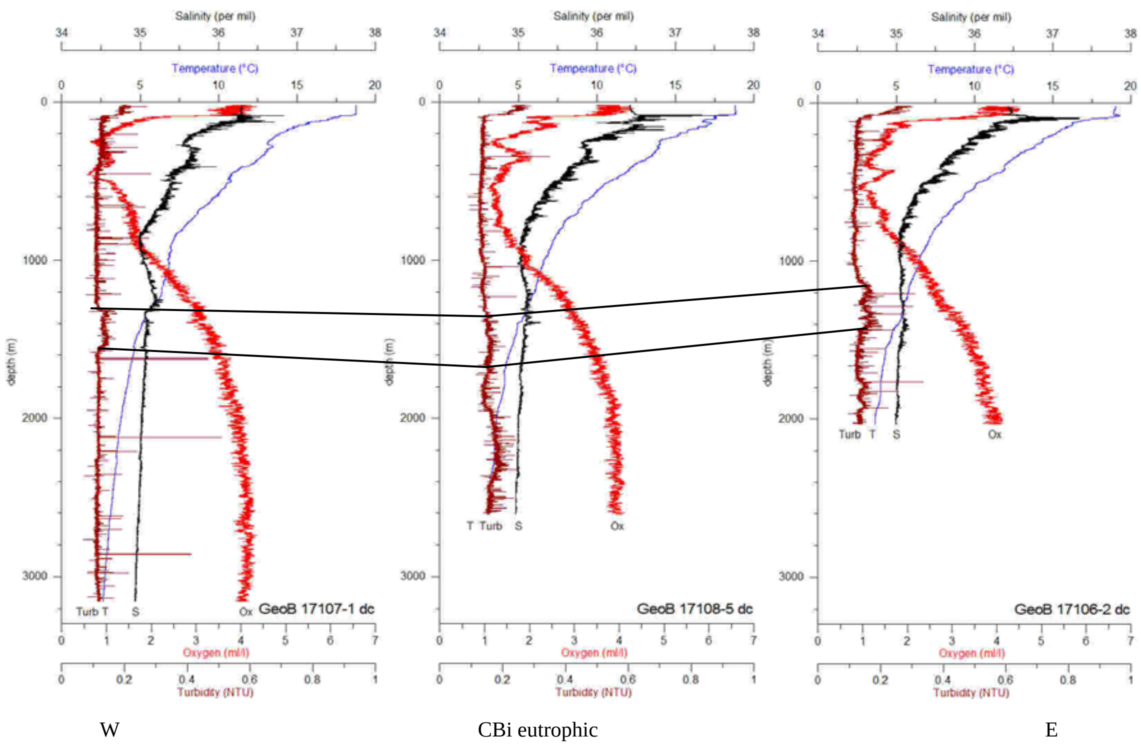


Fig. 12. CTD-O_2-turbidity profiles from W to E crossing the eutrophic mooring site CBi. Note higher turbidity between about 1200 and 1700 m in all profiles indicating offshore lateral transport of particles from the continental NW African margin. Another increase of particles (also observed in previous cruises) can be recognized above the seafloor between 1800-2000 (GeoB 17106-1) and 2000-2400 m (GeoB 17108-5) in the two eastern profiles. For comparison, see particle distributions from the ParCa-Pro system (chapter 2.5.1).

2.6.2 Rosette with CTD-O_2-chlorophyll-fluorescence-turbidity probe (SBE-9 Plus)

(Morten Iversen and Helle Ploug)

Seven profiles with the shipboard rosette equipped with a SBE-9 Plus-CTD from the Marum group (AG Zonneveld) (Table 9, see also station list) which was equipped with oxygen sensors and fluorometer was launched together with the multiple water collectors (rosette with 12 x 10 l Niskin bottles). Water samples were taken for incubations in roller tanks (see chapter 2.2) to perform artificial aggregates and for organic geochemistry of particles in the water column (see chapter 2.4).

