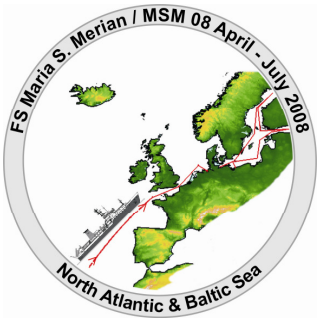

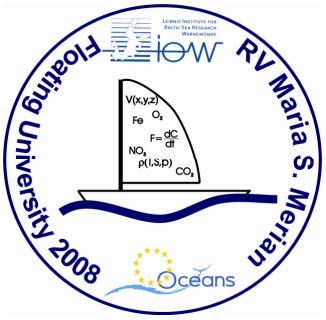

MSM 08/2
(06.05.2008 – 21.05.2008)
Short Cruise Report
MINDELO-EMDEN

Prof Dr. Detlef Schulz-Bull, Chief Scientist
Leibniz-Institut für Ostseeforschung Warnemünde

Cruise participants

1.	Prof. Dr. Detlef E. Schulz-Bull	Fahrtleiter / *Chief Scientist*	IOW
2.	Dr. Joanna Waniek	FU2008, CTD/XBT	IOW
3.	Dr. med. D. Hencke	Arzt / *Physician*	
4.	Dr. Ralf Prien	Fe/Mn Sensor	IOW
5.	Steffen Malwitz	Trace metals	IOW
6.	Enrique Fernandez Otero	Trace metals	IOW
7.	Dr. Thomas Leipe	Geology, multi corer	IOW
8.	Prof. Dr. Katarina Abrahamson	Chemistry, halocarbons	Chalmers
9.	Andrea Bauer	Argo floats	IOW
10.	Dr. Anna Orlikowska	Chemistry, halocarbons	IOW
11.	Birgit Sadkowiak	Nutrient analyses	IOW
12.	Ines Hand	Organic Chemistry	IOW
13.	Regina Hansen	Phytoplankton	IOW
14.	Irina Goldschmidt	FU2008	IOW
15.	Ines Serra Martins	FU2008	Instituto Hidrografico
16.	Paul J. Mann	FU2008	Univ. Newcastle
17.	Anibal	FU2008	INDP
18.	Pericles Neves Silva	FU2008	INDP
19.	Johann Engelbrektsson	FU2008	Chalmers
20.	Nicola Erdsack	FU2008	Univ. Rostock
21.	Barbara Kutsch	FU2008	Univ. Rostock
22.	Slawomir Dobosz	FU2008	Univ. Szczecin

Participating institutions

Leibniz-Institut für Ostseeforschung Warnemünde
Seestraße 15, 18119 Rostock / Germany
http://www.io-warnemuende.de

Chalmers University of Technology
SE-412 96 Göteborg, Sweden
http://www.chalmers.se

University of Newcastle upon Tyne
NE1 7RU, United Kingdom
http://www.ncl.ac.uk/

Instituto Hidrográfico Divisão de Oceanografia
Oceanografia Física / Engenharia Oceanográfica
Rua das Trinas, 49, 1249-093 Lisboa - Portugal
http://www.hidrografico.pt/

National Institute for Fisheries Development,
Mindelo, São Vicente, Cape Verde, P.O.Box 132,
http://www.indp.cv

Uniwersytet Szczecinski
Institute of Marine Sciences
Department of Palaeoceanology
Ul. Wąska 13; 71-415 Szczecin, Poland
www.univ.szczecin.pl

Scientific Background

The investigations of the cruise were carried out along a transect from Mindelo (Cape Verde Islands) until 49°N, 06°W with the focus on physical, chemical and biological properties of the surface layer of the Northeast Atlantic. Different physical and biogeochemical regimes were sampled and the early summer (post-bloom) situation at the Station Kiel 276 (33°N, 22°W) located in the Madeira Basin in the subtropical Northeast Atlantic was registered. The main objective of the work was to contribute to the knowledge of processes which control the carbon fluxes and fluxes of the associated biological elements in different regimes (subtropical, temperate NE Atlantic). In particular (1) the biogeochemical properties of the surface waters will be used to characterise and contrast the different biogeochemical provinces (2) the plankton population near the surface (e.g. foraminifera and coccolithophores) were monitored to study the change in the populations from calcifying to silica based organism. At the same time the Floating University 2008 took place on board of Maria S. Merian for students from the with the Euro-Oceans affiliated institutes. All FU2008 participants were persuading independent projects and participated in lectures hold over the duration of the cruise.

Research Program

The working program of the cruise MSM08/02 included intensive sampling of the surface layer of the Northeast Atlantic starting in Mindelo until 49°N, 6°W and vertical measurements using CTD at three positions: Kiel276 (33°N, 22°W), in Iberia Basin (39°N,

19°W) and in Biscaya (47°N, 8°W). Samples from the surface layer were taken every 30 nm for the basic parameters (nutrients, chlorophyll a, and dissolved oxygen). Samples for the determination of the mineralogical and geochemical composition of the suspended particulate material in surface waters were also taken, in order to determine the extension of the dust plumes originating from Africa, especially from the Sahara region. At the same positions profiles of temperature and salinity were registered using expendable bathythermograph (XBT's) or expendable conductivity, temperature, and depth profiler (X-CTD's). Additionally samples for studies of the halocarbon exchange between the surface of the ocean and the atmosphere were collected. Temperature, salinity and chlorophyll a of the surface water were registered continuously and a full set of meteorological data from the ship own meteorological station was recorded as well. Additionally at the station Kiel276 (33°N, 22°W), in Iberia Basin (39°N, 19°W) and in Biscaya (47°N, 8°W) near bottom CTD profiles (max. 5200m) were obtained as well as samples for nutrients, chlorophyll a and halocarbons. At Kiel276 an in-situ pump profile for the determination of PCB concentrations was taken and a multi corer was successfully deployed. Along the cruise track currents in the upper 300m of the water column were monitored using an Acoustic Doppler Current Profilers (ADCP).

