WOCE Line: AR26
ExpoCodes: 06PO202_1
06PO212_1
06PO233_1
06PO237_3

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ESTOC/CANIGO cruises with FS POSEIDON
cruise 202/1, 212, 233, 237/3

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Abstract

Within the framework of the ESTOC (**E**uropean **S**tation for **T**ime Series in the **O**cean, **C**anary Islands) and CANIGO (**Can**ary **I**slands Azores **G**ibraltar **O**bservations) projects several cruises with FS Poseidon and FS Meteor took place in the eastern Canary Basin. The ESTOC/CANIGO cruises with FS Poseidon include cruise 202/1 in September/October 1994, cruise 212 in September/October 1995, cruise 233 in September/October 1997 and cruise 237/3 in April 1998. A summary of those four cruise reports from FS Poseidon is given here by the chief scientists. Contributions of other participants are denoted.

Zusammenfassung

Im Rahmen der ESTOC (**E**uropean **S**tation for **T**ime Series in the **O**cean, **C**anary Islands) und CANIGO (**Can**ary **I**slands Azores **G**ibraltar **O**bservations) Projekte fanden mehrere Expeditionen mit FS Poseidon und FS Meteor im östlichen Kanarenbecken statt. Die ESTOC/CANIGO Fahrten von FS Poseidon beinhalten die Reisen 202/1 im September/Oktober 1994, Reise 212 im September/Oktober 1995, Reise 233 im September/Oktober 1997 und die Reise 237/3 im April 1998. Die Fahrtberichte dieser vier von FS Poseidon Reisen werden hier durch die Fahrtleiter zusammengefaßt. Beiträge anderer Fahrtteilnehmer sind als solche gekennzeichnet.

Contents

1. Research programmes

The upper ocean of the Canary Basin is characterized by the eastern North Atlantic subtropical gyre and the West African upwelling regime, and the atmosphere by the trade wind system and a considerable Saharan dust input from the atmosphere influencing the particle flux in this oceanic region. Investigations in this area take place within several projects like ESTOC (European Station for Time Series in the Ocean Canary Islands), JGOFS (Joint Global Ocean Flux Studies), the European MAST 2 programme EUROFLOAT and the European MAST 3 project CANIGO (Canary Islands Azores Gibraltar Observations). The POSEIDON cruises P202/1, P212, P233 and P237/3 were dedicated to investigations in the framework of those projects.

ESTOC

The ESTOC station, which is operational since the beginning of 1994, is providing long time series of physical, chemical and biological data in order to investigate the seasonal and interannual variability of the ocean. The data sets will also be supplementing WOCE and JGOFS data inventories. The position of the station is about 60 nautical miles northwest of Gran Canaria at nominally 29°10'N, 015°30'W and 3610 m water depth. Monthly measurements and water sampling are performed, usually with the research vessel TALIARTE of the Instituto Canario de Ciencias Marinas (ICCM), but the regular station work is supposed to be taken over by other Spanish or German ships when they operate in the area. Besides the monthly station work, the Institut für Meereskunde in Kiel (IfMK) operatess a current meter mooring and the university of Bremen (GeoB) a particle trap mooring at the ESTOC position both of which are regularly reset. In addition to satellite observations at least yearly cruises with German research vessels aim at checking the representativeness of the time series data and improving the understanding of the processes with mesoscale resolution in the area.

Cruises P202/1, P212, P233 and P237/3 had the goal to study zonal changes of physical, chemical and biological properties in the ocean around the Canary Islands, the latter two cruises in close connection with the CANIGO programme. During all cruises the regular monthly ESTOC station work was to be carried out and the current meter mooring at the ESTOC position was to be deployed or exchanged by a follow-up mooring, respectively.

JGOFS

Mooring KIEL276 is located at nominally 33°N, 022°W and 5320 m water depth about 240 nautical miles west of Madeira, outside economic zones of coastal states. Is is operated since 1980 with 7 current meters between 250 m and 5200 m depth. It is aimed to monitor the variability of te Azores Current at the northern rim of the North Atlantic subtropical gyre from mesoscale to seasonal and interannual scales.

Since 1993, it is continued as an open ocean JGOFS time series station with additional 4 particle traps. The mooring was to be recovered and reset during P202/1 and P212/4.

EUROFLOAT

The IfMK takes part within the European MAST 2 programme EUROFLOAT to study the large scale spreading of the Mediterranean water tongue at the 1000 m level in the northern Canary Basin and its interaction with the upper ocean Azores Front using RAFOS float technology. For the EUROFLOAT project three sound sources to track RAFOS floats were to be moored and 15 RAFOS floats to be dropped during cruise P212. Within an ending earlier three moorings with sound sources and a moored RAFOS float were to be recovered in the Iberian Basin.

CANIGO

CANIGO is an integrated European research project with the common objective of understanding the functioning of the marine system in the Canary-Azores-Gibraltar region through comprehensive interdisciplinary basin scale studies. The project started in September 1996 and will run for 3 years. Within subproject 1 the circulation and dynamics of transports through the Eastern Boundary Current System are investigated.

POSEIDON cruises P233a and P237/3 were the second and third of a total of four cruises during different seasons to determine the variability of the physical environment in the eastern Canary Basin. CTD/LADCP sections including biological and chemical sampling were carried out between the African Shelf, Madeira, La Palma and back to the African shelf to obtain a closed hydrographic box for budget calculations. Sampling for coccolithophorids, diatoms and planktic foraminifera was part of the CANIGO subproject 3, which studies the particle flux and paleoceanography in the Eastern Boundary Current. The scientific goals are (a) to obtain a better understanding of the seasonal and interannual interaction between planktonic organisms and the physical environment along a WE-transect north of the Canary Islands and (b) to compare this interaction with the long-term variability of species composition and flux into the sedimentary archives.

During P233/b-c, the main work was aimed at exchanging moorings for CANIGO as well as ESTOC. The moorings were designed to study the mean flow and particle flux, and their variability on long time scales including interannual variations (i) close to the ESTOC station (GeoB and IFMK mooring sites ESTOC/CI and ESTOC/367, respectively) that also serve as a background stations for CANIGO, (ii) in the coastal and upwelling influenced area of the Eastern Boundary Current System east of Lanzarote/Fuerteventura (EBC), and (iii) at a site well off the coastal and upwelling influence in an oligothrophic area at the CANIGO site LP north of La Palma in the open eastern Atlantic.

Deep western boundary currents at the Mid Atlantic Ridge

If the Mid Atlantic Ridges serves as a boundary between the western and the eastern Atlantic basins, one might expect deep western boundary currents (DWBC) on its eastern flank. From earlier direct measurements, there are speculations that such a DWBC sets northeast at about 34.75°N, 23.08°W at 5155 m water depth. To further test the hypothesis on the existence of such a DWBC, mooring V364 with current meters and thermistor strings between 4560 m depth and the bottom (5264 m) was deployed in July 1993 and was to be recovered during P202/1.

CTD test

During P202/1 some CTD tests were performed with a new deep sea CTD (KMS) made by Meerestechnik Elektronik ME, Trappenkamp, Germany in comparison with a standard MKIIIB Neil Brown CTD.

