# BERICHTE

## aus dem Fachbereich Geowissenschaften der Universität Bremen

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# REPORT AND PRELIMINARY RESULTS OF POSEIDON CRUISE POS 258, LAS PALMAS (SPAIN) - LAS PALMAS , MARCH 24 - APRIL 2, 2000

Berichte, Fachbereich Geowissenschaften, Universität Bremen,
23 pages, Bremen 2001

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# POSEIDON Cruise POS 258 (24.03. - 2.04.2000 / Las Palmas - Las Palmas)

## 1. Introduction

The aims of this POSEIDON cruise from the 24th of March till the 2nd of April 2000 were to perform the final DOMEST tests on site and to maintain the ESTOC mooring CI12 (Fig.1). The CI12-mooring is part of the permanent time series station ESTOC (ESTOC "European Station for Time Series in the Ocean - Canary Islands) and contains in-situ pumps for sampling the water column for trace metals, two currentmeters and three sediment traps. Sampling periods ranges from one to two weeks. The particulate material collected will be analysed to determine total fluxes of organic, anorganic components and for species composition of the planktonic organisms (pteropods, foraminifera, radiolaria, coccolithophorids, and diatoms). The objective of these studies is to identify signals of seasonal variations in those components, which play an important role in the sediment formation process. The results of these investigations will form a basis for the reconstruction of paleocurrent systems and paleoproduction of the sediments.

The aim of the project DOMEST is the development of a moored sensor network in the deep sea. The advanced sensors will provide high-resolution data on particle fluxes and element concentrations in the open ocean and can be accessed from land via satellite and acoustic transmission. Communication under water will be performed through a bidirectional acoustic high-speed telemetry. Above water, a satellite network will establish the data transport between the moored system and a land based ground station in Italy. The system will be deployed at 3600 m water depth over a maximum duration of one year. With DOMEST a remotely controlled measurement of element and particle transport in the deep sea will be possible. Importantly, remote control includes access on a variety of data without recovering the sensors from the deep ocean. These possibilities allow an advanced sampling and probing of parameters depending on various environmental parameters, such as satellite derived ocean colour or particle input during dust storms. Such an "interactive" measurement of relevant parameters will enhance the understanding of transport processes from the surface to the deep ocean and allows a more detailed reconstruction of paleoclimatic changes.

Within DOMEST three subsystems will be established and used:

1. Deep-sea mooring with several measurement devices:
   *Moored Sensor Unit (MSU) with SubSurface Platform (SSP) and Multi Sensor Device (MSD)*

2. Parallel mooring with surface buoy:
   *Surface Buoy Unit (SBU)*

3. Deep Ocean Bottom Station:
   *Deep Ocean Bottom Station (DOBS) with autonomous profiling Deep Ocean Profiler (DOP)*

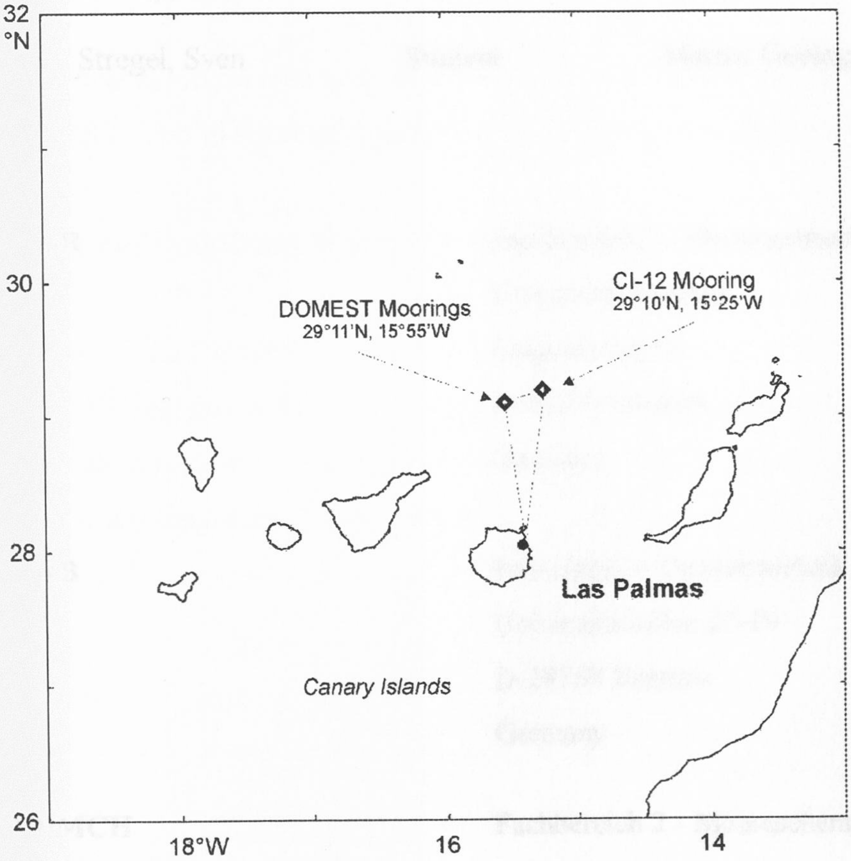

Figure 1: Planned cruise track and location of DOMEST site and ESTOC mooring CI12.

## 2. Participants

| | Name | Discipline | | Institute |
|---|---|---|---|---|
| 1. | Meinecke, Gerrit, Dr. | Dipl.-Geol. | Chief Scientist | GeoB-Bremen |
| 2. | Bergenthal, Markus | Dipl.-Phys. | DOMEST | GeoB-Bremen |
| 3. | Drünert, Frank | Dipl.-Ing. | DOMEST | OHB, Bremen |
| 4. | Metzler, Wolfgang | Dipl.-Ing. | DOMEST | GeoB-Bremen |
| 5. | Rosiak, Uwe | Technician | DOMEST | GeoB-Bremen |
| 6. | Ruhland, Götz | Dipl.-Geol. | DOMEST | GeoB-Bremen |
| 7. | Waldmann, Ch., Dr. | Dipl.-Phys. | DOMEST | GeoB-Bremen |
| 8. | Wilkop, Thomas | Technician | Marine Chemistry | UBMCH-Bremen |
| 9. | Stregel, Sven | Student | Marine Geology | GeoB-Bremen |

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## 3. Research Programs

The research activities during the POS 258 cruise are related to the scientific programs DOMEST and CANIGO.

The scientific work 60 miles north off the Canary Island Gran Canaria will focus on the final tests within the BMBF funded project DOMEST. The main objective will be to test again the data-transmission into the deep ocean, as well as the connection to a satellite communication network. New devices will be tested for their functioning on board, in the deep ocean and connected to the acoustic communication line (Fig. 2).