Floating University 2008:

PhD students and post-docs from England, Sweden, Portugal, Poland, Cape Verde and Germany participated in the cruise. All FU2008 participants were working on their own research embedded into the science program of the MSM08/02 cruise. Their project covered a wide range of topics including studies related to variability in the position of the Azores Front, to the characterisation of the plankton populations in surface near water especially diatoms, to the halocarbons production, iron speciation and to photochemical production of ammonium in marine systems.

Photo by R. Prien: Participants of the FU06 from left Pericles, Barbara, Nicola, Irina (tutor, IOW), Paul (front raw), Anibal, Ines, Joanna (organiser, IOW), Johann, Steffen, Andrea and Slawek (back raw).

1.	Anna Orlikowska	halocarbons	post doctoral study
2.	Johan Engelbrektsson	halocarbons	post doctoral study
3.	Steffen Mallwitz	iron speciation	master thesis
4.	Enrique Fernandes Otero	iron speciation	PhD studies
5.	Barbara Kutsch	phytoplankton	master thesis
6.	Slawomir Dobosz	phytoplankton	master thesis
7.	Nicola Erdsack	Chlorophyll a	master thesis
8.	Paul Mann	Uptake rates	PhD studies
9.	Andrea Bauer	Azores Front	master thesis
10.	Ines Martins	Hydrography, instrumentation	PhD studies
11.	Pericles da Silva	Nutrient chemistry	master thesis
12.	Anibal Medina	Water masses, Circulation	post doctoral study

The FU2008 lectures covered physical oceanography, biogeochemistry, marine chemistry and geology and marine technology and were focussed on the biogeochemical provinces of North Atlantic. According to the students the lectures about the influence of Sahara dust on biological production in the subtropical Atlantic, the role of organic contaminants, the development and composition of the marine sediments and the new generation of sensors and platforms were highly appreciated. The short Matlab course was also very popular, not only amongst the students.

Following lectures were held while on board of Maria S. Merian:

Abrahamsson, K (Chalmers):

- Halocarbons – the short story

Leipe, T (IOW):

- Particle analysis in marine research
- Sediments of Baltic Sea basins -archives of Holocene changes of climate and marine environment

Prien, R. (IOW):

- In situ sensors and platforms- making measurements on the right scale

Schulz-Bull, D.E. (IOW):

- Organic Contaminants in the Marine Environment

Waniek, J. (IOW):

- Biogeochemical properties of the surface waters in the Northeast Atlantic
- How does plankton respond to regional oceanography? Introduction to the idea of biogeochemical provinces
- Examples for biogeochemical provinces: North Atlantic Drift Region
- NAST (E) –North Atlantic Subtropical Gyral Province (East)
- Nordic Seas
- Saharan dust
- Tutorial Matlab

Student's opinion: The final interviews with the FU2008 participants are all highly positive, and highlighted especially the interdisciplinary character of the cruise, the lectures and the

opportunity to learn new methods, exchange ideas with other participants and the time to learn more from exchange with the scientists on board.

Narrative of the cruise

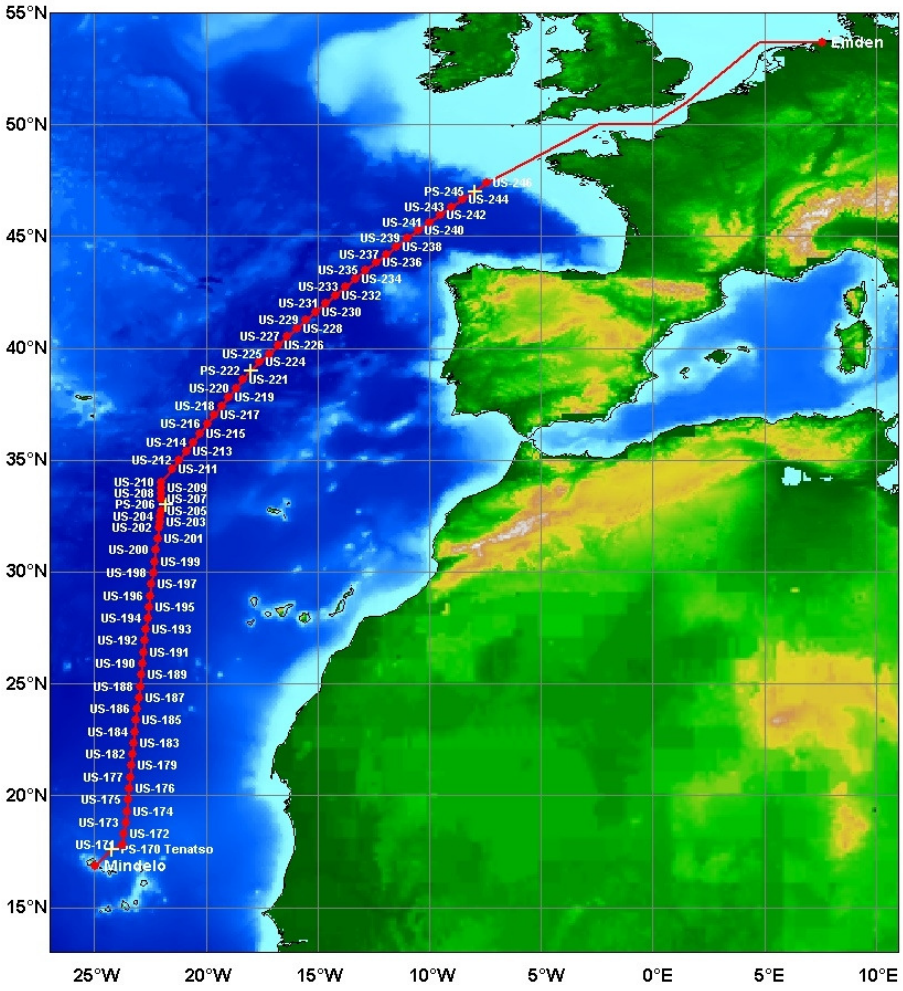

Fig. 1. Cruise track of MSM0802 from Mindelo to Cape Verde. Indicated are positions of the surface sampling (US#) and the positions of the main hydrographic stations (Tenatso, Kiel276, IB and B).