2. Scientific crew

Participant			Function during the cruise												
Name	Institute	Disci-pline	P202 1a	1b	1c	P212 1	2	3	4	5	P233 a	b	c	d	P237 3
Boebel, Olaf, Dr.	IfMK	PO							S	S					
Bollmann, Jörg, Dr.	ETHZ	GE									S				S
Busse, Markus	IfMK	PO	St	St	St	St	St	St							
Cantos, Alan	AINCO	PO							S						
Carlsen, Dieter	IfMK	PO	T	T		T			T	T			T	T	
Cianca, Andres	ICCM	CH									S				S
Cisneros, Jesus	ULPGC	PO											S		
Collado, Cayetano	ULPGC	CH			S										
Cortes, Mara Y.	ETHZ	GE													S
Deeken, Aloys	GeoB	CH										T		T	
Delgado, Esther	ICCM	CH			S			S							
Dugas,P.	FSI	E				T									
Escanez, Jose	IEO	CH			S		S								
Freudenthal, Tim	GeoB	BO										S	S		
Garcia-Ramos, Carlos	IEO	PO					S						S		
Godoy, Juana	ICCM	CH									S				S
Gonzalez, M. Prof.Dr.	ULPGC	CH						S							
Haag, Christian	IfMK	PO	S	S	S	S	S	S							
Hansen, Wiebke	IfMK	PO													St
Hilmi, Karim	INRH	PO									O				
Jäppinen, Tom	IBGMH	CH												T	
Kipping, Antonius	IfMK	PO	T	T											
Klass, Chrisine, Dr.	ETHZ	GE												S	
Knoll,Michaela, Dr.	IfMK	PO			C						C				
Koy, Uwe	IfMK	PO			T	T	T	T			T	T			T
Lenz, Bernd	IfMK	PO				St			St		S	S	S		S
Link, Rudolf	IfMK	PO	T	T					T	T					
Lopez-L., Federico	IEO	PO					S						S		
Meyer, Peter	IfMK	PO	T	T		T			T	T			T	T	
Molina, Raphael	IEO	PO		S											
Müller, Thomas J., Dr.	IfMK	PO	C	C					C	C		C	C	C	C
Neuer, Susanne, Dr.	GeoB	BO			S			S				S	S		
Petersen, Johannes	IfMK	CH		T					T						
Pou, Jordi	ICCM	CH													S
Reppin, Jörg	IfMK	PO									S	S			
Rocha, Francisco J.	ICCM	CH									T				
Rodriguez, Cristina	ICCM	CH			S			S							
Rodriguez Lopez, J.M	IEO	CH					S								
Rose, Henning	UBT	PH												S	
Sanders, Dirk	IfMK	CH		S					S						
Sangra, Pablo, Dr.	ULPGC	PO											S		
Santana, Rosa	ICCM	CH			S			S							
Segl, Monika, Dr.	GeoB	BO										S			
Siedler, Gerold, Prof. Dr.	IfMK	PO				C	C	C							
Spiedt, Andrea	GeoB	BO				S	S								
Sprengel, Claudia	GeoB	BO										S			
Torres, Silvia	IEO	PO										S			
Torres Padron, M.E.	ULPGC	CH						S							
Villagracia, Maria, Dr.	ICCM	CH									S				S
Will, S	IfMK	CH				T	T								
Zervakis, Vassilis, Dr.	AINCO	PO							S						

Participating institutes:

AINCO : AINCO Interocean, Madrid, Spain
ETHZ : Eidgenössische Technische Hochschule, Zürich, Switzerland
FSI : Falmouth Scientific Inc., Falmouth, U.S.A.
GeoB : FB5, Geowissenschaften, Universität Bremen, Germany
IBGMH : Institut für Biogeochemie u. Meereschemie, Universität Hamburg, Germany
ICCM : Instituto Canario de Ciencias Marinas, Telde de Gran Canaria, Spain
IEO : Instituto Español de Oceanografia, COC, Sta. Cruz, TF, Spain
IfMK : Institut für Meereskunde an der Universität Kiel, Germany
INRH : Institut National de Recherche Halieutique, Casablanca, Morocco
UBT : FB 1, Physik, Tracerozeanographie, Universität Bremen, Germany
UBMCh : FB 2, Biologie/Chemie, Meereschemie, Universität Bremen, Germany
ULPGC : Universidad de Las Palmas, Gran Canaria, Spain

Disciplines:

BO : biological oceanography
CH : chemical oceanography
E : engineering
GE : geology
PH : physics
PO : physical oceanography

Functions:

C : chief scientist
O : observer
S : scientist
St : student
T : technician

3. Scientific equipment and methods

3.1. Physical oceanography

Navigation and underway measurements (IfMK)

A GPS-receiver with accuracy of ca. 100 m was used during the first two cruises P202 and P212.. In the beginning of the P233/a a new GG24 receiver from Ashtec was installed. This unit combines the signals from the GPS and the Russian GLONASS satellites to determine positions to better than 20 m. Also four antennas of the ADU2 from Ashtech, which allow the determination of pitch, roll and heading from the GPS signals, were mounted on the very top of the vessel's mast where a good calibration could be made. After the installation, both units improved significantly the vessel-mounted ADCP (RDI, 150 KHz) data.

Since P233, the GG24 signal now is also supplied to the vessel's integrated underway data system by which data streams from the navigation, the automized weather station, the thermosalinograph and the digital echo sounding (12 kHz) are merged.

CTD/O_2-sensor/in-situ fluorometer (IfMK)

A standard MKIIIB CTD made by Neil Brown Instruments was available during all cruises. Usually the IfMK NB2 CTD was used except for the POSEIDON cruises P212 where the IfMK NB1 CTD was taken. Often the CTD was equipped with an oxygen sensor made by ME and/or an in-situ fluorometer made by Haardt, which is only applicable in the upper 3000 m. During P202 either the oxygen sensor or the fluorometer was attached to the CTD, which was usually lowered down to the bottom. During P212 only the fluorometer was used and most of the CTD casts stopped at 3000 m depth. During P233 and P237/3 the oxygen sensor and the fluorometer were used simultaneously with the CTD, except for stations with water depths greater than 3000 m where the fluorometer was removed.

Rosette (IfMK)

On each station water samples were obtained with a GO multisampler (21 x 10 l) usually if possible from the following pressure levels: bottom, 3000 dbar, 2500 dbar, 2000 dbar, 1500 dbar, 1300 dbar, 1200 dbar, 1100 dbar, 1000 dbar, 800 dbar, 600 dbar, 400 dbar, 200 dbar, 150 dbar, 100 dbar, 75 dbar, 50 dbar, 25 dbar, 10 dbar and the depth level of maximum chlorophyll content. Furthermore, the following depth levels were also used occasionally during P233 and P237: 4000 dbar, 3500 dbar, 2800 dbar, 1800 dbar, 1150 dbar, 900 dbar, 500 dbar, 300 dbar and 250 dbar. The water samples were analyzed for salinity, oxygen, nutrients, chlorophyll and plankton. During P202 and P212 also trace metals like aluminium were studied. Some water samples were already analyzed onboard of the ship, others were or will be analyzed in the laboratory.

Salinometer (IfMK, ICCM)

For the salinity measurements of the water samples a Guildline Autosal salinometer was used. The measurements were partly made on the ship and partly in the laboratory at the ICCM.

Lowered ADCP (IfMK)

A lowered Acoustic Doppler Current Profiler (RDI 150 kHz) was usually attached to the CTD. During P202 and P212 the LADCP was only applicable to 3000 m depth, for P233 and P237 the pressure case was changed and the LADCP was lowered to the bottom.

Moorings (IfMK, GeoB IEO, ULPGC)

During the cruises several moorings were recovered, deployed and exchanged. They were equipped with Aanderaa current meters, moored ADCPs, particle traps and sound sources for tracking RAFOS floats

RAFOS floats (IfMK)

The travelling times of sound pulses from moored (fixed position) sound sources to the freely drifting and listening RAFOS float is measured to determine the position of a RAFOS float. One to three pulses a day at prescribed times for a few seconds are required from two, better three, sources to get positions and thereby track lines of the float. During P202 three sound source moorings and a moored float were recovered, during P212 three EUROFLOAT sound source moorings and 15 RAFOS floats were deployed.

XBT (ICCM, IfMK)

During P202/1c and P212/2 also XBTs from Sippican were used to investigate a meddy in more detail and to increase the horizontal resolution for a study of the oceanic stratification between the Canary Islands and the African shelf, respectively.

3.2. Chemical oceanography

Oxygen: Metrohm 682 Titroprocessor (ICCM)

Glass bottles (ranging in volume from 120 to 135 ml) were used to collect water samples from the whole water column for oxygen which were immediately fixed using two reactives (manganese chloride and alkalin solution of iodure, respectively). Then, the bottles were left for at least six hours for precipitation; finally, they were titrated using a Metrohm 682 Titroprocessor.

Chlorophyll *a*: Laboratory fluorometer (ICCM)

For the determination of chlorophyll water samples were taken from 200 m to the surface using one liter plastic bottles. The chlorophyll was partly determined onboard using a Turner 10 fluorometer.

During P202 the water samples (100 ml or 200 ml, respectively) were filtered onto GF/F filters (vacuum≤ 100 mg HG) in replicates or triplicates and extracted in 10 ml of 90 % acetone for 24 hours in a refrigerator. Chlorophyll samples were measured 24 to 36 hours after filtration. The concentration of pigment was determined after measuring chlorophyll fluorescence before and after acidification with a few drops of 10% HCL, and applying a calibration factor determined using standards of pure chl a. Thus, not only chlorophyll but also phaeopigments can be measured.

During P233 water samples of 500 ml were subsequentely filtered with Whatman GF/F 47 mm glass microfibre filters, saving each filter in 10 ml glass tubes that were finally frozen. The samples were defrozen and acetone was added to dilute the pigments; they were left for 24 hours in order to release the pigments, and then chlorophyll *a* was measured using fluorometric analysis.

Nutrients: Skalar continuous-flow autoanalyser (ICCM)

Nutrient samples (50 ml plastic bottles) from the whole water column were taken and immediately frozen while standing vertically. The samples were analyzed later at the ICCM for the contents of nitrites and nitrates, phosphates and silicates using an Skalar continuous-flow autoanalyser.