Within the framework of the deep-sea device testing programme DOMEST the following work is planned:

1. Test of UW communication from the ship to devices and on ships wire down to 2500 m water depth also.

2. Communication with acoustic modems in SSP (UW-Winch and SubSurface Profiler) and MSD. Test of the total communication, including the satellite link.

3. Test of Deep Ocean Profiler (DOP).

Parallel to the DOMEST activities, scientific work related to the CANIGO project will be done. Particle flux will be investigated by servicing the sediment trap mooring CI12. In addition to sediment traps, the ESTOC-mooring contains *in-situ* pumps for sampling the water column for trace metals, also. These pumps will be maintained during this cruise.

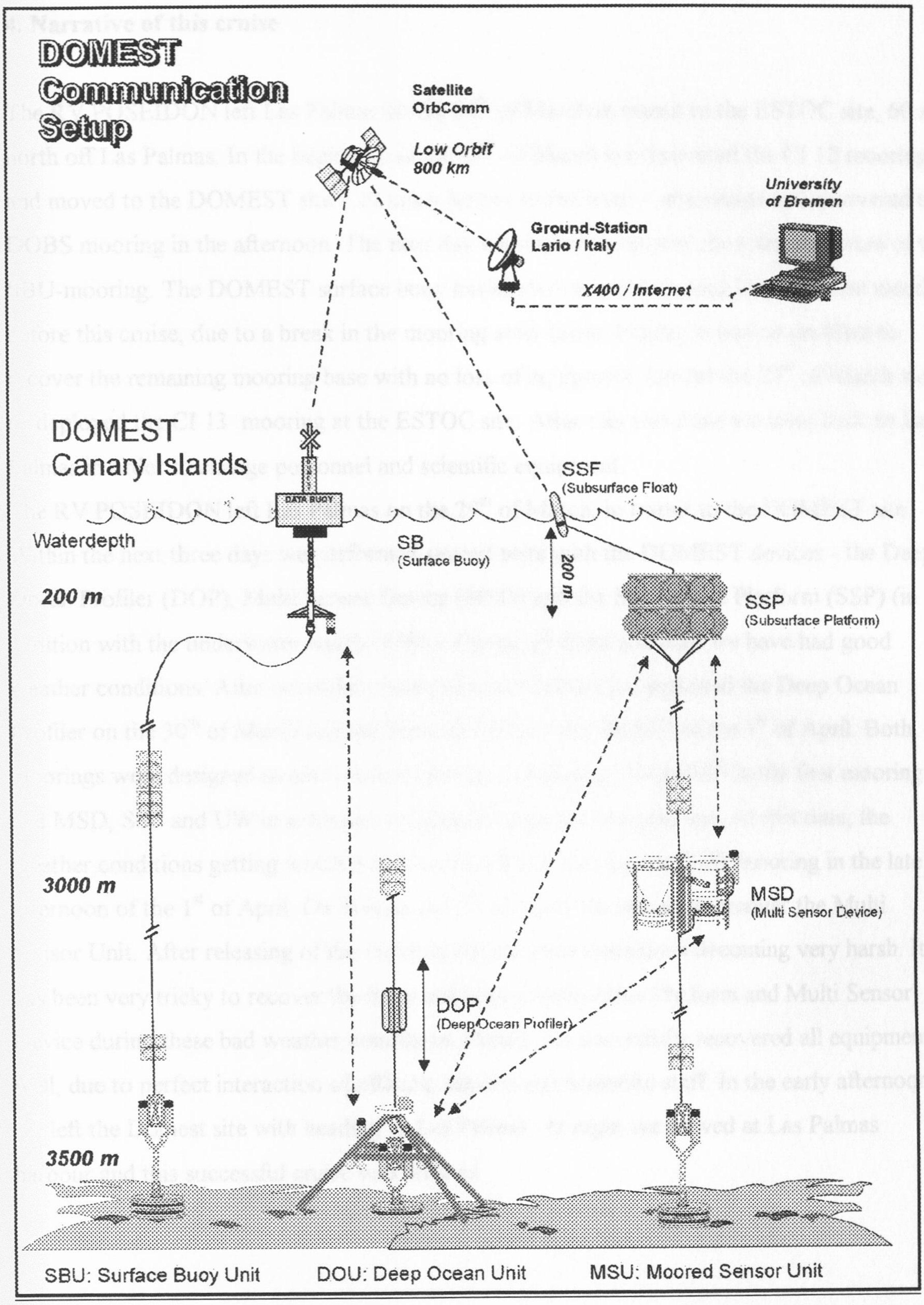


Figure 2: Communication setup and general design of DOMEST moorings and equipment.

## 4. Narrative of this cruise

The RV POSEIDON left Las Palmas on the 24th of March in transit to the ESTOC site, 60 sm north off Las Palmas. In the beginning of the 25th of March we recovered the CI 12 mooring and moved to the DOMEST site - 20 miles further to the west - afterwards and recovered the DOBS mooring in the afternoon. The next day we started to recover the remaining base of the SBU-mooring. The DOMEST surface buoy has started to move toward Teneriffe one month before this cruise, due to a break in the mooring steel-cable. Finally, it was no problem to recover the remaining mooring base with no loss of equipment. On the the 27th of March we re-deployed the CI 13 mooring at the ESTOC site. After this was done we went back to Las Palmas in order to change personnel and scientific equipment.

The RV POSEIDON left Las Palmas on the 29th of March, in transit to the DOMEST site. Within the next three days we performed several tests with the DOMEST devices - the Deep Ocean Profiler (DOP), Multi Sensor Device (MSD) and the SubSurface Platform (SSP) (in addition with the underwater winch (UW)). During all these activities we have had good weather conditions. After sucessful testing of these devices we deployed the Deep Ocean Profiler on the 30th of March and the Moored Sensor Unit (MSU) on the 1st of April. Both moorings were designed as short term moorings, consisting of the DOP in the first mooring and MSD, SSP and UW in a second, completely separate mooring line. At this time, the weather conditions getting worther and we decided to recover the DOP mooring in the late afternoon of the 1st of April. On Sunday the 2nd of April we started to recover the Multi Sensor Unit. After releasing of the mooring the sea state conditions becoming very harsh. It has been very tricky to recover the huge and heavy SubSurface Platform and Multi Sensor Device during these bad weather conditions. Finally, we sucessfully recovered all equipment well, due to perfect interaction of officers, seamen and scientific staff. In the early afternoon we left the Domest site with heading to Las Palmas. At night we arrived at Las Palmas harbour and this successful cruise was finished.