May 5: All scientists went on board MERIAN in the morning. The container was unpacked and the work places were set up. In the afternoon we have visited INDP.

May 6: MERIAN sails in the morning. It steams northward towards the Cap Verde Moored Time Series Station at 17°N 36' 24°W 19' against the strong trade wind of 9 bft and some choppy seas. Near the mooring two deep CTD casts were carried out. All systems were working well and we began steaming northward.

May 7-9: Every 30 nm an XBT profile was obtained and samples from the surface were taken. Along the cruise track the surface chlorophyll a fluorescence, salinity, temperature and a full set of meteorological data was registered.

May 10-11: In the morning on the 10th of May Merian arrived at the Kiel276 mooring site, were the first process study took place. Multi corer, CTD and in situ pumps were deployed several times at the position followed by plankton net and light penetration

measurements. Meanwhile the weather conditions have improved quite a bit with only a light breeze from Northern directions. All systems work well.

May 12-13: Early in the morning after the last deployment at the Kiel276 mooring station we steamed northward toward our next main station, with XBT and surface sampling every 30 nm.

May 14: We spend the day working on our next main station at 39°N, 18°W. Series of multi corer deployments and several CTD casts were carried out in order to provide water samples and sediment samples for all interested groups on board.

May 15-17: Merian stems northward, our surface sampling and XBT deployments continue every 30 nm. In the evening on 17th May we reach our last main station where hydrographic work and geological sampling is carried out.

May 18: This morning the last XBT at this cruise was deployed at 47° 22.97' N 7° 27.05' W. End of scientific work. From there we began steaming towards Emden.

May 02: All cruise participants are busy packing the equipment that will not be needed anymore, making long lists, and producing final plots.

May 21: The cruise terminates in Emden (Germany) with the departure of the scientific crew in the early morning.

Selected examples of the results from FU2008 student projects

Andrea Bauer (Master, IOW): Detection of the Azores Front in the subtropical Northeast Atlantic: In the course of the diploma thesis "Seasonal and interannual variability in the position of the Azores Front" XBTs and XCTDs were used to make a vertical section through the northeast subtropical Atlantic to detect the Azores Front during MSM08/02. Expendable bathythermograph (XBT) and expendable conductivity/ temperature (XCTD) probes are small oceanographic devises continuously measuring temperature and in the case of XCTD temperature and conductivity as they descend. The measurements are sent to a data acquisition system by a wire.

The Azores front is evinced in rising of the 15°C isotherm from depths below 300 m to above 200 m. To diagnose whether the Azores Front has been hit isotherms of temperature were plotted in a diagram during the cruise. Figure 2a shows the vertical temperature distribution in the top 500 m water column between 29.5 and 39°N. The 15°C isotherm is marked by a solid line, the 18°C isotherm by a dashed line and the mixed layer depth by a dotted line. Figure 2b shows the salinity distribution between 32.5 and 36.2°N because only in this part of the transect the XCTD probes were used. The dotted line shows the position of the 15°C isotherm. This year the Azores Front was detected between 33.5 and 36.2°N. The front is also evident in the salinity distribution by the enhancement of the yellow patch following the lifting of the 15°C isotherm (Fig.2b). The cruise results show that the Azores Front seems to be located 1.5 degree further to the South and has the major thickness in comparison to the cruise P349 in April 2007.

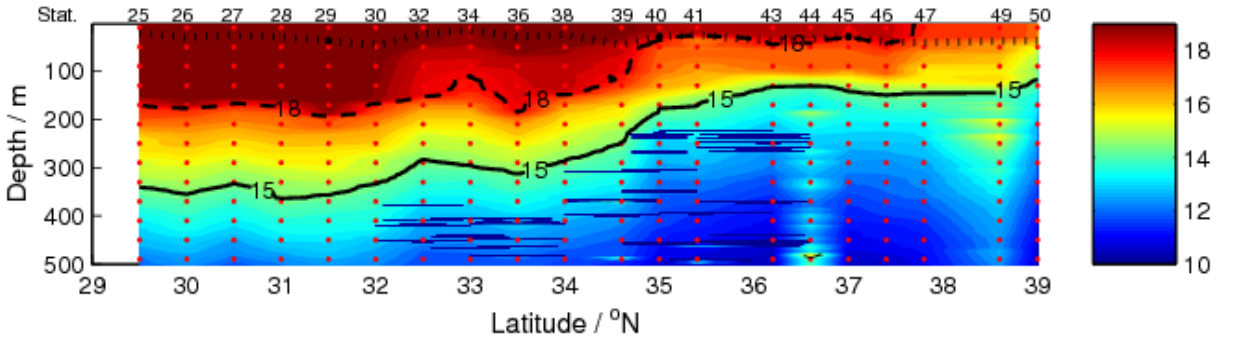

Fig.2a: Vertical temperature distribution up to 500 m depth between 29.5 and 39°N based on the XBT and XCTD data. The plotted lines are the 15°C isotherm (-), the 18°C isotherm (--) and the mixed layer depth (ⁿ). The red dots indicate the position of the XBT and XCTD casts and the numbers on top give the station ID.