Potentiometric alkalinity system (ULPGC)

During P212/3 the pH, total alkalinity and total CO_2 measurements have been done *in situ* by using a potentiometric alkalinity system that was developed to meet the WOCE recommendations. The main objective of the work of the carbon dioxide group at the ULPGC was to study the spatial variability of the parameters which define the carbonate system in the water column for the first time in the region just north of the Canary Islands. The parameters to be determined are pH, total alkalinity and total CO_2. Values of pCO_2 will be determined theoretically and related to published pCO_2 values of the atmosphere in order to determine whether the Canary Islands region acts as source or a sink of CO_2. This study will be part of future work in order to study also the seasonal variability of carbon dioxide system related to hydrographic conditions in the area (subtropical convergence, upwelling).

Trace metals (ULPGC)

Samples were taken for test purposes during P202/1c and kept frozen at -20° C in polyethylene bottles for later analysis ashore. For the aluminium analysis a voltametric method will be used to determine labil aluminium. The procedure is based on the complexation of aluminium with 1,2-dihydroxyanthraquinone-3-sulphonic acid (DASA) and on the measurement of the reduction current of this complex using a high speed cathodic stripping voltammetry (HSCSV). Reduction of Al-DASA complex produces a faradaic current proportional to the concentration of dissolved Al. The free DASA ligand has a cathodic peak at -0.63 V while Al-DASA peak is more negative at -1.1 V (Ag/ClAg). Optimal experimental parameters include an accumulation potential of -0.95 V during 45 s, DASA concentration 2z10-6 M and staircase scan mode to 30 V/s speed. Samples are buffered at 7.1 pH using N,N'-bis (2-hydroxyethyl)-2-aminoethane sulphonic acid (BES). The detection limit is 1.75 nM for 30 s adsorption time. The deviation is less than 3% for a 19 nM Al concentration sample.

Determinations of cobalt, nickel and zinc will be tested using electrochemical procedures. The electrochemical system that will be used in the analysis has been designed to measure of instantaneous currents at short times with a low noise level. The analysis time required for each sample is substantially reduced, allowing to increase the number of determinations. A PAR-303A electrochemical cell with hanging mercury drop electrode (HMDE) is used with the home-made computer-controlled potentiostat.

3.3 Biological oceanography

Drifting particle trap (GeoB)

The surface tethered particle trap consisted of four cylinders mounted in a welded iron frame. Each cylinder was topped with a baffle to reduce turbulence at the mouth of the cylinder and had a sample bottle screwed on from below. The sample bottles were filled with a 0.2 µm filtered 40 ‰ density gradient solution (achieved with Suprapur NACL) that was poisoned with 2% formalin. Before deployment, the cylinders were filled with 0.2 µm filtered water from 1000 m to 2000 m depth. The trap array consisted of a surface buoy that carried an Argos transmitter integrated in a Benthos sphere, an IBAK 27 MHz radio transmitter and a Xenon flasher; twelve (first deployment) or eleven (second and third deployment) Benthos spheres as floats; the trap at about 150 m depth and an Aanderaa RCM8 current meter about 10 m below the trap. Three or four of the spheres were afloat, in addition to the surface buoy, while the trap was drifting for 3 to 4 days. Due to the ARGOS system the position of the drifting trap was recorded several times per day.

Coccolithophore sampling (ETHZ)

Coccolithophore sampling during P212, P233 and P237 were carried out using a newly developed low vacuum filtration unit (Fig. 3.2.1). The design of this filtration device is based on the experience gained during earlier campaigns at the JGOFS time series stations Bermuda and Hawaii. Thanks to the offer of

Prof. Gerold Siedler to test this new device during P212, the performance of the unit could be significantly improved especially by the advice of Uwe Koy from IfMK, and Andrea Spiedt, GeoB. The simultaneous filtration of sea water from up to twelve different depth levels enabled the sampling of coccolithophores at nearly each station during all subsequent cruises within the CANIGO project including P233a and P237/4.

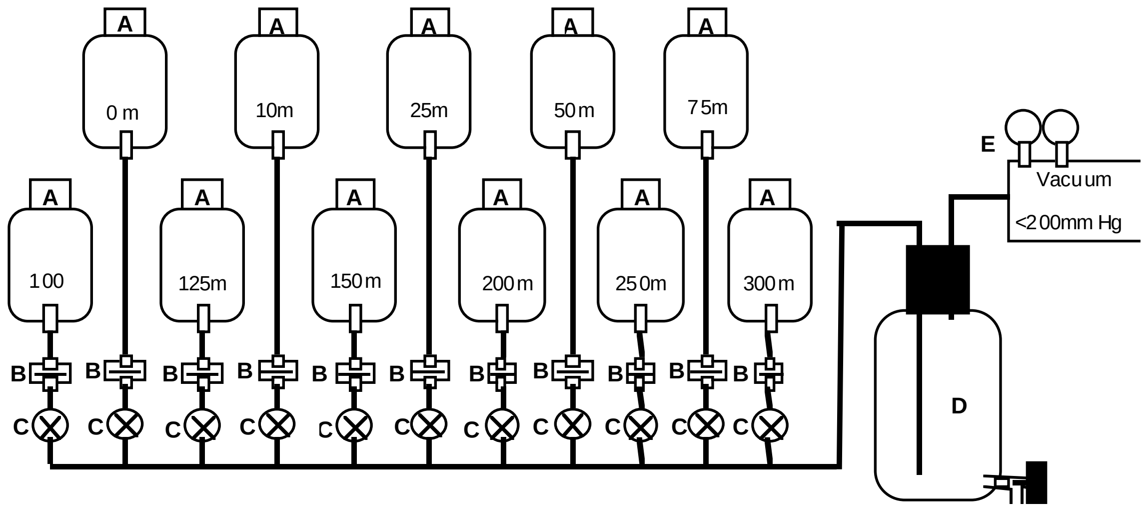


Fig. 3.2.1: Low vacuum filtration device used for filtration of coccolithophores during all CANIGO cruises. A: 10 litre carboys; B: 47mm in-line filter holders; C: Stopcock valve; D: large water trapping tank; E: membrane vacuum pump. Up to 10 litre of sea water were drawn off from Niskin bottles and filtered through Nucleopore® filters.

The sampling strategy was as follows: Carboys were rinsed twice (about 0.5 litres) with tap water in order to avoid contamination and then up to 10 litres of sea water were transferred from the rosette Niskin bottles into the carboys from the following depth levels: 0 (bucket), 10, 25, 50, 75, 100, 125, 150, 200, 250, 300 meters. Within one to three hours the sea water was filtered onboard through Nucleopore filters (0.8µm, 47 mm diameter) using the new filtration device (see Fig. 3.2.1). Filtration was terminated if the filter became clogged up and the amount of remaining water was measured and noted. After filtration the filter membranes were rinsed with 50ml buffered destilled water (NH_4OH, PH8.5) in order to eliminate all traces of sea salt. Rinsed filters were transferred to labelled petri-dishes and dried immediately in an oven at 40°C for several hours.

Later ashore, coccolithophore cell density (#/l) and taxonomic composition were determined using a Scanning Electron Microscope. For these analyses a piece of filter along the filter radius was mounted on an aluminium stub using carbon tape and coated with 15 nm of gold. All counts were done with a HITACHI S2300 and a Philips XL30 SEM at a magnification of X3000. Both SEM were equiped with a computer controlled stage. The following set-up was used to count all samples (see Fig. 3.3.2):

A fixed area in each filter was analysed along a transect from the centre to the edge of a filter. Thirty to forty equidistant tracks of observation were analysed along this transect. Each track of observation consists of 64 single screens each 900 µm^2 large at a magnification of 3000X (for details see Fig. 3.2.2).