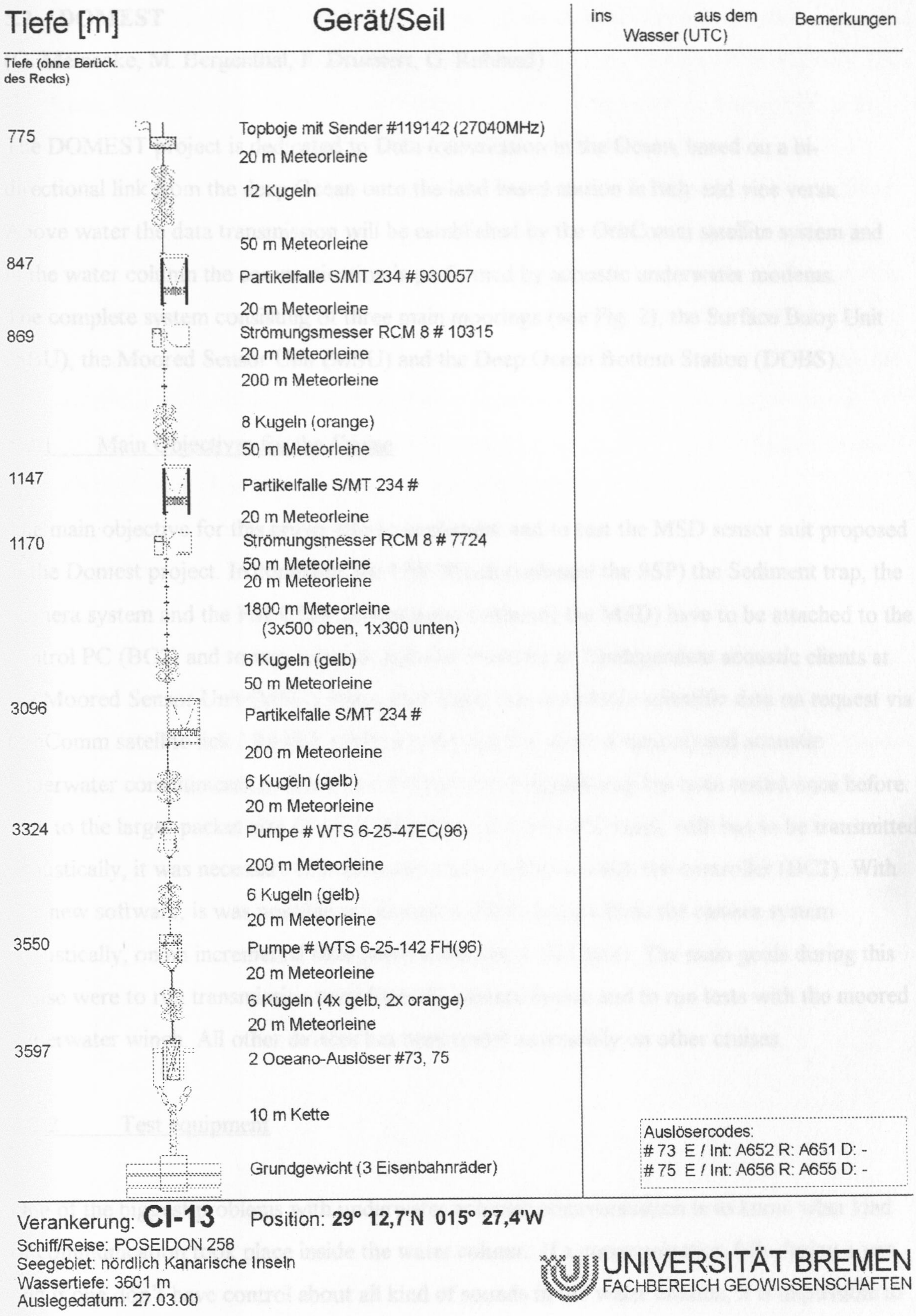
## 5. Report and Preliminary Results

### 5.1 Particle flux measurements with moored particle traps

(G. Ruhland, M. Bergenthal, U. Rosiak)

Particle flux measurements at the ESTOC site (European Station for Time-series in the Ocean, Canary Islands) carried out since fall of 1991 show seasonal and short-term variability due to varying productivity and hydrographic conditions. This long-term particle flux record also indicates that a large portion of deep particle flux originates laterally. In CANIGO, additional sediment traps have been placed for some mooring intervals north of La Palma (mooring LP), between the eastern Canary islands (mooring CI) and the Moroccan shelf (moorings EBC). Including the ESTOC position, these three main trap locations cover the productivity gradient from the shelf region to the oligotrophic gyre.

On March the 25th the ESTOC sediment trap mooring CI12 was recovered. It carried three traps, two RCM 8 Aanderaa current meter and two particle pumps (Marine Chemistry department, Univ. of Bremen). The sediment traps have worked well till the end of 1999 and have stopped afterwards due to a year 2000 problem within the electronics. After servicing of the mooring equipment the CI mooring was re-deployed as CI13 (Fig. 3) at the same location. The CI13 mooring is equipped with three sediment traps, two Aanderaa current meter and two particle pumps.



| Tiefe [m]<br>Tiefe (ohne Berück. des Recks) | Gerät/Seil | ins | aus dem Wasser (UTC) | Bemerkungen |
|---|---|---|---|---|
| 775 | Topboje mit Sender #119142 (27040MHz) | | | |
| | 20 m Meteorleine | | | |
| | 12 Kugeln | | | |
| | 50 m Meteorleine | | | |
| 847 | Partikelfalle S/MT 234 # 930057 | | | |
| | 20 m Meteorleine | | | |
| 869 | Strömungsmesser RCM 8 # 10315 | | | |
| | 20 m Meteorleine | | | |
| | 200 m Meteorleine | | | |
| | 8 Kugeln (orange) | | | |
| | 50 m Meteorleine | | | |
| 1147 | Partikelfalle S/MT 234 # | | | |
| | 20 m Meteorleine | | | |
| 1170 | Strömungsmesser RCM 8 # 7724 | | | |
| | 50 m Meteorleine | | | |
| | 20 m Meteorleine | | | |
| | 1800 m Meteorleine (3x500 oben, 1x300 unten) | | | |
| | 6 Kugeln (gelb) | | | |
| | 50 m Meteorleine | | | |
| 3096 | Partikelfalle S/MT 234 # | | | |
| | 200 m Meteorleine | | | |
| | 6 Kugeln (gelb) | | | |
| | 20 m Meteorleine | | | |
| 3324 | Pumpe # WTS 6-25-47EC(96) | | | |
| | 200 m Meteorleine | | | |
| | 6 Kugeln (gelb) | | | |
| | 20 m Meteorleine | | | |
| 3550 | Pumpe # WTS 6-25-142 FH(96) | | | |
| | 20 m Meteorleine | | | |
| | 6 Kugeln (4x gelb, 2x orange) | | | |
| | 20 m Meteorleine | | | |
| 3597 | 2 Oceano-Auslöser #73, 75 | | | |
| | 10 m Kette | | | |
| | Grundgewicht (3 Eisenbahnräder) | | | |

Auslösercodes:
# 73 E / Int: A652 R: A651 D: -
# 75 E / Int: A656 R: A655 D: -

Verankerung: **CI-13** Position: 29° 12,7'N 015° 27,4'W

Schiff/Reise: POSEIDON 258
Seegebiet: nördlich Kanarische Inseln
Wassertiefe: 3601 m
Auslegedatum: 27.03.00

UNIVERSITÄT BREMEN
FACHBEREICH GEOWISSENSCHAFTEN

Figure 3: Sediment trap mooring CI 13 deployed at ESTOC site.