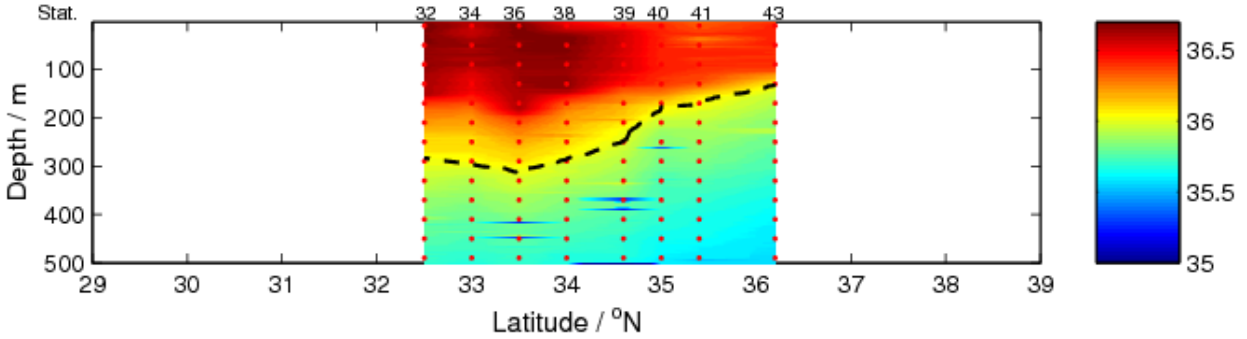

Fig.2b: Vertical salinity distribution up to 500 m depth between 32.5 and 36.2°N based on the XCDT data. The dashed line shows the position of the 15°C isotherm. The red dots indicate the position of the XCTD casts and the numbers on top give the station ID.

Enrique F. Otero (PhD, IOW): Iron speciation in surface waters: Iron is an essential micronutrient for phytoplankton growth. The concentrations in seawater are in the range between 20pM to 1nM in High Nutrient - Low Chlorophyll (HNLC) areas. In those "HNLC" areas of the world's oceans, iron appears to limit phytoplankton growth being required in numerous metabolic processes, which may have important implications for global cycles e.g. carbon. These concentrations and the oxidation state of iron species play an important role, because they vary as function of several factors including redox potential, pH, salinity, dissolved oxygen concentration and the presence of organic matter. Fe (II) and Fe (III) are the most common states found in seawater being Fe (II) species thermodynamically unstable in oxic conditions. Thus its concentrations are much lower than Fe (III) forms due to rapid oxidation by O2 in the surface. Fe (II) is much soluble than Fe (III), hence Fe (II) is supposed as the most bio-available form of iron in seawater. Aeolian deposition (e.g. Saharan dust), fluvial transport, hydrothermal vents, continental shelf generation and upwelling of Fe enriched subsurface waters are the most sources of iron in the surface waters of the oceans.

My field of work is the speciation of iron in the Baltic Sea. A combination of several analytical techniques for use on board previously reported have been adapted and for the first time used during that cruise. My system will allow on board accurate and rapid iron determination

at the levels of iron in seawater. As sampling systems of contamination free surface water two systems were used, a snorkel system and a fish both developed at IOW. The two main devices of the Lab-system are a peristaltic pump and a PMT. An eight channels peristaltic pump was used to carry the different reagents through the system. As pre-concentration column a 1cm column of 8- hydroxyquinoline resin immobilised on a toyopearl gel HW65C was used. Before the preconcentration step of the sample, this is mixed with the sample buffer to reach the optimal pH for retain Iron II onto the column (> pH4). The measurement consists in two different phases. In the load phase the buffered sample goes through the column being the iron (II) ions retained. Then, the valve is changed to position B and the acid carrier elutes the samples carrying the sample to the acquisition cell. During the pathway of the sample, this is mixed with a solution of 1M of ammonia, reaching the optimal pH (10-11) for the reaction with luminol.

The goals for the cruise were 1) setting and testing the system for the cruise in June/July in the Baltic Sea, 2) sampling on different stations and analysis on board, 3) developing a station diary considering main parameters (position, salinity and temperature), 4) to establish the system for the measurements of Iron (II) and getting some values for low concentrations found in the surface waters of the open ocean as well as 5) to collect several samples for the measurement of total dissolved iron in the IOW trace metals lab.

Anna Orlikowska (Post Doc, IOW) & Johan Engelbrektsson (Post Doc, University of Gothenburg): Halogenated organic compounds (halocarbons) are a group of compounds present as trace constituents in the oceans and atmosphere. Halocarbons consist of a multitude of chlorinated, brominated and iodinated organic compounds originating from a number of chemical and biological processes. While similar to the anthropogenic chlorofluorocarbons (CFC's), known for their capability to deplete stratospheric ozone, the dynamics of halocarbons are much less understood. The effect of halocarbons on transport of halogens into the stratosphere and on stratospheric ozone budgets has been discussed extensively over the last decade. It is known that a number of brominated and chlorinated compounds deliver chlorine and bromine to the stratosphere, and it has been shown that in the stratosphere, bromine is about 50 times more efficient at depleting ozone than is chlorine, also it has been shown that the synergistic effect of chlorine and bromine species accounts for approximately 20 % of the polar stratospheric ozone depletion. Iodinated compounds are currently believed to mainly influence reactions in the lower troposphere due to rapid photolysis leading to short atmospheric life-times.

During the cruise, air and surface water was sampled at high spatial resolution in order to capture as much as possible of the widely varying dynamics of halocarbon processes (Fig.3). On selected stations, high resolution depth profiles were also collected. The samples were analyzed for 23 different halocarbons with an onboard capillary gas chromatography system with electron capture detection and online purge and trap pre-concentration. Further samples were collected for later analysis of isotopic makeup in order to elucidate the origin

of the halocarbons. The stable carbon isotope analysis was carried out by a continuous flow purge and trap system coupled to a gas chromatograph interfaced with a mass spectrometer and an isotope ratio mass spectrometer. The low molecular weight volatile halogenated organic compounds (VHOCs), along with dimethylsulfide (DMS) and isoprene, as well as monocyclic aromatic compounds were determined.