The study site off Cape Blanc, located between 21.15 N and 20.37 N, is a major upwelling region with offshore Ekman transport supporting high open ocean primary production. We often observe ‘Giant Cape Blanc filaments’ of phytoplankton spreading 450 km offshore in a region that includes our stations. The vertical salinity and temperature distributions indicate that there was high coastal upwelling of cold and less saline South Atlantic Central Waters and strong offshore Ekman transport during our cruise (an example of vertical profiles of temperature, salinity, oxygen, and fluorescence is given in Fig. 13). The increased salinity and temperature in the surface waters at this offshore station resulted from mixing of the upwelled water with the more saline and warmer North Atlantic Central Water.at ~120 m.

Table 9. List of CTD-rosette profiles (SBE 9 Plus) and depths of water samples taken with the NISKIN bottles. Water samples were taken for microbial analysis (e.g. experiments) and organic chemistry analysis of suspended particles (filtration).

GeoB Station	**Date 2013**	**Time UTC**	**Lat N**	**Long W**	**Water depth m**	**Deployment depth (m)**	**Water samples taken/method**
17102-3	21.01.	22:30	21°15,83’	20°54,35’	4179	1000	1000, 400, 150, 40 m (filtration)
17103-1	23.01.	20:46	20°33,26’	17°41,21’	211	180	13 m (chl-max., experiments)
17104-1	24.01.	18:25	20°37,14’	17°59,37’	758	750	740, 400, 40 m (filtration)
17105-1	25.01.	14:45	20°42,01’	18°23,05’	1515	1500	1500, 280, 24 m
17106-1	25.01.	19:06	20°44,09’	18°32,79’	2072	2050	1350, 300, 40 m (filtration)
17108-3	26.01.	18:21	20°47,25’	18°42,99’	2669	400	400 m and 18 m (chl.-max., experiments)
17108-4	26.01.	20:13	20°47,25’	18°42,97’	2676	2650	2600, 2350, 2000, 1800, 1600, 1400, 1000, 800, 400, 200, 100, 40 m (filtration)
17109-2	27.01.	14:28	20°43,28’	18°44,54’	2779	2600	No water samples taken

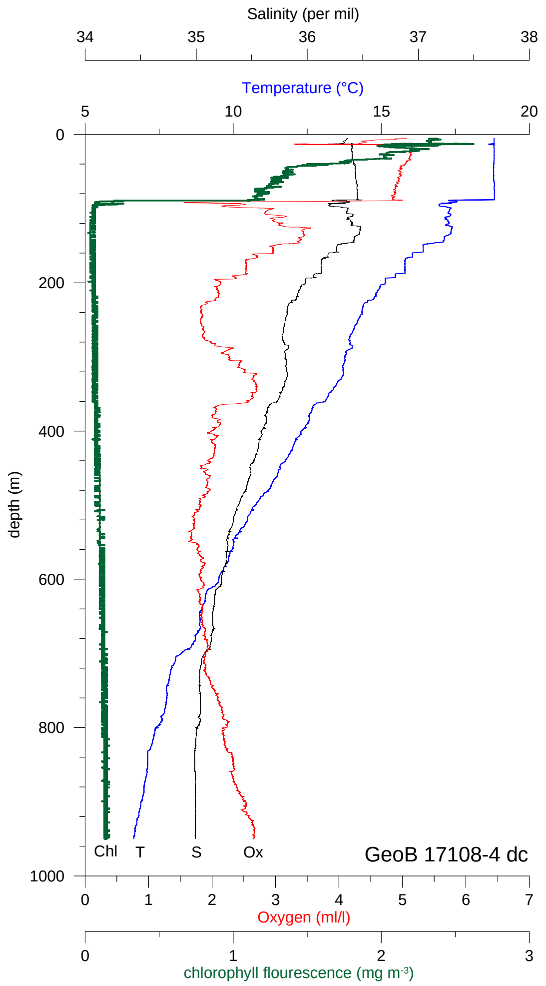


Fig. 13. Example of a CTD-oxygen-chlorophyll fluorescence profile (GeoB 17108-4) taken with the SBE-9 Plus at the eutrophic sediment trap site CBi. The profile shown here is only down to about 950 m water depths. Note the very high chlorophyll of more than 2 mg m^{-3} in the upper 40m; chlorophyll values remain rather high (more than 1 mg m^{-3}) in the lower mixed layer down to about 80m water depth.