## 5.2 DOMEST

(G. Meinecke, M. Bergenthal, F. Druenert, G. Ruhland)

The DOMEST project is dedicated to Data transmission in the Ocean, based on a bi-directional link from the deep Ocean onto the land based station in Italy and vice versa. Above water the data transmission will be established by the OrbComm satellite system and in the water column the communication is performed by acoustic underwater modems. The complete system consisting of three main moorings (see Fig. 2), the Surface Buoy Unit (SBU), the Moored Sensor Unit (MSU) and the Deep Ocean Bottom Station (DOBS).

### 5.2.1 Main Objectives for the Cruise

The main objective for this cruise was to implement and to test the MSD sensor suit proposed in the Domest project. In complete, the UW-Winch (onboard the SSP) the Sediment trap, the Camera system and the FSI-CTD/Currentmeter (onboard the MSD) have to be attached to the control PC (BC2) and to two separate acoustic modems as 2 independent acoustic clients at the Moored Sensor Unit (MSU). From each client one can obtain scientific data on request via OrbComm satellite link / SATEL (Pocket radio link for short distances) and acoustic underwater communication. The FSI CTD and the Sediment trap has been tested once before. Due to the larger packet size of the ADCP data output (1.000 byte), with has to be transmitted acoustically, it was necessary to implement a new software inside the controller (BC2). With this new software, is was possible to transmit a JPEG-picture from the camera system acoustically, on an incremental base (each increment 1.000 byte). The main goals during this cruise were to run transmission tests from the camera device and to run tests with the moored underwater winch. All other devices has been tested sucessfully on other cruises.

### 5.2.2 Test equipment

One of the biggest problems with underwater acoustic communication is to know what kind of communication took place inside the water column. If a communication fails during a test and if one don't have control about all kind of sounds in the water column, it is impossible to decide why the communication fails - due to a real hardware problem or because the underwater client haven't heard the signal. For this reason, the ORCA Deck Unit is used in conjunction with an FFT-Spectrogram Software package for all acoustic tests. This software is running on an separate PC, with itself is connected via an DAT-Recorder to the Line-socket of the Deck Unit. While the Deck Unit is transmitting a signal as an acoustic data stream into the Ocean, this signal is displayed in real time in the FFT-software on the monitor PC in the Lab. The same will happens with each sound and noise in the water column. If a signal is coming back from an acoustic client - moored deep in the ocean - received by the transducer and passes through the Deck Unit, this signal will be displayed in the FFT-software on the monitor PC. With growing experiences, it is easy to analyse the transmitted signals - optically displayed as spectrograms on the monitor PC and acoustically monitored at the Deck Unit, in order to separate different underwater clients or to analyse possible failure sources. Both, the DAT-Recorder and also the FFT-software have the ability to save all the communication, either as WAV-files on Harddisk or as digital soundfiles on the DAT Tape. This equipment has been used with great success from the beginning of the DOMEST project.

### 5.2.3 Test of the Underwater Winch at the ships wire

In order to test the winch, the winch was build into an modem test frame which was attached to the ships wire (Fig. 4). The test frame consist of two batteries and an acoustic client (Modem, SSP-BC2) also. The test frame was lowered down to 200 m water depth (original working depth of the winch system). Via the onboard the POSEIDON installed acoustic deck unit and transducer - which was connected to an BC2 controller – the acoustic communication with the underwater winch system was tested. The winch successfully runs different programs (left turn the cable drum, right turn the cable drum), all controlled via acoustic data link.

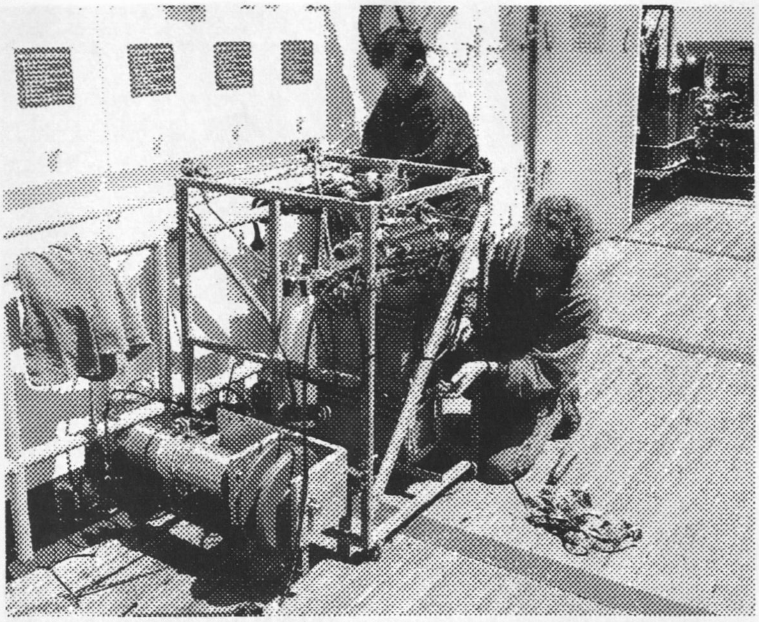


Figure 4: Modem test frame with batteries, acoustic modem, control PC and attached underwater winch (UW).

### 5.2.4 Final field test of SSP with the Underwater Winch

With the deployed SubSurface Platform (SSP) and the attached underwater winch (UW) on site (within the Moored Sensor Unit) the final tests with the UW were performed (Fig. 5). The former tests has been only done within the test frame on the ships wire. The underwater winch was equipped with 600 m of DYNEMA Kevlar rope (0.8 mm) on the cable drum, to which the SubSurface Float was attached. During deployment of the mooring, the subsurfac float was fixed in the parking position on the SubSurface Platform. After deployment of the mooring, it was planned to contact the winch via satellite commands, in order to start the drum rotation and allow the SubSurface Float to ascend to the surface. The float itself was fitted with a small LED Flasher and a short distance radio link to send commands if it will be at the surface. This have happened very quickly after the first satellite commands. After a while it was clear that the SubSurface Float was free floating due to a break of the Dynema rope. This has happened because the Dynema rope clamped itself on the cable drum and instead of release the rope it pull in the SubSurface Float against the winch. Despite this failure, the winch worked very well. All commands, send via satellite and acoustic, were performed very successfully. Finally, it was also possible to contact the float during its free drifting way via the short distance radio link.