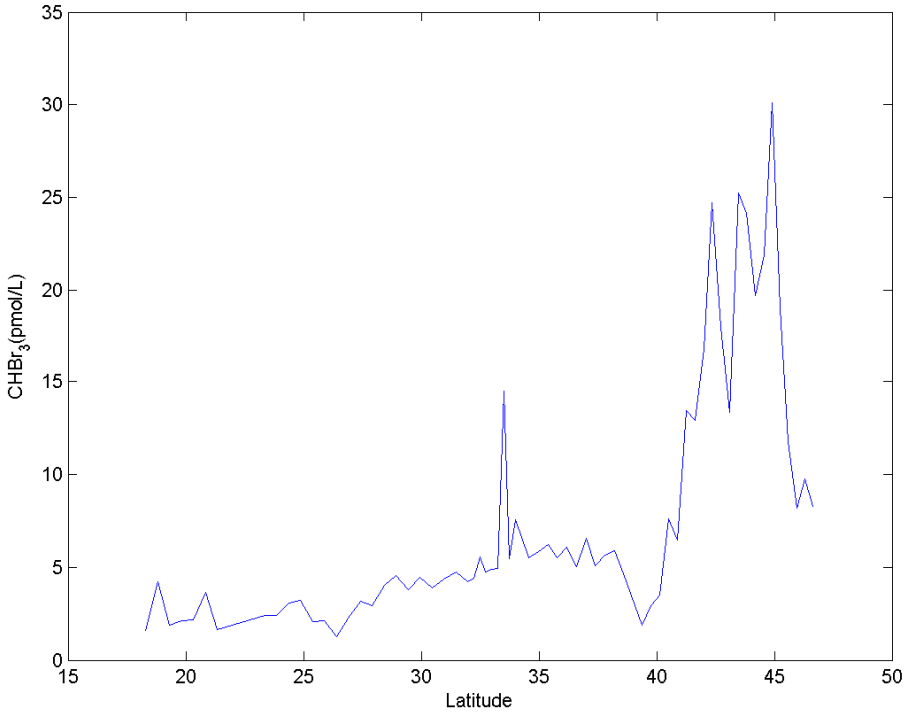

Fig.3. Surface water concentrations (pmol/L) of tribromomethane at different latitudes along the cruise track from Cape Verde Islands to the Bay of Biscay.

Paul Mann (PhD, Univ. Newcastle): Photochemical degradation of dissolved organic matter and production of ammonium in the North Atlantic. A paradigm of ocean biogeochemistry is that phytoplankton within the surface mixed layer are limited by inorganic N. Excluding di-nitrogen (N2), dissolved organic nitrogen (DON) constitutes the second-largest reservoir of nitrogen in the oceans, but has until recently been considered largely refractory in nature. One potential pathway for DON remineralisation to inorganic forms of N, especially ammonium (photoammonification), has been observed from inland and riverine waters (Bushaw, 1996). Despite the potential importance of this nutrient pathway however, only limited studies have investigated photoammonification rates in the open ocean (Bronk, 2002; Kitidis, 2006) and none to date had been conducted in the Atlantic Ocean.

During the cruise, we measured surface water photoammonification rates during 6 on-deck irradiation experiments using freshly collected, filtered samples. Experiments were carried out on water collected from a range of biogeochemical regions to investigate regional variability. During each experiment ammonium increased over time with respect to dark controls, which were treated identically and wrapped in foil (Fig. 4). Rates obtained ranged

between 13.5 – 42.0 nM L^{-1} hr (Tab. 1). When normalised to time integrated irradiance rates were 9.4 – 25.5 pmol L^{-1} h^{-1}/ (Wm^{-2}). A comparison of the current results to published oceanic rates can be seen in Table 1.

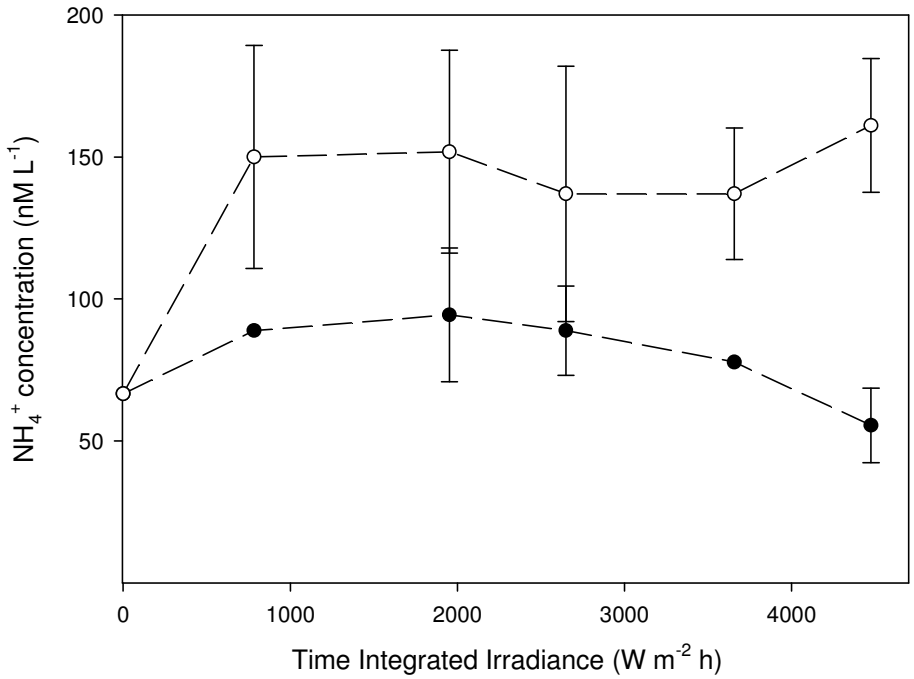

Fig. 4. Ammonium concentration during 4 hour incubation at surface irradiance and temperature. Open circles represent light exposed, closed black are dark controls. Error bars represent one standard deviation.