2.7. Marine Geology

2.7.1 Upper Ocean particle flux measured with free-drifting particle traps: Marine snow in the twilight zone

(Morten Iversen, Nicolas Nowald, Götz Ruhland, Marco Klann and Gerhard Fischer)

Background

Vertical export of organic matter is dominated by marine snow aggregates and zooplankton fecal pellets (Fig. 14). Since zooplankton migrates from depth to the surface water to feed every night, it must be assumed that the relative dominance of the two particle types is diurnal. However, it is still unclear how this influences the efficiency of the biological pump. Grazing on marine snow by zooplankton can have several implications for the vertical flux; e.g. marine snow aggregates can be completely removed by ingestion of whole aggregates, their size can decrease due to fragmentation and partly ingestion, and the sinking particles can be repacked from marine snow to fecal pellets. Both repackaging and changes in aggregate sizes will change the sinking speed of the aggregates, either to slower speeds in case of fragmentation and partly ingestion or potentially to higher speeds when repackaged into dense fecal pellets. Hereby, the retention time of sinking particles in the upper water column may be strongly influenced by the presence of zooplankton. By investigating the composition of vertical fluxes at high resolution in the upper water column, we hope to reveal the processes determining the deep ocean fluxes on short timescales.

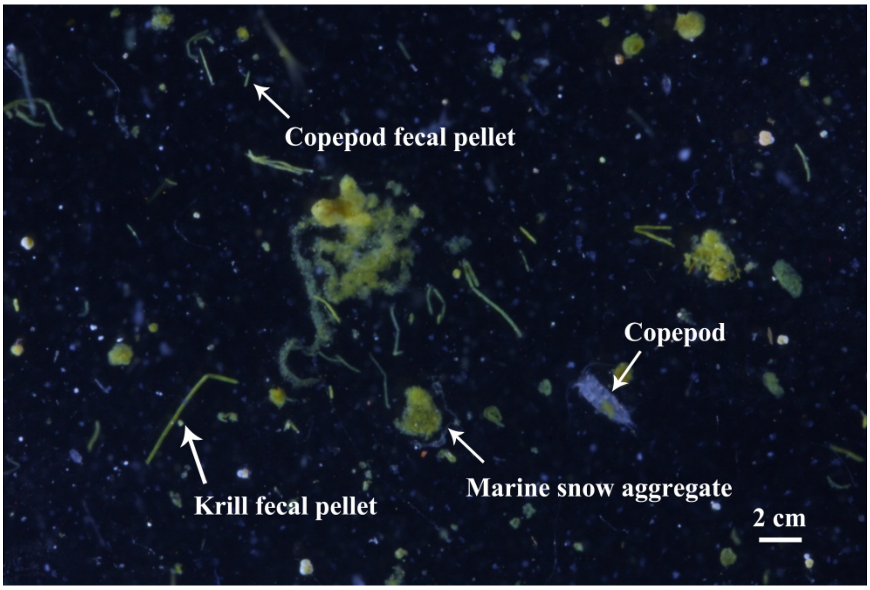


Fig. 14. Microphotograph of a small section from the gel-filled cylindrical trap sample (100 m water depth, DF-6 deployment, Table 10). The shape and structure of all particles collected in the gel is preserved and can be used to identify particle types and measure their sizes.

Work at sea

The export fluxes in the upper 400 m of the water column were collected by surface-tethered free-drifting sediment traps. Two deployments were carried out during the cruise, one collecting only during night (DF-5) and one allowed to collect during a 24 h period (night and day) (see position, deployment, and recover times in Table 10). Each deployment had three collection depths: the base of mixed layer depth (100 m), directly below the flux attenuation depth (200 m), and in the twilight zone well below the depths with high degradation (400 m). Four cylindrical traps were deployed at each collection depth. Three of the cylinders captured biogeochemical mass fluxes of carbon, nitrogen, biogenic opal, calcium carbonate and lithogenic material while the fourth cylindrical trap was equipped with viscous gel which preserved the sinking material in its original shape. The different particle types collected in the gel were photographed using a digital camera and will be used to create particle size distribution of the flux. The combination of several deployments ranging from the base of the mixed layer and down to the upper mesopelagic zone will potentially provide quantitative and qualitative information on the origin of sinking particles and processes important for the flux attenuation on shorter timescales.