Figure 5: SubSurface Patform (SSP) ready for deployment. In the middle part, the underwater winch is visible and behind the winch one can see the small black antenna from the SubSurface Float (SSF) docked in the white basket.

### 5.2.5 Integration and Test of the Multi Sensor Device (MSD)

The Multi Sensor Device (MSD) is the most complex device in the DOMEST project (Fig. 6). The MSD consist of 3 scientific sensors: CTD, Camera and Sedimenttrap (all with its own microcontroller inside). The FSI-CTD is a combination of CTD, acoustic currentmeter and backscatter sensor. The camera system is a combination of a digital video-camcorder - controlled by an BASIC tiger - and an image analysis PC, based on an miniaturised industrial used 200 Mhz Pentium PC with Windows and Optimas software. Finally, the sedimenttrap is also controlled by a small PHYTEC microcontroller, too. These sensors are connected via their serial RS 232 interface to the BC2 controller. The software running on the BC2, has to convert the different protocols from each sensor into one common protocol. This is necessary to understand each sensor and to pass the data through the 4th serial interface to the acoustic modem, where the data were converted to an acoustic data stream. With its own host serial port, the BC2 has to control 5 serial com-ports. Despite all specific problems of sounds - prolongating through the water column - to establish a communication from one acoustic client to another one, the acoustic request passes through the target modem to the connected BC2. Here, the information will be routed to the specific sensor. Inside the sensor, different processes have to start: *wake up, boot, gather data, build up communication, send data, acknowledge* .... - all these processes need to have different time to process. To take all these into account, different "time out" times and different "priorities" for processes have to stated and one build up on the other one. If one process need a longer time than stated in the "time out", no data transmission could happen and the modem won't proceed with the communication. Specially in the developmental stage of the DOMEST project, there are a lot of potential failure sources and all these processes need to have a fine tuning on each field test. On this cruise it was the second time for testing the complete integrated MSD, with new software, with 5 serial ports and the new 1.000 byte driver implemented.

After fixing of minor problems - especially with the camera decive, we were capable to request data from all sensors installed at the MSD. Acoustically we requested for CTD data and the FSI CTD typically offers *Conductivity, Temperature* and *Density* - in addition *current speed* and *direction* (from 3D ACM sensor) and *particle information* (from Backscatter sensor). The sediment trap was capable to display *status, RTC, sample list* and the *sample device* can be programmed to run to specific samples. Due to an electronic failure of the camera, we only could requested for status data of the digital camera system.

After a complete checkup onboard the POSEIDON, the MSD was deployed in the Moored Sensor Unit. During the mooring deployment, all sensors have been sucessfully contacted acoustically (from the ship) and via the coupled OrbComm satellite telemetry and acoustic underwater link, also.

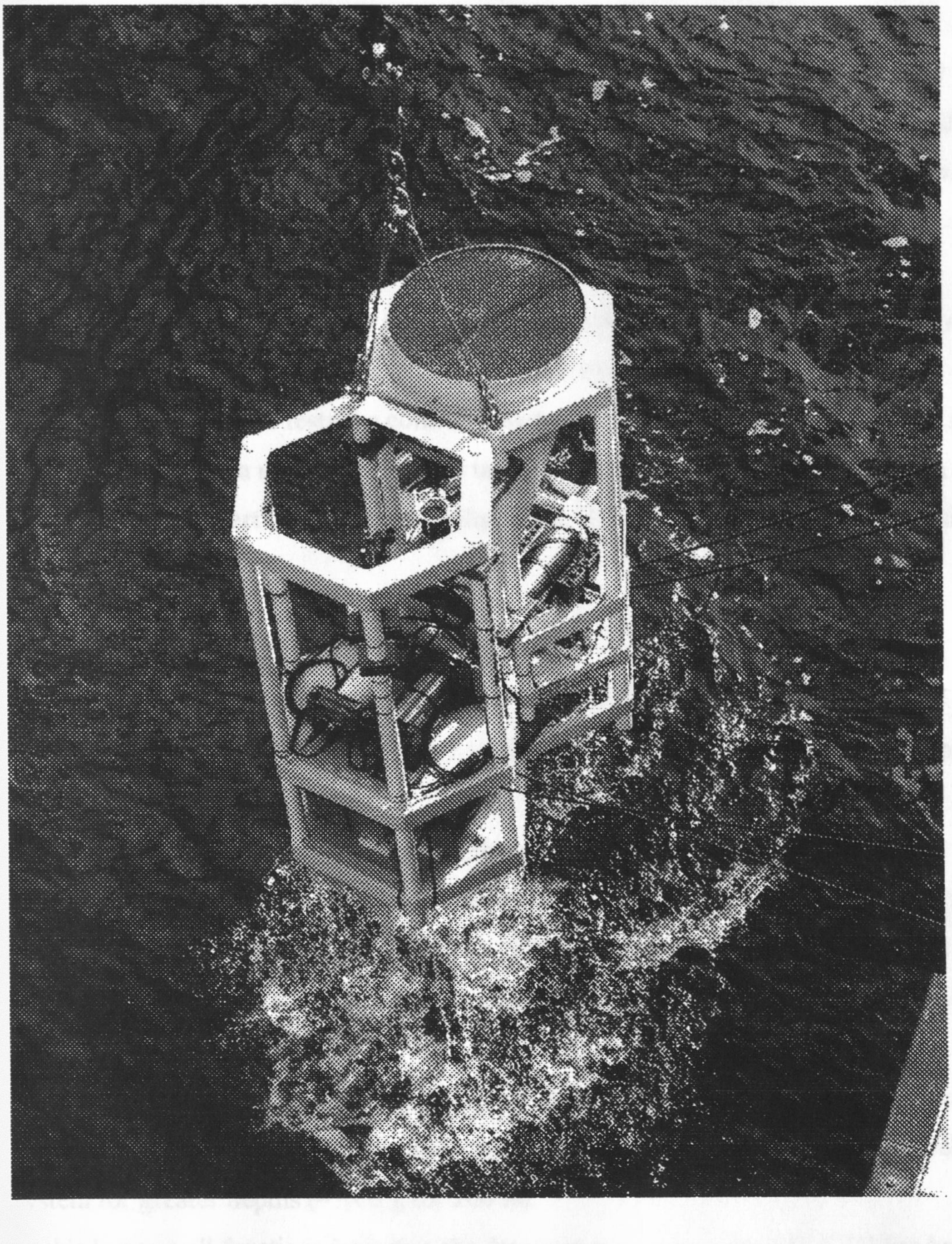


Figure 6: Multi Sensor Device (MSD) during deployment.