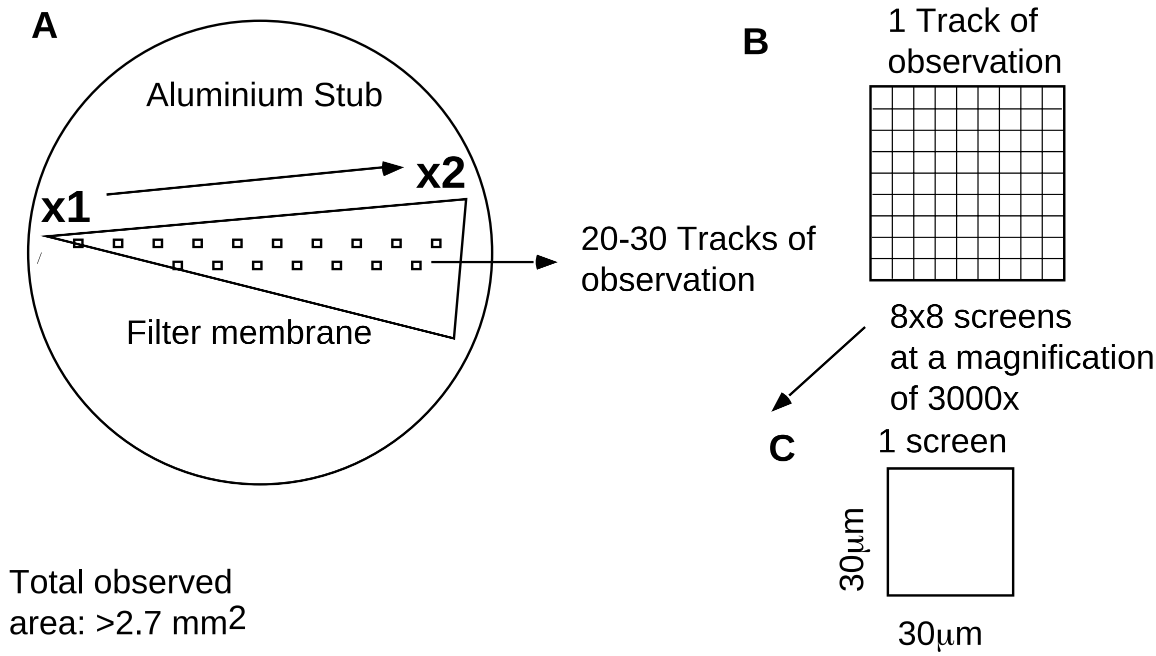


Fig. 3.2.2: Schematic diagram of the counting method used. A: A sector of a filter is mounted on an aluminium stub. The count direction is from x1 to x2. B: 20 to 33 tracks of observation were analysed. Each track consists of 8x8 screens at a magnification of x3000. C: The area of a screen is 30x30 µm.

To quantify the number of coccolithophores in one litre of water, the folowing formula is used:

$$CD = \frac{A * N}{(a * v)}$$

Where:

CD = Cell density (cells per litre sea water)

A = Filtration Area

N = Total number of individuals

a = observed area

v= volume of filtered water per litre (l)

Coccolithophore culture isolation (ETHZ)

Four single plankton nets with 10µm and 20µm mesh size were attached to a METEOR rope and released down to about 100m water depth. Subsequently, the nets were pulled slowly back to the surface and carefully rinsed with sea water on board. The catch were transferred into plastic vials and isolation of single coccolithophore cells was immediately started. Single coccolithophore cells were isolated under the light microscope and transferred into small vials with different nutrient concentration. Subsequently, the vials were stored on deck in a continuous sea water flow bath in order to keep the temperature comparable to the natural sea surface temperature. In addition, the cells were protected against direct sun light with a neutral density filter foil. Upon to the return to the shore laboratory, each isolate was checked and the species were identified using a scanning electron microscope. Key species like *Gephyrocapsa oceanica* were separated and subsequently cultured under different environmental conditions in order to study their morphology, genetic and ecology.

Diatom sampling (ETHZ)

In order to sample diatoms two different sampling strategies were applied, first diatom water sampling and second diatom plankton net sampling.

For sampling of diatoms in sea water, 300 ml sea water were transferred from the rosette Niskin bottles into plastic bottles and preserved with 30ml Formol which was buffered to a pH of 8 with Hexamethyl-Tetramin. In total eleven water depth levels were sampled at each station: 0, 10, 25, 50, 75, 100, 125, 150, 200, 250, 300 meters.

In addition to the water sampling, a plankton net with 63 µm mesh size was used to sample diatoms within the upper 100 m of the water column (integrated sampling). The net was released to 100 m water depth and it was pulled with 0.3 m/s back to the surface. Subsequently, the net was rinsed with sea water and the catch was transferred into a plastic bottle and stained with Glutardialdehyde.

In subsequent analyses a light microscope and if necessary a Scanning Electron Microscope (SEM) were used, to determine the diatom standing stock and assemblage composition.

Planktic foraminifera sampling (ETHZ)

Planktic foraminifera were collected with a multi-closing-net (mesh size 64µm) at five depth intervals (500-300, 300-150, 150-50, 50-25, 25-0). The multinet-samples were preserved on board with a saturated solution of $HgCl_2$ and stained with Rose Bengal. In addition, sea water was taken at the base of each net-interval for stable isotope analyses ($d^{18}O$- and $d^{13}C$). These samples were preserved with $HgCl_2$ and the glass bottles were sealed with Paraffin to prevent the oxidation of organic matter. All samples were stored immediately in a refrigerator at 4°C.
In future analyses the assemblage composition of foraminifera will be determined. Stable isotope analyses of selected foraminifera species as well as the stable isotope composition of sea water will be analysed.

4. POSEIDON cruise P202/1

4.1. Cruise narrative of P202/1

P202/1a, 01.09. - 14.09.94, Bremerhaven - Funchal

The cruise began in Bremerhaven on the 1st of September, 1994. Under fairly good weather conditions which persisted throughout the cruise, we quickly reached position N2 (for positions see maps in Sec. 4.2 and tables in Sec. 4.3 and 4.4) where on the 6th of September mooring 326-2 with a sound source was recovered after 3_ years of deployment (station 756). A CTD profile also was obtained. Two days later, 8th September, the second sound source within mooring 345 at position G within the economic zone of Portugal was recovered.

Again outside the economic zone of Portugal, on station 758 the first test with the KMS CTD was performed. The position is close to a station of CTD tests made in 1992, and chosen to test the response of CTDs to step like structures with scales of 0.2 m and less below the saline Mediterranean water tongue.

On the 9th of September we reached position A where the third sound source within mooring 324-3 was recovered. To control eventual drifts of clocks in sound sources by measuring travel times between fixed positions, two RAFOS floats were moored; they were recovered in mooring 346 on the 10th of September. At the same position, another test with the KMS was performed with repeated profiles at great depths.

POSEIDON called in to Funchal, Madeira, in the morning of the 12th of September to exchange mooring equipment, and to embark a colleague from the IEO at Sta. Cruz, Tenerife, and two scientists for the JGOFS programme. During our stay, the captain and four members of the crew enjoyed an evening reception in the house of the German consulate, Frau E. Gesche.

P202/1b, 15.09. - 24.09.94, Funchal - Sta. Cruz de Tenerife

POSEIDON sailed again on the 15th of September to reach position L1 on the 16th of September. Here we recovered the JGOFS mooring L1 with particle traps. However, due to a current event in the Azores Current with a strong barotropic component 4 months after beginning of recording, the mooring tilted extremely which forced the top buoy down to overpressure. As a result the top buoy scrunched and the uppermost trap and the uppermost current meter at 200 m nominal depth came upside down. Nervertheless, due to enough back up buoyancy, the mooring stayed vertically in the rest of the time.

On the 17th of September, close to L1, mooring 276-14 at position KIEL276 was recovered. Here, too, the Azores Current event had tilted the mooring and scrunched the top bouyancy. But contrary to L1, less back up bouyancy put the upper most instruments down to the bottom. Thus data are only available from the 3000 m depth level. The combined current meter and particle trap mooring 276-15 was deployed on the 18th of September at the position of KIEL276. Two CTD stations and a hydrocast down to 2000 m completed the work on this positions.

On the 19th of September we recovered mooring 364, supplemented with a CTD on that position.

Heading towards the Canary Islands, we reached the ESTOC position on the 22th of September to deploy the ESTOC current meter mooring 367 at a water depth of 3610 m. A CTD station was taken afterwards. Next day, 23rd of September POSEIDON called port of Sta. Cruz de Tenerife where the scientific crew changed with Dr. M. Knoll as new chief scientist.