Preliminary results

Figure 15 shows the material collected in one cylinder from each of the three depths during the DF-6 deployment. The highest flux was found at 100 m and decreased with increasing depth, indicating that the sinking material was either removed at a high rate or re-packed into small dense pellets in the upper few hundred meters.

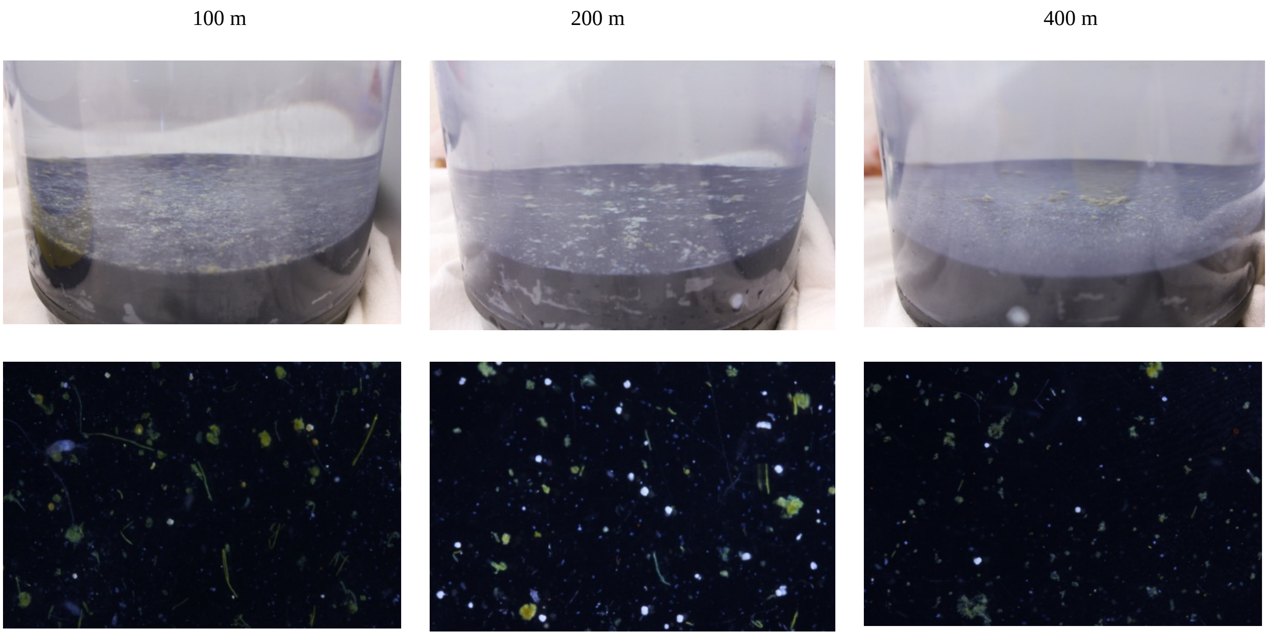


Fig. 15. Images of sediment trap tubes with collected material from 100, 200 and 400 m depths during the DF-6 deployment (Table 10). The top row is the total fluxes and the lower row is high resolution images from the gel-filled trap cups.

The material collected in the gel traps showed that krill fecal pellets were present at high abundance at 100 m and were rare at 200 m and almost completely absent at 400 m depth. The largest marine snow aggregates were observed in 100 and 200 m depths while the marine snow found at 400 m seemed heavily degraded small aggregate fragments.

Table 10. Overview of deployment and recovery dates for the two drifting sediment trap deployments DF-5 and DF-6.

Trap name / GeoB No.	**Deployment /Recovery**	**Lat N**	**Long W**	**Time UTC**
DF-5:				
GeoB17108-2	26.01.2013	20°36.37	18°43.66	17:08
GeoB17109-1	27.01.2013	20°43.60	18°44.62	08:32
DF-6:				
GeoB17109-3	27.01.2013	20°43.18	18°44.43	17:34
GeoB17113-2	28.01.2013	20°41.33	18°45.28	17:30

2.7.2. Seasonal particle fluxes measured with moored sediment traps

(Götz Ruhland, Gerhard Fischer, Nico Nowald and Marco Klann)

It was planned to recover and redeploy the moorings CB-23 and CB-24 at the beginning of the cruise just after the deployment of dust buoy array. The mesotrophic CB study site is operated since 1988 and is located at the edge of the Cape Blanc filament about 200 nm offshore in about 4150 m water depth. It is used to monitor the long-term change of particle fluxes in the Mauritanian offshore upwelling zone. Another mooring named CBi-10 was deployed during Poseidon POS 425 cruise around 80 nm further to the east and was also planned to be exchanged (CBi-10/11). The data of deployments and recoveries of the moorings are listed in Table 11, alongside with the sampling data of the traps.