## 5.3 Deep Ocean Profiler (DOP)

(Markus Bergenthal, Wolfgang Metzler)

During the POSEDION cruise further tests of the deep sea profiling instrument carrier DOP has been carried out. These *in-situ* tests were necessary steps to evaluate the function of the complete system under field conditions.

The profiler itself consists of three major mechanical building blocks, the hydraulic unit housed in a highly rigid ceramic tube, the electronics unit housed in a glass tube and the two floatation material blocks (Fig. 7). These blocks predominantly determine the overall weight and volume of the system and in the end the dynamical performance i.e. speed and depth range. The mechanical design of the basic building blocks has been approved and remained unchanged compared to the former tests.

The *in-situ* testing of the profiler is a rather time consuming task. The typical deployment time interval is 8 h for two cycles in 2000 m depth over a depth range of 300 m. To get the best results during these tests the controller system is operating under a real time kernel that allows recording data under independent tasks. Therefore a minimal amount of data is available even if a part of the system malfunctions. This makes a localisation of possible failure sources easier.

### 5.3.1 Test sequence

The test sequence is determined by the balancing of the weight of the profiler and follows a uniform procedure:

1. Rough adjustment of the weight at the sea surface.
2. Deployment in shallow depth (~ 200 m) to measure the speed for both directions of motion (up and down).
3. Calculating the excessive weight from different speeds and fine trimming of the system.

Due to the different compressibility of the profiler compared to seawater and the density change due to salinity and temperature variations one has to add some weight to balance the system for greater depths (~ 100 g for 200 m).

In this last test all functions including the data acquisition from the ME CTD has been tested successfully and valuable data were delivered.

### 5.3.2 Results of the tests

*Hydraulic system*

The combination of the chosen motor with the high pressure pump proved to be working satisfactory in all test. The pump duration for pumping out an amount of 2 l of oil against a pressure of 200 bar was 40 min. The motor current and the flow rate were within the specifications, given by the manufacturer. The flow reduction vent which was designed to reduce the re-flow rate of the oil from the external bladder (under the influence of the high pressure difference) had to be opened for about 100 s to let the 2 l of oil back in the system. We do not expect a major change of this time duration under higher pressures. This time interval can be controlled to adjust flow of the oil volume to 20 ml. This value is of sufficient accuracy for this application.

The internal pressure sensor had enough resolution to control the flow in and out of the ceramic cylinder. During the tests it was detected that the sensor showed a strong hysteresis, which might cause malfunctions in long term operations. A more reliable system has to be acquired for future tests.

The propulsion of the profiler results from a buoyancy change. The maximum pumping volume of oil is 3 l. Accordingly one achieves a maximum propulsion force of 1.5 kg. With 2 l pumped we achieved an approximate speed of 15 cm/s for both directions of motion.

*Electronic unit*

The central component of the electronic unit is the micro controller. For this system it is necessary to have highly efficient power down modi available for long term operations. In contrast, when the system is powered up it should be powerful enough to control the different tasks. The system proved to be versatile and easy programmable. Additionally it is possible to use standard mass storage devices like hard disks or RAM-disks for storing scientific data and housekeeping data. The performance tests showed that the typical load on the CPU was in the range of 30 %. That means that for instance more complex missions could be supported and additional sensors could be adapted easily. The ME-CTD that currently delivers the scientific data is sending the data at a rate of 4 data sets per second. Two successive temperature profiles were taken with the CTD mounted on the profiler. Due to the monotonic and smooth motion of the profiler very high quality data are recorded.

The following figures shows some time series plots of the built-in pressure sensors and monitoring logs. In former tests, the smooth and monotonic motion has been checked. This was the basis to calculate the speed of the profiler. In principle, the speed for the up and down motion differ by 2 cm/s at an absolute speed of 15 cm/s.

At the end of this cruise, the Deep Ocean Profiler was successfully deployed in a short term mooring.