To investigate if a relationship exists between coloured dissolved organic matter (CDOM) and photoammonification rate, samples for CDOM characterisation were collected. Analyses were carried out for absorbance and fluorescence spectrophotometry and dissolved organic C (DOC) and DON concentration. No direct relationship was observed between photoammonification and CDOM absorbance (300nm) or spectral slope (S290-350). Future work aims to determine if fluorescence signatures can be used as a proxy for photoammonification and allow independent organic matter pool degradation rates to be determined.

Table 1. Photoammonification rates measured in open ocean environments to date.

Sample	Ammonification rate (nM L-1 h-1)	Reference
Eastern Tropical North Pacific	0.4 – 2.5	Bronk (2002)
Oligotrophic Mediterranean	0.7 – 2.9	Kitidis (2006)
North-East Atlantic	13.5 – 42.0	Present study

In summary, this study for the first time demonstrates a strong contribution for photoammonification processes in N cycling within surface waters of the Atlantic Ocean.

Steffen Mallwitz (Master, IOW) Distribution of trace metals (Cd, Pb, Co, Ni, Cu, Zn and Fe) in Atlantic surface waters: During the Merian cruise MSM 08/02 in May 2008 surface water samples were taken for trace metal analysis by two different sampling methods between Cape Verde Islands and the English Channel. The two sampling systems were tested and compared: a) snorkel, pumping water from 8m depth and b) fish, sampling of directly surface water. Further pre-treatment and measurements have been carried out in IOW. Trace metal samples in the laboratory at IOW are analysed with two different methods: 1) Liquid - liquid extraction [Danielsson et al. 1978] and 2). Liquid - solid phase extraction [Modified method after Willie et al. 1998].

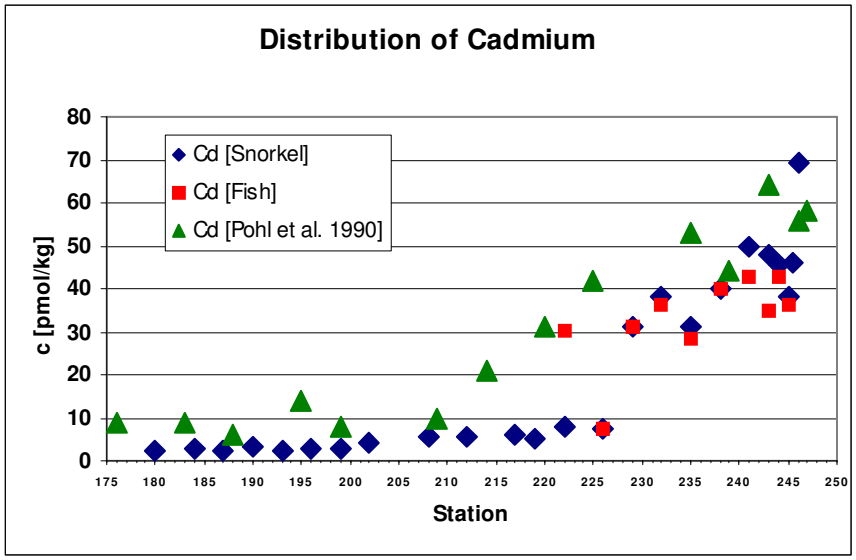

Fig. 5: Surface distribution of Cadmium (unfiltered) in the North-East Atlantic, during MARIA S: MERIAN cruise MSM 08/02, measured with the Liquid-liquid-extraction

First results have been compared to a dataset from 1990 [Pohl et al. 1990]. The transect (Fig. 5) show an increase of metal concentration between the open Atlantic (2.5 to 8 pmol/kg) and the shelf waters (30-50 pmol/kg). Furthermore the snorkel data conform the results from the fish. Data from May 1990 show slightly higher concentrations. This is possibly a result of the variations of low concentrations near the detection limit, but also other possibilities have to be considered: As described by Kremling & Pohl (1989) cadmium is subject to seasonal variability, for example 24 to 78 pmol/kg in March and 6 to 35 pmol/kg in June-July between the open Atlantic and the continental slope were previously reported. Therefore increasing concentrations in the North Atlantic surface waters may be also a result of transport of deepwater from the continental shelf and/or by atmospheric deposition. Also the continental shelf waters provide considerable inputs from west European rivers. Otherwise a decrease of cadmium contents is caused by biogenic particulate flux from the surface layer into the deeper waters. Therefore lower Cd concentrations in June 2008 could be a result of the seasonal variations.

Appendix:

Station	Date	Time (UTC)	Position	Position	Gear
MSM8/170-1	06.05.2008	18:37	17° 35,00' N	24° 15,01' W	CTD/RO
MSM8/170-2	06.05.2008	19:55	17° 35,00' N	24° 15,01' W	SNO
MSM8/170-1	06.05.2008	20:59	17° 35,00' N	24° 15,01' W	CTD/RO
MSM8/170-3	06.05.2008	21:00	17° 35,00' N	24° 15,01' W	PLA
MSM8/170-4	06.05.2008	21:07	17° 35,00' N	24° 15,01' W	XBT
MSM8/171-1	07.05.2008	00:29	17° 47,24' N	23° 43,01' W	XBT
MSM8/172-1	07.05.2008	03:29	18° 17,12' N	23° 39,99' W	XBT
MSM8/173-1	07.05.2008	06:42	18° 48,01' N	23° 37,00' W	XBT
MSM8/174-1	07.05.2008	09:39	19° 17,70' N	23° 34,03' W	XBT
MSM8/175-1	07.05.2008	12:35	19° 48,95' N	23° 30,00' W	XBT
MSM8/176-1	07.05.2008	15:16	20° 19,04' N	23° 27,00' W	XBT
MSM8/177-1	07.05.2008	18:06	20° 49,91' N	23° 24,00' W	XBT
MSM8/178-1	07.05.2008	18:11	20° 50,35' N	23° 23,96' W	XBT
MSM8/179-1	07.05.2008	20:57	21° 19,99' N	23° 21,01' W	XBT
MSM8/180-1	07.05.2008	20:59	21° 20,15' N	23° 20,99' W	XBT
MSM8/181-1	07.05.2008	21:04	21° 20,60' N	23° 20,94' W	TD
MSM8/182-1	07.05.2008	23:43	21° 49,95' N	23° 18,00' W	XBT
MSM8/182-2	07.05.2008	23:45	21° 50,12' N	23° 17,99' W	XBT
MSM8/182-3	07.05.2008	23:52	21° 50,72' N	23° 17,90' W	TD
MSM8/183-1	08.05.2008	02:28	22° 20,93' N	23° 13,99' W	XBT
MSM8/183-2	08.05.2008	02:34	22° 21,41' N	23° 13,95' W	TD
MSM8/184-1	08.05.2008	05:15	22° 51,05' N	23° 11,00' W	XBT
MSM8/185-1	08.05.2008	08:12	23° 21,98' N	23° 8,00' W	XBT
MSM8/186-1	08.05.2008	11:02	23° 51,92' N	23° 5,01' W	XBT
MSM8/186-2	08.05.2008	11:08	23° 52,44' N	23° 4,94' W	TD
MSM8/187-1	08.05.2008	13:52	24° 22,82' N	23° 1,03' W	XBT
MSM8/187-2	08.05.2008	13:58	24° 23,24' N	23° 0,95' W	TD
MSM8/188-1	08.05.2008	16:34	24° 52,90' N	22° 58,00' W	XBT
MSM8/188-2	08.05.2008	16:39	24° 53,31' N	22° 57,95' W	TD
MSM8/189-2	08.05.2008	19:19	25° 23,19' N	22° 53,98' W	XBT
MSM8/189-3	08.05.2008	19:25	25° 23,74' N	22° 53,92' W	TD
MSM8/190-1	08.05.2008	22:07	25° 54,03' N	22° 51,00' W	XBT
MSM8/190-2	08.05.2008	22:13	25° 54,55' N	22° 50,95' W	TD
MSM8/191-1	09.05.2008	00:51	26° 23,99' N	22° 48,00' W	XBT
MSM8/191-2	09.05.2008	00:57	26° 24,52' N	22° 47,94' W	TD
MSM8/192-1	09.05.2008	03:41	26° 54,99' N	22° 44,01' W	XBT
MSM8/192-2	09.05.2008	03:42	26° 55,08' N	22° 44,01' W	XBT
MSM8/192-3	09.05.2008	03:50	26° 55,69' N	22° 43,93' W	XBT
MSM8/193-1	09.05.2008	06:32	27° 24,97' N	22° 41,00' W	XBT
MSM8/194-1	09.05.2008	09:19	27° 54,95' N	22° 37,00' W	XBT
MSM8/195-1	09.05.2008	12:12	28° 25,93' N	22° 33,00' W	XBT
MSM8/195-2	09.05.2008	12:17	28° 26,35' N	22° 32,96' W	TD
MSM8/196-1	09.05.2008	14:52	28° 56,01' N	22° 29,98' W	XBT
MSM8/196-2	09.05.2008	14:57	28° 56,41' N	22° 29,96' W	TD
MSM8/198-2	09.05.2008	20:20	29° 57,48' N	22° 21,95' W	TD
MSM8/199-1	09.05.2008	22:54	30° 27,14' N	22° 18,98' W	XBT
MSM8/199-2	09.05.2008	23:00	30° 27,64' N	22° 18,91' W	TD
MSM8/200-1	10.05.2008	01:39	30° 58,18' N	22° 14,98' W	XBT
MSM8/200-2	10.05.2008	01:46	30° 58,73' N	22° 14,91' W	TD
MSM8/201-1	10.05.2008	04:15	31° 28,14' N	22° 10,98' W	XBT