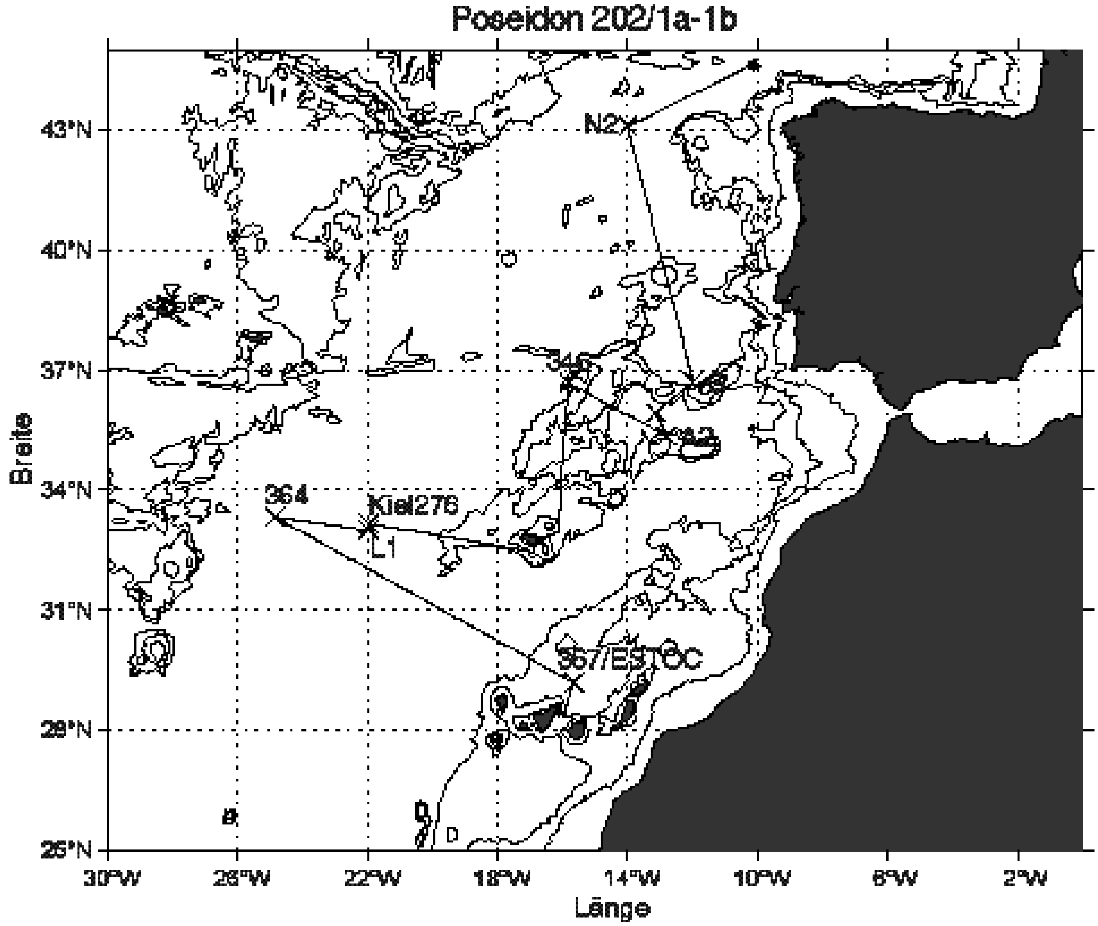
P202/1c, 25.09. - 08.10.94, Sta. Cruz de Tenerife - Las Palmas

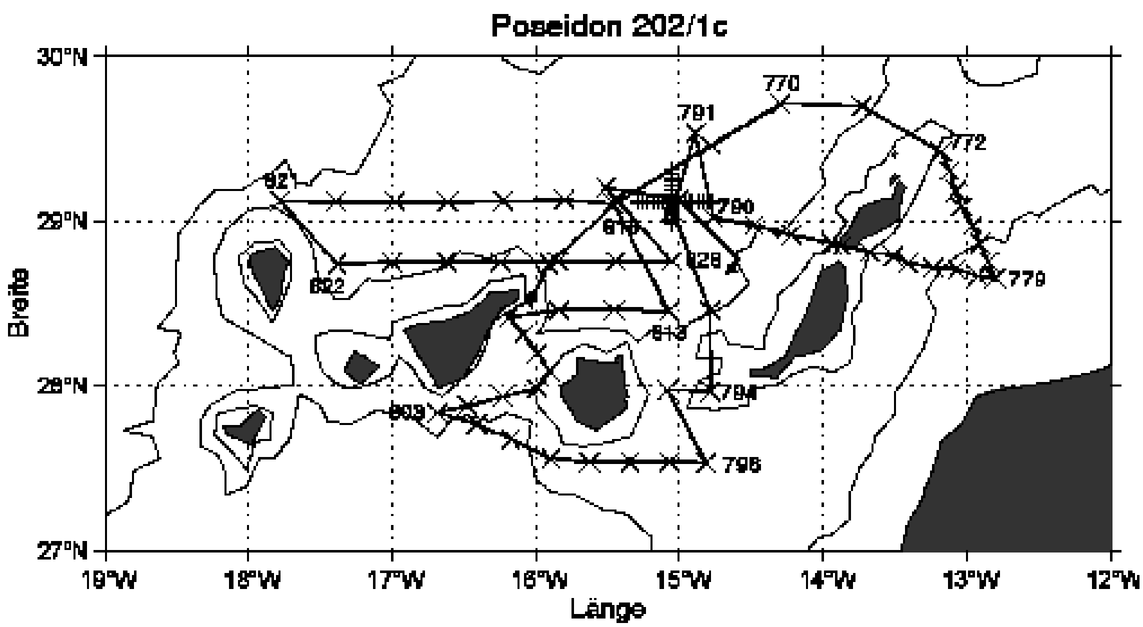
POSEIDON left Sta. Cruz de Tenerife on 25th of September 1994 at 09 in the morning for station work around the Canary Islands. CTD observations were obtained on 63 station. The CTD (NB2) was either equipped with an oxygen sensor (24 stations) or a fluorometer and a lowered ADCP (39 stations), both of which were only applicable in the upper 3000 m. All CTD profiles were down to the bottom, unless the profile depth is noted explicitly in the station list in Section 4.3.

A surface tethered particle trap was deployed three times (stations 769, 792, 815) close to the ESTOC station and was drifting for 3 to 4 days. The position of the drifting trap was recorded several times per day by the ARGOS system.

Two XBT sections were carried out to study a meddy, a meridional one along 15° 03.0' W with 19 XBT profiles and a zonal one along 29° 07.0' N with 15 XBT profiles. Since T5 probes were used, the XBT profiles reached down to nominally 1800 m thus covering the core of Mediterranean water mass. Close to the ESTOC station, a bongo net was lowered once to a depth level of 200 m. On the 7th of October at 09 in the evening, the station work was finished and we reached Las Palmas on the 8th October 1994 at 09 in the morning.

4.2. Cruise track of P202/1





4.3. Mooring work during P202/1

Seven moorings were recovered and two moorings were deployed during P202:

Mooring ID	Date 1994	Latitude [N]	Longitude [W]	Water depth [m]	Recovered / deployed	Instru-ments	Coastal state (200 nm)
326-2/N	06.09.	43° 01.61’	14° 00.92’	5300	recovered	1s	
345/G	08.09.	36° 42.41’	11° 59.28’	4400	recovered	1s	Portugal
324-3/A	09.09.	35° 20.93’	12° 48.48’	3380	recovered	1s, 1m	
346	10.09.	36° 39.94’	15° 48.95’	4040	recovered	3m	
L1	16.09.	33° 08.5’	21° 58.5’	5275	recovered	4t, 2c	
Kiel276-14	17.09.	32° 59.63’	22° 00.10’	5275	recovered	8c	
Kiel276-15	18.09.	32° 57.45’	22° 01.98’	5275	deployed	8c, 4t	
364	19.09.	33° 18.91’	24° 51.70’	5310	recovered	3c	
367/ESTOC	22.09.	29° 10.09’	15° 40.25’	3620	deployed	7c, 1a	Spain

Instruments:

a: ADCP (moored) current meter
c: RCM8 current meter
m: moored RAFOS float
s: sound source
t: particle trap