In the morning of January 22nd, 2013, the mooring CB-23 located approximately 200 nm off Cape Blanc was successfully recovered. It was planned to recover the moorings approximately in March or April 2013. Both installed particle traps had worked perfectly but due to the earlier cruise schedule the sample set has not been completed. The traps delivered a set of 18 samples each showing elevated fluxes after a dust storm event on January 19th, 2012 (Fig. 17). Also in winter 2012-13 flux was elevated due to strong upwelling and high chlorophyll as shown in Figure 16. The mooring was redeployed as CB-24 with a similar configuration in the afternoon of the same day (Fig. 18).

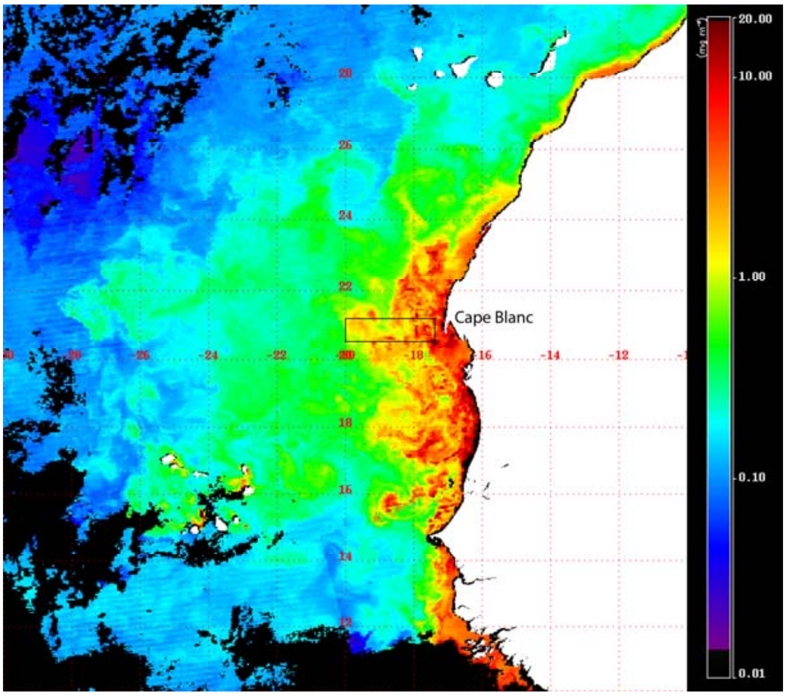


Fig. 16. MODIS-Satellite chlorophyll (in mg m-3) in January 2013 (weekly composite: 8.1.- 16.1.2013) showing overall very high chlorophyll off NW Africa and a large seaward extension of the Cape Blanc filament (http://oceancolor.gsfc.nasa.gov/cgi/l3). Working area off Cape Blanc during POS 445 is indicated.

At noon of January 26th, 2013 the 1500 m long mooring array CBi-10 has been released in the coastal part of the Cape Blanc filament. This mooring was equipped with a particle trap and a so-called MSD trap which has two sampling carousels installed to increase the number of samples to 40. Mass fluxes increased in winter-spring 2012 at this site showing similar flux patterns compared to the mesotrophic site CB-23, however, fluxes were almost twice as high at CBi-10 (Fig. 17.).