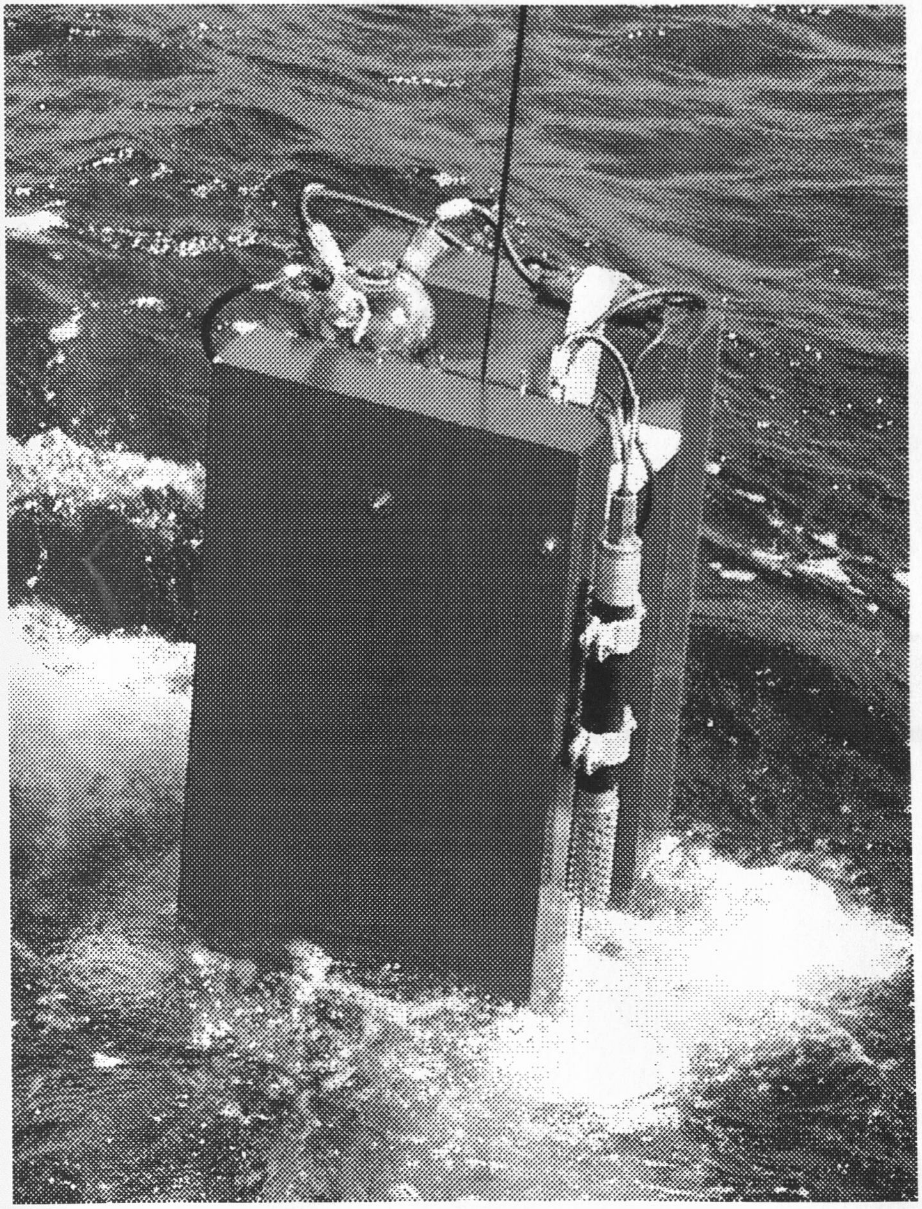


Figure 7: The Deep Ocean Profiler (DOP) during deployment. The CTD is visible at the right side of the profiler.

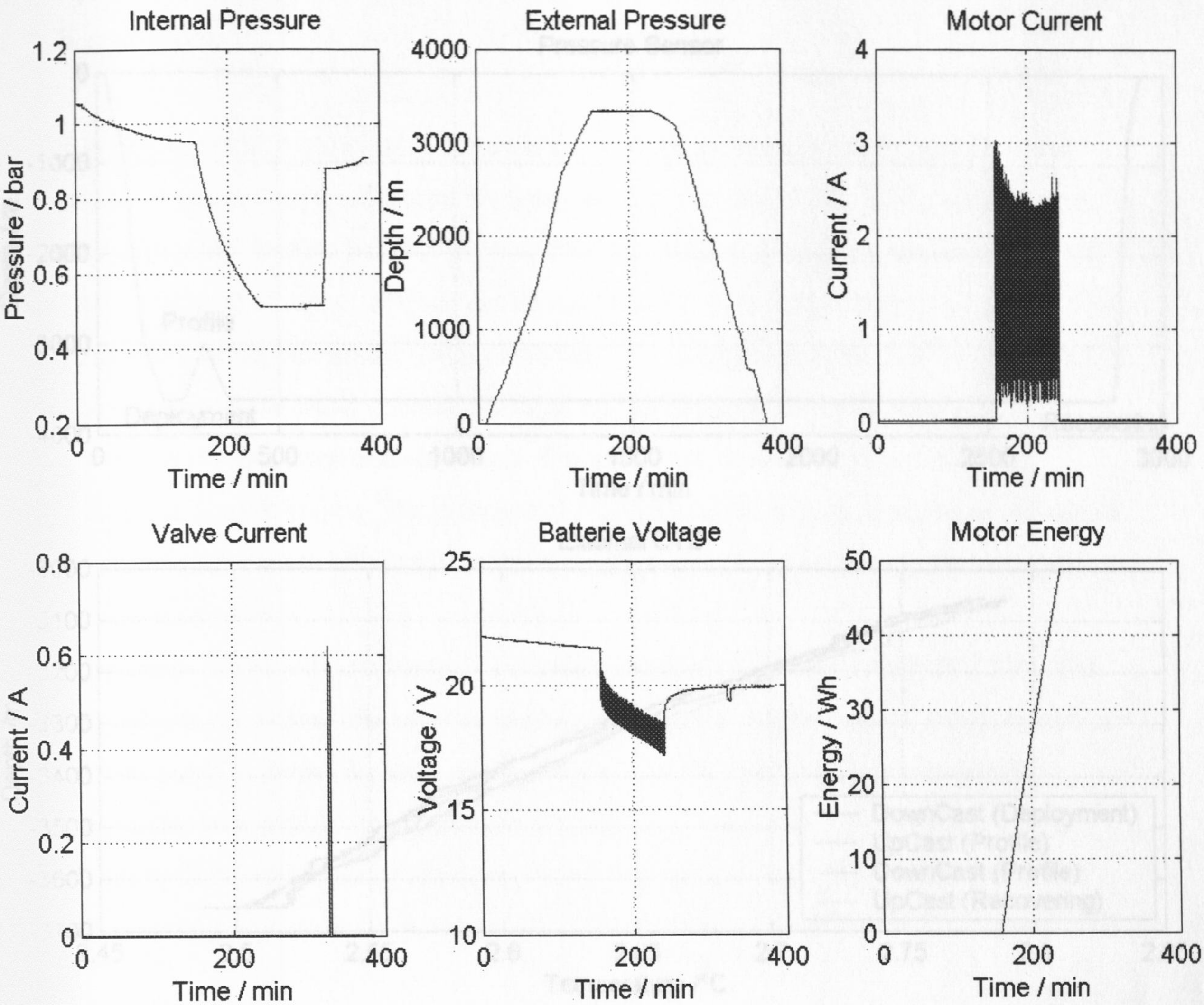


Figure 8: Diagrams of internal senors and monitoring logs of DOP during short term deployment.