4.4. Station list for P202/1

STATION	DATE 1994	TIME [UTC]	POSITION φ [°N]	λ [°W]	DEPTH [m]	INSTRUMENTS
P202/1a						
	01.09.	9:00				sail Bremerhaven
756	06.09.	8:00	43°01.61	14°00.92’	5300	V326-2/N recover
		10:25	43°01.42’	14°00.36’	5260	NB2/1
757	08.09.	7:00	36°42.41’	11°59.28’	4400	V345/7G recover
758	08.09.	15:35	35°55.00’	13°08.08’	4800	KMS/1 test
759	09.09.	7:00	35°20.93’	12°48.48’	3380	V324-3/A recover
760	10.09.	7:00	36°39.94’	15°48.95’	4040	V346 recover
		9:29	36°39.95’	15°48.05’	4000	KMS/2 test
		12:50	36°40.42’	15°48.78’	3950	NB2/2
		10:00				call port of Funchal
P202/1b						
	15.09.	8:00				sail Funchal
762	16.09.	12:00	33°08.5’	21°58.5’	5275	L1 recover
		17:00	33°07.57’	21°56.46’	5275	hydrocast 2000 m
		18:45	33°08.23’	21°56.05’	5275	NB2/3
763	17.09.	8:00	32°59.63’	22°00.10’	5275	V276-14 recover
764	18.09.	8:30	32°57.45’	22°01.98’	5275	V276-15 deploy
		12:50	32°55.36’	22°01.96’	5275	NB2/4
765	19.09.	8:00	33°18.91’	24°51.70’	5310	V364 recover
		10:10	33°18.83’	24°51.88’	5310	NB2/5
766	22.09.	8:30	29°10.09’	15°40.25’	3620	V367 deploy
		11:30	29°11.06’	15°40.50’	3620	NB2/6
	23.09.	8:00				call port of S. Cruz
P202/1c						
767	25.09.	12:21	28°44.3’	15°54.4’	3514	CTD/Rosette
768	25.09.	20:00	29°07.1’	15°25.9’	3606	CTD/Rosette
769	26.09.	4:07	29°27.4’	14°46.8’	3519	CTD/Rosette
		8:15	29°26.8’	14°47.1’	3508	deploy particle trap
770	26.09.	12:15	29°42.7’	14°17.7’	3382	CTD/Rosette
771	26.09.	18:10	29°42.4’	13°44.5’	3144	CTD/Rosette (500 m)
		19:51	29°41.9’	13°43.8’	3153	CTD/Rosette
772	27.09.	2:45	29°25.1’	13°10.8’	1318	CTD/Rosette/ADCP
773	27.09.	5:13	29°18.2’	13°07.1’	1430	CTD/Rosette/ADCP
774	27.09.	8:20	29°10.9’	13°04.5’	1463	CTD/Rosette/ADCP
775	27.09.	11:04	29°05.1’	13°02.0’	1412	CTD/Rosette/ADCP
776	27.09.	13:50	28°58.3’	12°57.4’	1277	CTD/Rosette/ADCP
777	27.09.	17:30	28°51.8’	12°54.4’	1001	CTD/Rosette/ADCP
778	27.09.	19:45	28°45.2’	12°50.9’	573	CTD/Rosette/ADCP

Station list P202 (continued)

STATION	DATE 1994	TIME [UTC]	POSITION φ [°N]	λ [°W]	DEPTH [m]	INSTRUMENTS
779	27.09.	21:30	28°39.2’	12°48.0’	278	CTD/Rosette/ADCP
780	27.09.	23:30	28°40.0’	12°55.2’	497	CTD/Rosette/ADCP
781	28.09.	1:25	28°42.3’	13°04.1’	818	CTD/Rosette/ADCP
782	28.09.	3:30	28°43.0’	13°13.9’	1128	CTD/Rosette/ADCP
783	28.09.	5:57	28°44.6’	13°24.6’	1345	CTD/Rosette/ADCP
784	28.09.	8:30	28°47.2’	13°30.6’	1254	CTD/Rosette/ADCP
785	28.09.	11:15	28°48.6’	13°40.5’	985	CTD/Rosette/ADCP
786	28.09.	13:45	28°50.9’	13°52.1’	78	CTD/Rosette/ADCP
787	28.09.	15:00	28°51.9’	13°56.5’	1250	CTD/Rosette/ADCP
788	28.09.	18:25	28°55.0’	14°13.0’	2803	Rosette (30 m)
		19:08	28°55.0’	14°13.0’	2803	CTD/Rosette/ADCP
789	28.09.	23:00	28°58.5’	14°28.8’	3162	CTD/Rosette/ADCP (3000 m)
790	29.09.	3:45	29°01.3’	14°45.9’	3521	CTD/Rosette/ADCP (3000 m)
791	29.09.	10:35	29°31.4’	14°51.9’	3517	recover particle trap
		11:10	29°32.1’	14°53.1’	3515	CTD/Rosette/ADCP (200 m)
792	29.09.	14:40	29°03.9’	15°02.9’	3569	CTD/Rosette/ADCP (3000 m)
		18:15	29°04.1’	15°02.8’	3569	deploy particle trap
XBT01	29.09.	19:10	28°58.9’	15°03.4’	3577	XBT
XBT02	29.09.	19:30	28°57.2’	15°03.2’	3577	XBT
XBT03	29.09.	20:20	29°00.0’	15°03.0’	3573	XBT
XBT04	29.09.	20:30	29°01.0’	15°03.0’	3572	XBT
XBT05	29.09.	20:40	29°02.0’	15°03.0’	3570	XBT
XBT06	29.09.	20:49	29°03.0’	15°02.7’	3570	XBT
XBT07	29.09.	20:59	29°04.0’	15°02.7’	3570	XBT
XBT08	29.09.	21:08	29°05.0’	15°02.7’	3570	XBT
XBT09	29.09.	21:16	29°06.4’	15°02.9’	3570	XBT
XBT10	29.09.	21:24	29°07.2’	15°02.9’	3572	XBT
XBT11	29.09.	21:31	29°08.0’	15°02.8’	3567	XBT
XBT12	29.09.	21:39	29°09.0’	15°02.8’	3562	XBT
XBT13	29.09.	21:48	29°10.0’	15°02.9’	3556	XBT
XBT14	29.09.	22:01	29°11.5’	15°02.8’	3560	XBT
XBT15	29.09.	22:15	29°13.0’	15°02.8’	3563	XBT
XBT16	29.09.	22:29	29°14.5’	15°02.9’	3561	XBT
XBT17	29.09.	22:42	29°16.0’	15°02.9’	3559	XBT
XBT18	29.09.	22:55	29°17.5’	15°02.9’	3561	XBT
XBT19	29.09.	23:07	29°18.8’	15°02.8’	3565	XBT
793	30.09.	4:30	28°27.5’	14°47.3’	3024	CTD/Rosette/ADCP (3000 m)
794	30.09.	10:05	27°58.0’	14°47.1’	165	CTD/Rosette/ADCP
795	30.09.	12:15	27°58.3’	15°05.1’	1414	CTD/Rosette/ADCP

Station list P202 (continued)

STATION	DATE 1994	TIME [UTC]	POSITION φ [°N]	λ [°W]	DEPTH [m]	INSTRUMENTS
796	30.09.	16:28	27°32.1’	14°48.8’	2516	CTD/Rosette/ADCP
		19:48	27°31.7’	14°48.8’	2520	CTD/Rosette/ADCP (100 m)
797	30.09.	21:35	27°32.3’	15°04.1’	2624	CTD/Rosette/ADCP
798	1.10.	1:20	27°32.3’	15°20.5’	2452	CTD/Rosette/ADCP
799	1.10.	5:15	27°32.1’	15°37.5’	2262	CTD/Rosette/ADCP
800	1.10.	9:15	27°33.4’	15°53.6’	2028	CTD/Rosette/ADCP
801	1.10.	12:32	27°40.4’	16°10.4	3357	CTD/Rosette/ADCP (3000 m)
802	1.10.	17:10	27°46.1’	16°24.7’	3301	CTD/Rosette/ADCP (3000 m)
803	1.10.	21:10	27°50.0’	16°41.0’	2223	CTD/Rosette/ADCP
804	2.10.	0:20	27°52.7’	16°28.4’	2341	CTD/Rosette/ADCP
805	2.10.	3:55	27°56.0’	16°13.8’	2530	CTD/Rosette/ADCP
806	2.10.	8:20	27°58.9’	15°59.2’	709	CTD/Rosette/ADCP
807	2.10.	10:15	28°05.6’	15°54.4’	715	CTD/Rosette/ADCP
808	2.10.	12:05	28°11.8’	15°59.2’	2772	CTD/Rosette/ADCP
809	2.10.	15:40	28°18.7’	16°05.0’	2273	CTD/Rosette/ADCP
810	2.10.	18:55	28°24.8’	16°11.3’	1746	CTD/Rosette/ADCP
811	2.10.	22:55	28°27.5’	15°50.2’	3419	CTD/Rosette
812	3.10.	3:45	28°27.4’	15°27.1’	3431	CTD/Rosette
813	3.10.	9:20	28°27.0’	15°04.3’	3377	CTD/Rosette (2000 m)
814	3.10.	19:55	29°20.3’	15°21.3’	3600	recover particle trap
XBT20	4.10.	0:01	29°07.0’	14°46.1’	3535	XBT
XBT21	4.10.	0:19	29°07.0’	14°48.0’	3545	XBT
XBT22	4.10.	0:35	29°07.0’	14°50.1’	3553	XBT
XBT23	4.10.	0:52	29°07.1’	14°52.0’	3557	XBT
XBT24	4.10.	1:08	29°07.0’	14°54.2’	3558	XBT
XBT25	4.10.	1:24	29°07.0’	14°56.0’	3558	XBT
XBT26	4.10.	1:42	29°07.1’	14°58.0’	3563	XBT
XBT27	4.10.	2:00	29°07.1’	15°00.0’	3568	XBT
XBT28	4.10.	2:18	29°07.1’	15°02.0’	3570	XBT
XBT29	4.10.	2:34	29°07.0’	15°05.0’	3572	XBT
XBT30	4.10.	2:51	29°07.0’	15°07.0’	3576	XBT
XBT31	4.10.	3:06	29°07.1’	15°09.0’	3580	XBT
XBT32	4.10.	3:22	29°07.0’	15°11.0’	3585	XBT
XBT33	4.10.	3:41	29°07.0’	15°13.3’	3588	XBT
XBT34	4.10.	3:55	29°07.0’	15°15.0’	3591	XBT
XBT35	4.10.	4:12	29°07.0’	15°17.0’	3594	XBT
815	4.10.	5:15	29°06.5’	15°27.7’	3606	Rosette (30 m)
		6:05	29°06.5’	15°27.7’	3606	CTD/Rosette
		9:14	29°07.6’	15°26.9’	3606	deploy particle trap
816	4.10.	11:40	29°07.7’	15°48.0’	3625	CTD/Rosette