Also a so-called Multi-Sensor-Platform (MSP) was moored, equipped with a video camera to record sequences of sinking particles and a CTD to monitor oceanographic parameters at the same time. Two sets of samples of CBi-10 could be received, one with 35 samples (MSD trap) and one with only 16 samples instead of the assumed 18 ones. The failure of the trap is not found yet. The sample sets have not been completed due to the early recovery of the mooring. The video camera had recorded a set of 85 video sequences, the CTD logged a complete data set until January 26th, 2013. In the early afternoon of January 28th, the mooring array CBi-11 could be redeployed (Fig. 18). Instead of the upper MSD trap, a standard particle trap with one sampling turntable for 20 samples was installed. It is planned to recover and redeploy these moorings with RV POSEIDON in winter-spring 2014.

a: mesotrophic site CB-23 sample cups 1-4

b: eutrophic site CBi-10, sample cups 1-4

Fig. 17. Sediment trap material captured at the mesotrophic site CB-23 (a) versus the eutrophic site CB-10 (b) during the winter-spring bloom 2012. Each cup sampled over 21.5 days (except CBi-10 cup #1: 15.5 days), starting at the end of January, and ending mid-April, 2012. Note the doubling of fluxes at the eutrophic site CBi-10 (b) compared to the mesotrophic site CB-23 (a).

Table 11. Data for recoveries and redeployments of the particle trap mooring arrays.

Mooring	**Position**	**Water Depth (m)**	**Interval**	**Instr.**	**Depth (m)**	**Intervals (no x days)**
<u>Mooring recoveries:</u>						
Cape Blanc mesotrophic:						recovered
CB-23	21°15,8' N	4160	20.01.12-	SMT 234 NE	1214	17 x 21.5d, 1 x 3d
	20°52.7' W		25.03.13	SMT 234 NE	3622	17 x 21.5d, 1 x 3d
Cape Blanc eutrophic:						
CBi-10	20°46.5’ N	2712	26.01.12-	MSP	1211	
	18°44.2’ W		25.03.13	MSD trap	1318	1 x 4.75d, 33 x 10.75d 1 x 7.5d
				SMT 234 NE	1875	1 x 15.5d, 14 x 21.5d, 1x7d
<u>Mooring deployments:</u>						
Cape Blanc mesotrophic:						programmed
CB-24	21°16,9' N	4160	24.01.13-	SMT 243 NE	1214	1 x 26d, 19 x 21d
	20°50.6' W		25.03.14	SMT 243 NE	3622	1 x 26d, 19 x 21d
Cape Blanc eutrophic:						
CBi-11	20°46.4’ N	2800	29.01.13-	MSD platform	1211	
	18°44.4’ W		25.03.14	SMT 234 NE	1318	20 x 21 d
				SMT 234 NE	1875	20 x 21d

Instruments used:

SMT 234 NE = standard particle trap, KUM, Kiel (20 samples)
SMT 243 NE = standard particle trap (Titanium), KUM, Kiel (20 samples)

MSD trap = particle trap, KUM, Kiel, with two sampling tables (in total 40 samples)
MSP = Multi-Sensor-Platform with FSI-CTD and video camera

CB-23/24 = long term sediment trap mooring at mesotrophic site
CBi-10/11 = long term sediment trap mooring at eutrophic site