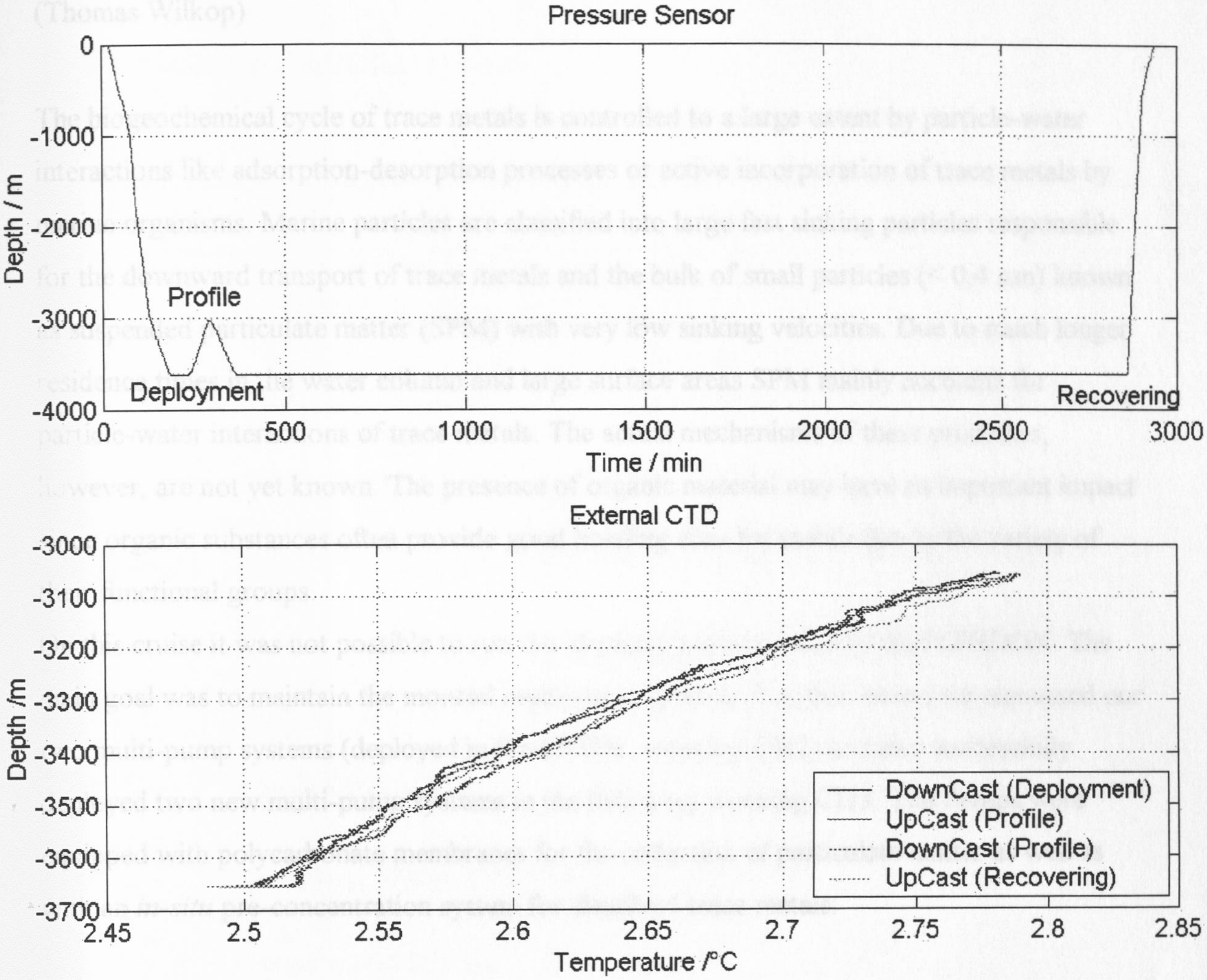


Figure 9: Pressure profile vs. time during short term deployment of DOP (upper fig.) and temperature profiles during deployment of DOP (lower fig.).

## 5.4 Marine Chemistry

(Thomas Wilkop)

The biogeochemical cycle of trace metals is controlled to a large extent by particle-water interactions like adsorption-desorption processes or active incorporation of trace metals by marine organisms. Marine particles are classified into large fast sinking particles responsible for the downward transport of trace metals and the bulk of small particles (< 0,4 µm) known as suspended particulate matter (SPM) with very low sinking velocities. Due to much longer residence times in the water column and large surface areas SPM mainly accounts for particle-water interactions of trace metals. The actual mechanisms of these processes, however, are not yet known. The presence of organic material may have an important impact since organic substances often provide good bonding sites for metals due to the variety of their functional groups.

On this cruise it was not possible to run the chemical analysis onboard the POEIDON. The main goal was to maintain the moored multi-pump systems. For this reason we recovered our two multi-pump systems (deployed in the ESTOC mooring CI12) and also successfully deployed two new multi-pump systems in the following mooring CI13. The Pumps were equipped with polycarbonate membranes for the collection of particulate matter as well as with an *in-situ* pre-concentration system for dissolved trace metals.

## 6. Station list PO 258

Table 1: Stations during POS 258 Cruise.

| *Date* | *Stat.-No.* | *Device* | *Lat. (°)* | *Lon. (°)* | *WD (m)* | *Rec.* | *Remarks* |
|---|---|---|---|---|---|---|---|
| 24.03. | | Transit to ESTOC Site | | | | | |
| 25.03. | PO 024 | CI 12 | 29 12,00 N | 015 26,70 W | 3608 | | Recovery of CI 12 Mooring |
| | PO 025 | DOBS | 29 09,70 N | 015 56,00 W | 3628 | | Recovery of DOBS Mooring |
| 26.03. | PO 026 | SBU | 29 10,80 N | 015 55,20 W | 3629 | | Recovery of SBU Mooring base |
| 27.03. | PO 027 | CI 13 | 29 14,30 N | 015 24,70 W | 3601 | | Deployment of CI 13 Mooring |
| 27.03. | | Transit to Las Palmas | | | | | |
| 28.03. | | Las Palmas | Change of scientific crew and instruments | | | | |
| 29.03. | | Transit to DOMEST Site | | | | | |
| 29.03. | PO 028 | DOP | 29 10,70 N | 015 55,30 W | 3627 | | Deep water test DOP SL 2866 m |
| 30.03. | PO 029 | MSD | 29 10,80 N | 015 56,40 W | 3628 | | Test of MSD |
| | PO 030 | MSD | 29 10,50 N | 015 55,60 W | 3629 | | Deployment of DOP Mooring |
| 31.03. | PO 031 | MSD | 29 10,30 N | 015 49,30 W | 3625 | | Test of MSD |
| | PO 032 | UW | 29 11,70 N | 015 48,90 W | 3624 | | Test of UW |
| 01.04. | PO 033 | MSU | 29 06,20 N | 015 56,40 W | 3625 | | Deployment of MSU Mooring |
| | PO 034 | DOP | 29 05,90 N | 015 54,60 W | 3630 | | Recovery of DOP Mooring |

| | | | | | | |
|---|---|---|---|---|---|---|
| 01.04. | PO 035 | COM | 29 11,40 N | 015 55,30 W | | Test of acoustic Devices |
| 02.04. | PO 036 | MSU | 29 05,90 N | 015 56,80 W | 3625 | Recovery of MSU Mooring |
| 02.04. | | Transit to Las Palmas | | | | |

Legend:

| | |
|---|---|
| MSD | Multi Sensor Device (Sensor Suite, Sediment trap, CTD, 3D ACM) |
| MSU | Moored Sensor Unit (Mooring with MSD inside) |
| DOP | Deep Ocean Profiler /Profiling YoYo vehicle) |
| DOBS | Deep Ocean Bottom Station |
| UW | Underwater Winch |
| CI | Canary Island mooring |
| COM | Communication tests via Satellite and Acoustic Communication) |

## 7. Acknowledgement

The POSEIDON cruise POS 258 was very successful. All the time on board we have had an outstanding teamwork and a very friendly comradeship between crew and scientists. For this we very sincerely thank Captain Klassen and the entire crew of the RV POSEIDON.