Station list P202 (continued)

STATION	DATE 1994	TIME [UTC]	POSITION φ [°N]	λ [°W]	DEPTH [m]	INSTRUMENTS
817	4.10.	17:27	29°07.3'	16°13.6'	3652	CTD/Rosette
818	4.10.	22:50	29°07.0'	16°37.0'	3703	CTD/Rosette
819	5.10.	3:40	29°07.2'	16°58.7'	3852	CTD/Rosette
820	5.10.	9:30	29°07.1'	17°23.2'	3868	CTD/Rosette
821	5.10.	14:40	29°07.3'	17°46.5'	3462	CTD/Rosette
822	5.10.	21:25	28°44.9'	17°22.9'	3372	CTD/Rosette (140 m)
		22:16	28°44.4'	17°22.9'	3385	CTD/Rosette
823	6.10.	3:25	28°45.0'	16°59.9'	3425	CTD/Rosette
824	6.10.	9:00	28°45.1'	16°37.3'	3061	CTD/Rosette
825	6.10.	13:30	28°45.0'	16°14.6'	2941	CTD/Rosette
826	6.10.	18:15	28°45.3'	15°50.6'	3572	CTD/Rosette
827	6.10.	23:15	28°45.3'	15°26.5'	3586	CTD/Rosette
828	7.10.	4:35	28°45.3'	15°03.2'	3572	CTD/Rosette
829	7.10.	13:25	29°11.9'	15°31.1'	3611	recover particle trap
		13:52	29°12.0'	15°30.7'	3613	bongo net (200 m)
		14:30	29°12.2'	15°30.8'	3613	CTD/Rosette (200 m)
		15:10	29°12.2'	15°30.9'	3613	CTD/Rosette (200 m)
830	7.10.	18:34	29°08.0'	15°00.2'	3554	CTD/Rosette

4.5. Sampling during P202/1

During P202/1a-b, some water samples were taken from deep levels and from close to the surface to calibrate the CTD's conductivity sensor for salinity calculations. During P202/1c, on each station water samples were obtained with a GO multisampler (21 x 10 l) if possible from the following 20 depth/pressure levels: 2 x bottom, 3000 dbar, 2500 dbar, 2000 dbar, 1500 dbar, 1300 dbar, 1200 dbar, 1100 dbar, 1000 dbar, 800 dbar, 600 dbar, 400 dbar, 200 dbar, 150 dbar, 100 dbar, 75 dbar, 50 dbar, 25 dbar, 10 dbar and the depth level of maximum chlorophyll content. On station 802 the multisampler did not work properly and no water samples were obtained. The water samples were analyzed for salinity, oxygen, nutrients, chlorophyll and heavy metals (aluminium, cobalt, nickel, zinc). Some water samples were already analyzed onboard of the ship, others after the cruise in the laboratory. At stations 771, 788, 815, 796 and 822 additional water samples were taken in the upper 500 m to study phytoplankton growth and microzooplankton grazing rates. At the following stations no samples for metal analysis were taken: 791, 793, 802, 810-815, 823, 825, 827, 828. In addition, at station 771 and 829 calibration casts with 6 bottles were carried out in the top and below the thermocline, respectively. Those will be used to determine the reproducibility of determinations.

5. POSEIDON cruise P212

5.1. Cuise narrative of P212

P212/1, 12.09. - 18.09.95, Lisbon - Las Palmas

POSEIDON arrived in Lisbon, Portugal, on 11.09.1995. The task of the chief scientist was transferred on 12.09 to Prof. Dr. G.Siedler who had already cooperated with the German Embassy in Lisbon on 11.09. in preparing a press conference and a reception for Portuguese officials and marine scientists which were held on 12.09. Personnel were exchanged and laboratories were equipped on 13.09.

POSEIDON departed from Lisbon on 14.09., 08.00 and headed directly for Las Palmas, Gran Canaria. Some underway repair work was necessary on instrumentation that had already been used on earlier legs of the cruise. On 15.09. the CTD NB1 was lowered for a test at Station 786, and the ICTD 1349 (made by FSI) was similarly tested on stations 787 and 790 (see map in Sec. 5.2 and the station list in Sec. 5.3). Five RAFOS floats of the EUROFLOAT program were launched on 5 positions en route between 15.09. and 17.09. (stations 787 - 791). The ESTOC mooring no.367-1 which had been launched on 22.09.1994 was recovered on 17.09. and replaced by the new mooring no.367-2 on 18.09. During the night from 17.-18.09. tests were performed on acoustic releases, a Plankton multinet and both CTDs. The ship arrived in Las Palmas on 18.09., 16.30.

P212/2, 19.09. - 29.09.95, Las Palmas - Las Palmas

Three members of the scientific party left on 18. and 19.09., respectively, and 4 Spanish scientists joined the ship on 19.09. and installed their chemical equipment while the ship was in port. The captain and the chief scientist paid a visit to the German consul in Las Palmas on 19.09. to inform him about the ongoing cruise and future Spanish-German marine programs in the Canary region and to provide material for a press release.

POSEIDON left Las Palmas on 20.09., 08.00, and headed to a position about 10 miles north of the island of La Palma (see map in Sec 5.2 and the station list in Sec. 5.3). There the work began on a section to a position 40 nautical miles farther north and from there eastward across the ESTOC position and through the Strait of Bocayna between the islands of Lanzarote and Fuerteventura to the African continental slope.

The ship then went to the northeastern corner of Lanzarote to begin a section across the Canary Current between this island and the African continental slope. This was supplemented by another section between Fuerteventura and the slope. POSEIDON then occupied a station to the south of Fuerteventura to test the ICTD. The leg ended with an XBT section between Fuerteventura and Gran Canaria, including one CTD cast (station 839) in the middle.

POSEIDON arrived in Las Palmas again on 29.09., 08.30. Personnel was exchanged in port, and the Spanish scientific group from the IEO Tenerife was replaced by 3 scientists from the ICCM Telde and 2 scientists from the University of Las Palmas.

P212/3, 30.09. - 08.10.95, Las Palmas - Sta. Cruz de Tenerife

The ship departed on 30.09., 18.30. After the passage to the ESTOC position (see map in Sec. 5.2 and the station list in Sec 5.3) work started with the launching of a drifting particle trap, followed by CTD casts. The ship then went to a position to the southwest of Fuerteventura (station 842), and section work began again on a track along the western side of Fuerteventura and Lanzarote to the north (station 846) and from there westward on a zonal course to a position north of ESTOC (station 851). After retrieving the drifting particle trap for the first time, the trap was relaunched at the ESTOC position, and CTD measurements were performed at this location. A north-south section to Tenerife followed to station 859, and consecutive sections between Tenerife and Gran Canaria and from there to Fuerteventura (station 867). The vessel then returned to the ESTOC position in order to recover the drifting particle trap and to perform standard time series station operations at ESTOC again. After a passage to La Palma (station 870) the final section of P212/3 led from there to the north coast of Tenerife.

POSEIDON arrived in the port of Sta.Cruz on 08.10., 09.00. The complete scientific group was exchanged, and the task of the chief scientist was transferred from Prof. Dr. G. Siedler to Dr. T.J. Müller. A reception for the participants of the Second ESTOC Workshop, for scientists of the University of La Laguna and local officials was organized in collaboration with the German consulate in Sta.Cruz. Participants of the cruise joined the 2nd ESTOC workshop organized by the IEO in their facilities in Sta. Cruz.