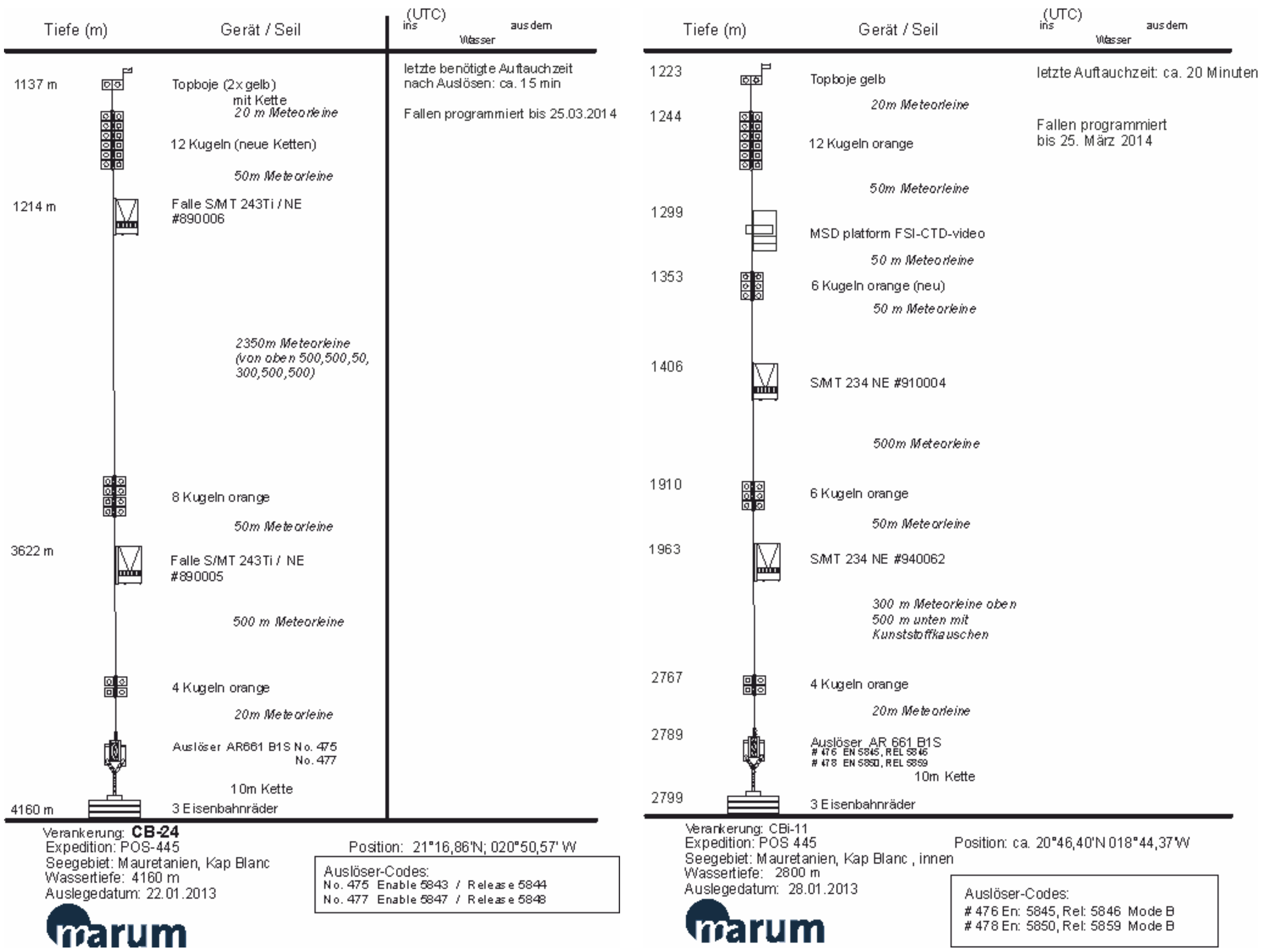


Fig. 18. Drawings of the newly deployed mooring arrays CB-24 (mesotrophic) and CBi-11 (eutrophic) (see Figure 1).

2.9. References

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2.10. Acknowledgements

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3. Station List (POS 445)