Station	Date	Time	Position	Position	Gear
MSM8/201-2	10.05.2008	04:21	31° 28,63' N	22° 10,93' W	TD
MSM8/202-1	10.05.2008	07:04	31° 59,00' N	22° 7,00' W	XBT
MSM8/202-2	10.05.2008	07:09	31° 59,41' N	22° 6,95' W	TD
MSM8/203-1	10.05.2008	08:32	32° 14,00' N	22° 5,00' W	XBT
MSM8/204-1	10.05.2008	10:03	32° 29,03' N	22° 4,00' W	XCTD
MSM8/204-2	10.05.2008	10:15	32° 29,46' N	22° 4,24' W	TD
MSM8/205-1	10.05.2008	11:35	32° 44,06' N	22° 0,79' W	XCTD
MSM8/206-1	10.05.2008	13:28	32° 59,98' N	21° 50,02' W	XCTD
MSM8/206-2	10.05.2008	13:39	32° 59,98' N	21° 50,02' W	SD
MSM8/206-3	10.05.2008	13:43	32° 59,98' N	21° 50,03' W	PLA
MSM8/206-4	10.05.2008	14:14	33° 0,00' N	21° 50,00' W	SD
MSM8/206-5	10.05.2008	14:49	32° 59,77' N	21° 47,26' W	MUC
MSM8/206-6	10.05.2008	18:41	33° 0,00' N	21° 50,00' W	CTD/RO
MSM8/206-7	10.05.2008	22:39	33° 0,00' N	21° 50,00' W	ISP
MSM8/206-8	11.05.2008	08:32	33° 0,00' N	21° 50,00' W	CTD/RO
MSM8/206-9	11.05.2008	09:21	33° 0,00' N	21° 50,00' W	PUFI
MSM8/206-9	11.05.2008	09:26	33° 0,00' N	21° 50,00' W	PUFI
MSM8/206-9	11.05.2008	12:18	32° 59,98' N	21° 50,00' W	PUFI
MSM8/206-10	11.05.2008	12:28	32° 59,97' N	21° 50,01' W	CTD/RO
MSM8/206-11	11.05.2008	15:08	33° 0,00' N	21° 49,99' W	CTD/RO
MSM8/206-12	11.05.2008	18:53	32° 59,99' N	21° 50,00' W	ISP
MSM8/207-1	12.05.2008	12:55	33° 15,08' N	22° 0,09' W	XCTD
MSM8/208-1	12.05.2008	14:25	33° 30,02' N	22° 0,07' W	XCTD
MSM8/209-1	12.05.2008	15:56	33° 44,87' N	21° 59,86' W	XCTD
MSM8/210-1	12.05.2008	17:30	33° 59,95' N	21° 59,98' W	XCTD
MSM8/211-1	12.05.2008	21:25	34° 34,90' N	21° 30,10' W	XCTD
MSM8/212-1	13.05.2008	00:02	34° 58,86' N	21° 12,01' W	XCTD
MSM8/213-1	13.05.2008	02:40	35° 22,99' N	20° 53,05' W	XCTD
MSM8/214-1	13.05.2008	05:18	35° 47,01' N	20° 34,99' W	XCTD
MSM8/215-1	13.05.2008	07:57	36° 11,97' N	20° 16,05' W	XCTD
MSM8/216-1	13.05.2008	10:36	36° 36,03' N	19° 56,98' W	XBT
MSM8/217-1	13.05.2008	13:07	36° 59,85' N	19° 38,29' W	XBT
MSM8/218-1	13.05.2008	16:31	37° 24,03' N	19° 18,98' W	XCTD
MSM8/219-1	13.05.2008	19:05	37° 48,00' N	18° 58,99' W	XBT
MSM8/220-1	13.05.2008	22:07	38° 11,96' N	18° 40,03' W	XBT
MSM8/221-1	14.05.2008	01:22	38° 35,94' N	18° 20,09' W	XBT
MSM8/222-1	14.05.2008	04:55	39° 0,00' N	18° 0,00' W	CTD/RO
MSM8/222-2	14.05.2008	08:28	39° 0,00' N	18° 0,00' W	SD
MSM8/222-3	14.05.2008	08:31	39° 0,00' N	18° 0,00' W	PLA
MSM8/222-4	14.05.2008	08:43	39° 0,00' N	18° 0,00' W	MUC
MSM8/222-6	14.05.2008	13:38	38° 59,54' N	18° 3,22' W	MUC
MSM8/222-7	14.05.2008	16:45	38° 59,53' N	18° 3,22' W	MUC
MSM8/222-8	14.05.2008	20:14	39° 0,00' N	18° 0,00' W	CTD/RO
MSM8/222-9	14.05.2008	21:22	39° 0,00' N	18° 0,00' W	CTD/RO
MSM8/223-1	15.05.2008	01:00	38° 59,99' N	18° 0,00' W	PUFI
MSM8/223-1	15.05.2008	01:06	39° 0,01' N	18° 0,18' W	PUFI
MSM8/224-1	15.05.2008	03:44	39° 21,95' N	17° 36,06' W	XBT
MSM8/225-1	15.05.2008	06:24	39° 45,03' N	17° 10,97' W	XBT
MSM8/226-1	15.05.2008	09:03	40° 7,99' N	16° 47,01' W	XBT
MSM8/228-1	15.05.2008	14:25	40° 53,03' N	15° 56,06' W	XBT
MSM8/229-1	15.05.2008	17:20	41° 15,90' N	15° 30,99' W	XBT
MSM8/230-1	15.05.2008	20:19	41° 38,01' N	15° 5,00' W	XBT
MSM8/231-1	15.05.2008	23:02	41° 59,94' N	14° 39,09' W	XBT
MSM8/232-1	16.05.2008	01:41	42° 21,89' N	14° 13,14' W	XBT

Station	Date	Time	Position	Position	Gear
MSM8/233-1	16.05.2008	05:09	42° 44,00' N	13° 46,00' W	XBT
MSM8/234-1	16.05.2008	08:37	43° 6,04' N	13° 18,97' W	XBT
MSM8/235-1	16.05.2008	11:56	43° 28,04' N	12° 51,97' W	XBT
MSM8/236-1	16.05.2008	15:16	43° 50,01' N	12° 23,99' W	XBT
MSM8/237-1	16.05.2008	18:36	44° 10,98' N	11° 56,03' W	XBT
MSM8/238-1	16.05.2008	22:04	44° 32,97' N	11° 28,05' W	XBT
MSM8/239-1	17.05.2008	01:20	44° 53,99' N	10° 59,04' W	XBT
MSM8/240-1	17.05.2008	04:33	45° 14,97' N	10° 30,04' W	XBT
MSM8/241-1	17.05.2008	07:42	45° 36,02' N	10° 0,98' W	XBT
MSM8/242-1	17.05.2008	10:54	45° 57,00' N	9° 31,02' W	XBT
MSM8/243-1	17.05.2008	14:06	46° 18,01' N	9° 1,00' W	XBT
MSM8/244-1	17.05.2008	16:48	46° 39,04' N	8° 30,96' W	XBT
MSM8/223-1	17.05.2008	19:25	46° 59,97' N	7° 59,92' W	PUFI
MSM8/245-1	17.05.2008	19:27	46° 59,97' N	7° 59,93' W	SD
MSM8/245-2	17.05.2008	19:30	46° 59,98' N	7° 59,95' W	PLA
MSM8/245-3	17.05.2008	19:39	46° 59,99' N	8° 0,00' W	CTD/RO
MSM8/245-4	17.05.2008	22:49	46° 59,99' N	8° 0,00' W	MUC
MSM8/245-5	18.05.2008	01:51	47° 0,71' N	7° 57,06' W	CTD/RO
MSM8/246-1	18.05.2008	04:53	47° 22,97' N	7° 27,05' W	XBT