GeoB #	Ships Stat. No	Date 2013	Device	Time at seafloor/ max. wire length [UTC]	Latitude N	Longitude W	Water depth [m]	Recovery/Remarks
17101-1	497-1	21.01.	CBs-01	15:03	21°15.05’	21°00.35’	4235	Deployment of the dust collector buoy (4500 m long array)
17102-1	480-1		MN	18:41	21°15,83’	20°54,38’	4174	Down to 1000m: 1000-600, 600-300, 300-150, 150-80, 80-0m
17102-2	480-2		ParCa-Pro + CTD	20:46	21°15,82’	20°54,39’	4181	Down to 1000m
17102-3	480-3		ROS + CTD	22:30	21°15,83’	20°54,35’	4179	Down to 1000: water filtration in 1000, 400, 150, 40m
17102-4	480-4		ISP (4x)	23:42	21°15,83’	20°54,34’	4179	Down to 1000m: pumping in 1000, 400, 150, 40m
17102-5	480-5	22.01.	CB-23	08:54	21°16,11’	20°51,17’	4182	Release and recovery of sediment trap mooring, both traps ok and 18 samples
17102-6	480-6		CB-24	17:36	21°16,86’	20°50,57’	4160	Slip of ankerstone
17103-1	482-1	23.01.	ROS + CTD	20:46	20°33,26’	17°41,21’	211	Down to 180m: water samples for experiments in 13m
17104-1	483-1	24.01.	ROS +CTD	18:25	20°37,14’	17°59,37’	758	Down to 750m: water filtration in 740, 400, 40m
17105-1	484-1	25.01.	ROS + CTD	14:45	20°42,01’	18°23.05’	1515	Down to 1500m: water filtration in 1500, 280, 24m
17106-1	485-1	25.01.	ROS + CTD	19:06	20°44,09’	18°32.79’	2072	Down to 2050m: water f iltration in 1350, 300, 40m
17106-2	485-2		ParCa-Pro + CTD	21:23	20°44,09’	18°32,78’	2069	Down to 1980m: 197 pictures
17107-1	486-1	26.01.	ParCa-Pro + CTD	09:53	20°49,81’	19°00,02’	3185	Down to 3150m
17108-1	487-1		CBi-10	13:56	20°45,94’	18°44,48’	2670	Release and recovery of the mooring array: upper trap 35 samples (o.k.), lower trap 16 samples
17108-2	488-1		DF-5	17:08	20°36,37’	18°43,66’	2670	Deployment of the drifting array DF-5 with 3 traps (each 4 cylinders, one filled with gel) in 100, 200, 400m depth
17108-3	489-1		ROS + CTD	18:21	20°47,25’	18°42,99’	2669	Down to 400m: 400m and 18m (chl-max), lab experiments
17108-4	489-2		ROS + CTD	20:13	20°47,25’	18°42,97’	2676	Down to 2650m: filtration in 2600, 2350, 2000,1800, 1600, 1400, 1000, 800, 400, 200, 100 and 40m
17108-5	489-3		ParCa-Pro + CTD	23:08	20°47,23’	18°42,97’	2670	Down to 2600m
17108-6	489-4	27.01.	ISP (4x)	00:27	20°47,23’	18°42,99’	2673	Down to 400m: 400, 200, 100, 40m
17109-1	490-1		DF-5	08:32	20°43,60’	18°44617’	2788	Recovery of the drifting array DF-5 with 3 trap depths levels
17109-2	490-2		ROS +CTD	14:28	20°43,28’	18°44,54’	2779	Down to 2600m, no water samples taken
17109-3	490-3		DF-6	17:34	20°43,18’	18°44,43’	2782	Deployment of the drifting array DF-5 with 3 traps (each 4 cylinders, one filled with gel) in 100, 200, 400m depth
17109-4	491-1		ParCa-Pro + CTD	20:41	20°44,15’	18°44,05’	2804	Down to 1000m
17110-1	492-1	27.01.	ISP (4x)	22:49	20°47,20’	18°42,94’	2667	Down to 2350,:2350, 2000, 1600, 800m
17111-1	493-1	28.01.	ParCa-Pro + CTD	09:38	20°42,84’	18°44,44’	2769	Down to 1000m

Station list. Continued

GeoB #	Ships Stat. No	Date 2013	Device	Time at seafloor/ max. wire length [UTC]	Latitude N	Longitude W	Water depth [m]	Recovery/Remarks
17112-1	494-1		CBi-11	14:43	20°46,40’	18°44,37’	2800	Deployment of sediment trap mooring CBi-10 with 2 sediment traps and Multi-Sensor-Platform (MSP)
17113-1	495-1		MN	16:33	20°42,11’	18°44,86’	2779	Down to 1000m: 1000-600, 600-300, 300-150, 150-80, 80-0m
17113-2	496-1		DF-6	17:30	20°41,33’	18°45,28’	2772	Recovery of the drifting array DF-6 with 3 trap levels

CBs-01: mooring array with buoy and dust collector (24 filters)

CB-23/24, CBi-10/11: meso- and eutrophic sediment trap moorings off Cape Blanc (Mauritania)

DF-5/6: Drifting trap deployed and recovered around the eutrophic CBi site

ROS-CTD: Multi-water sampler (rosette) with 12 x 10l bottles and CTD-SBE-9 Plus (Geomar and Marum)

PARCA-PRO-Pro-CTD: Particle Camera System with CTD-SBE-19 (No. 2069) inside the frame (CTD-O_2- chlorophyll-fluorescence-turbidity)

ISP: *in situ* pumps (4 at maximum)

MN: multinet (5 depth ranges) with 200µm mesh size

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