P212/4, 09.10. - 18.10.95, Sta. Cruz de Tenerife - Funchal

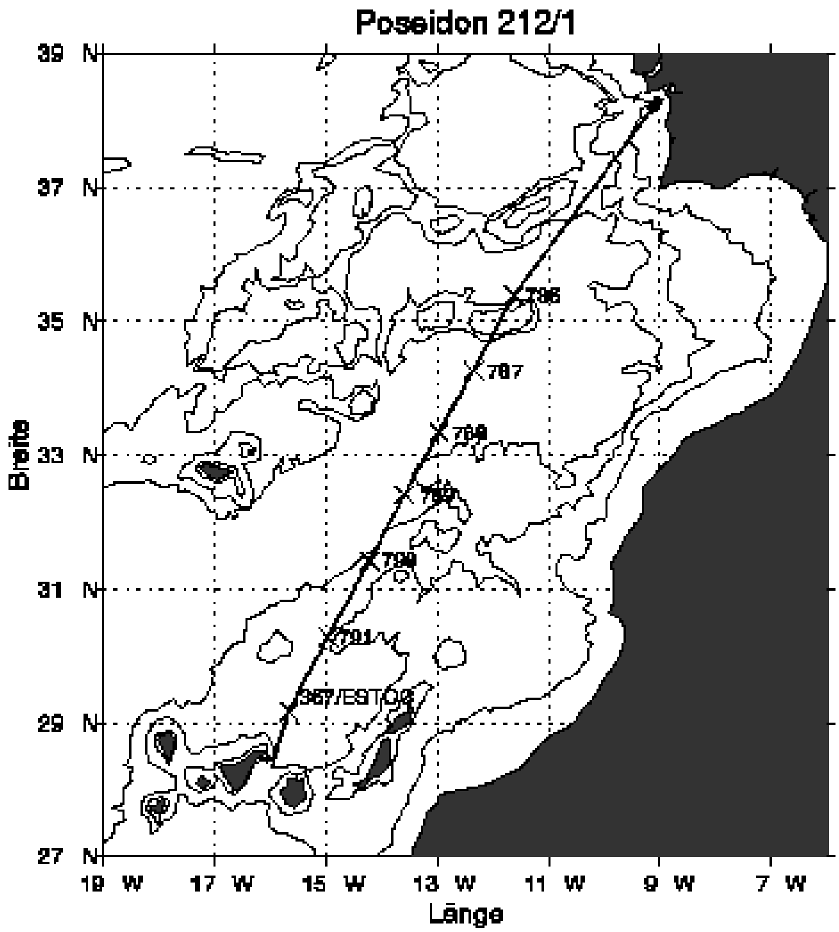
POSEIDON sailed for leg P212/4 from Sta. Cruz on 10.10., 19.00 heading westward to the position SQ3 at 29°N, 22°W (see map in Sec. 5.2 and the station list in Sec 5.3) where the sound source mooring V370 (station 875) for EUROFLOAT was launched on 12.10. CTD profiles were taken on this and all other mooring sites as well. Heading northward along 22°W, 4 floats were dropped (stations 877 to 880). An XBT section along 22°W began at 31°10'N to detect the Azores Front. On position SQ2 at 32°50'N, 022°W, the second sound source was placed in mooring V369 (station 880), close to mooring site KIEL276. Mooring KIEL276-15 was replaced by KIEL276-16 (stations 882 and 883), a special hydrocast (station 881) and a deep CTD cast (station 884) were taken close to the mooring site. Heading northeast to cross the Azores Front, XBTs No. 11 to 26 and floats 5 to 8 (station 884 to 887) were dropped, and a CTD cast (station 887) occupied at 35°50'N, 20°05'W. Then heading southeast, the front was crossed a second time launching XBTs No. 28 (No. 27 failed) to 38 and the last two floats (station 888 and 890). POSEIDON called port of Funchal on 18.10., 09.00.

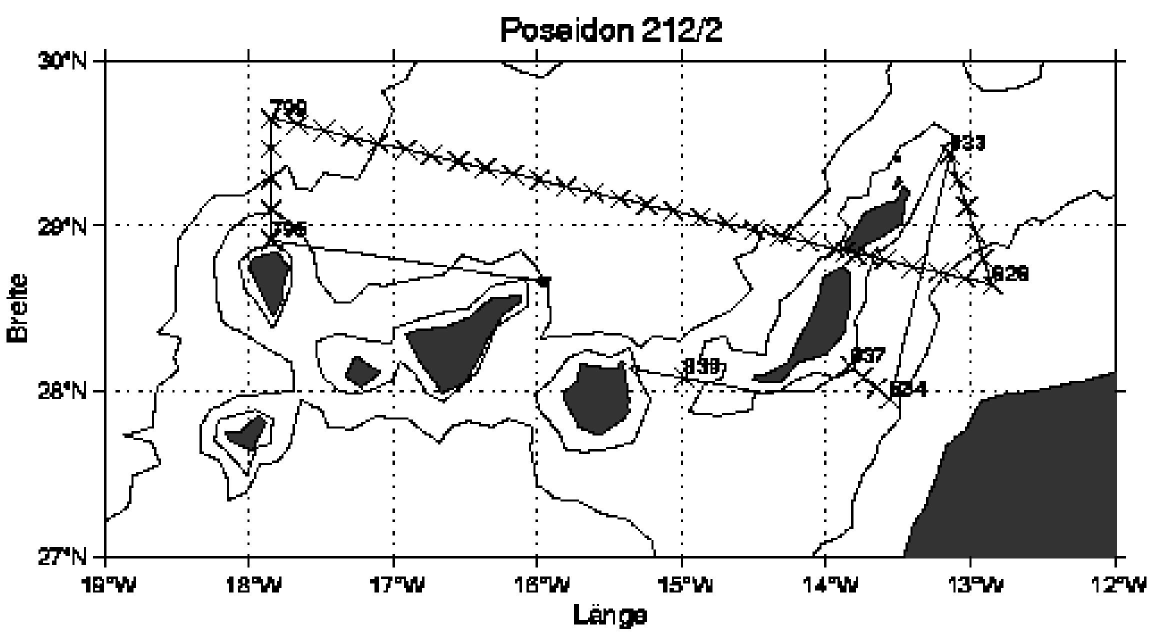
P212/5, 19.10. - 29.10.95, Funchal - Bremerhaven

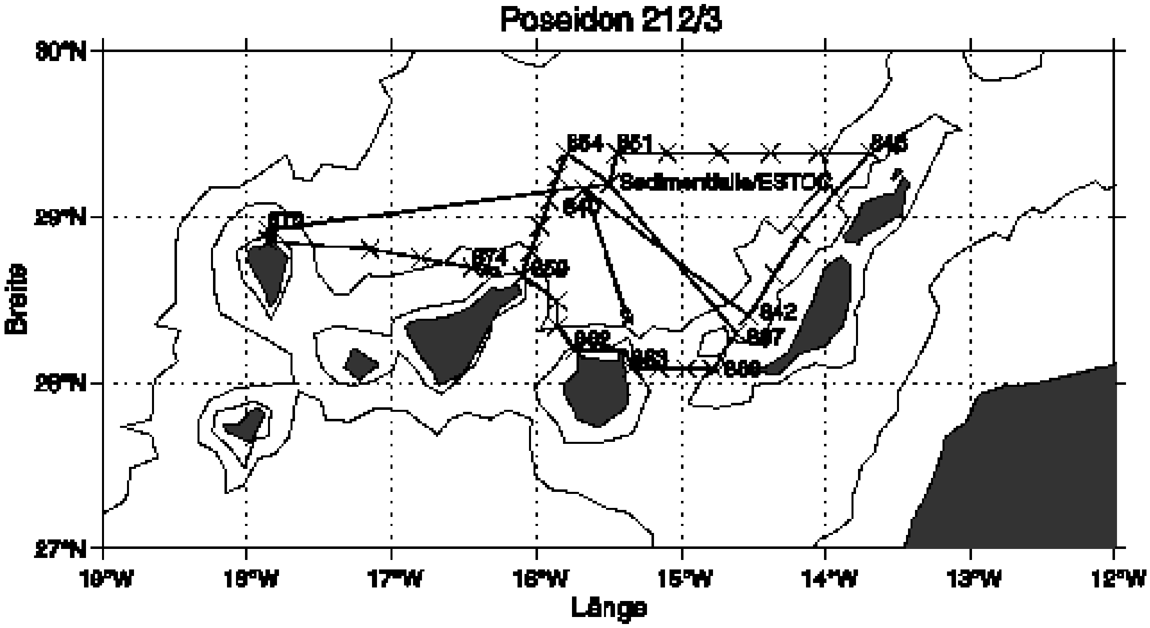
The German Honory Consul in Funchal, Frau E. Gesche, had been invited to the ship for lunch, and a party of 6 visited her house next evening for a cocktail. The chief scientist was contacted by a member of the marine biology group of the University of Madeira, Dipl-Biol. Kaufmann, and visited his laboratory.

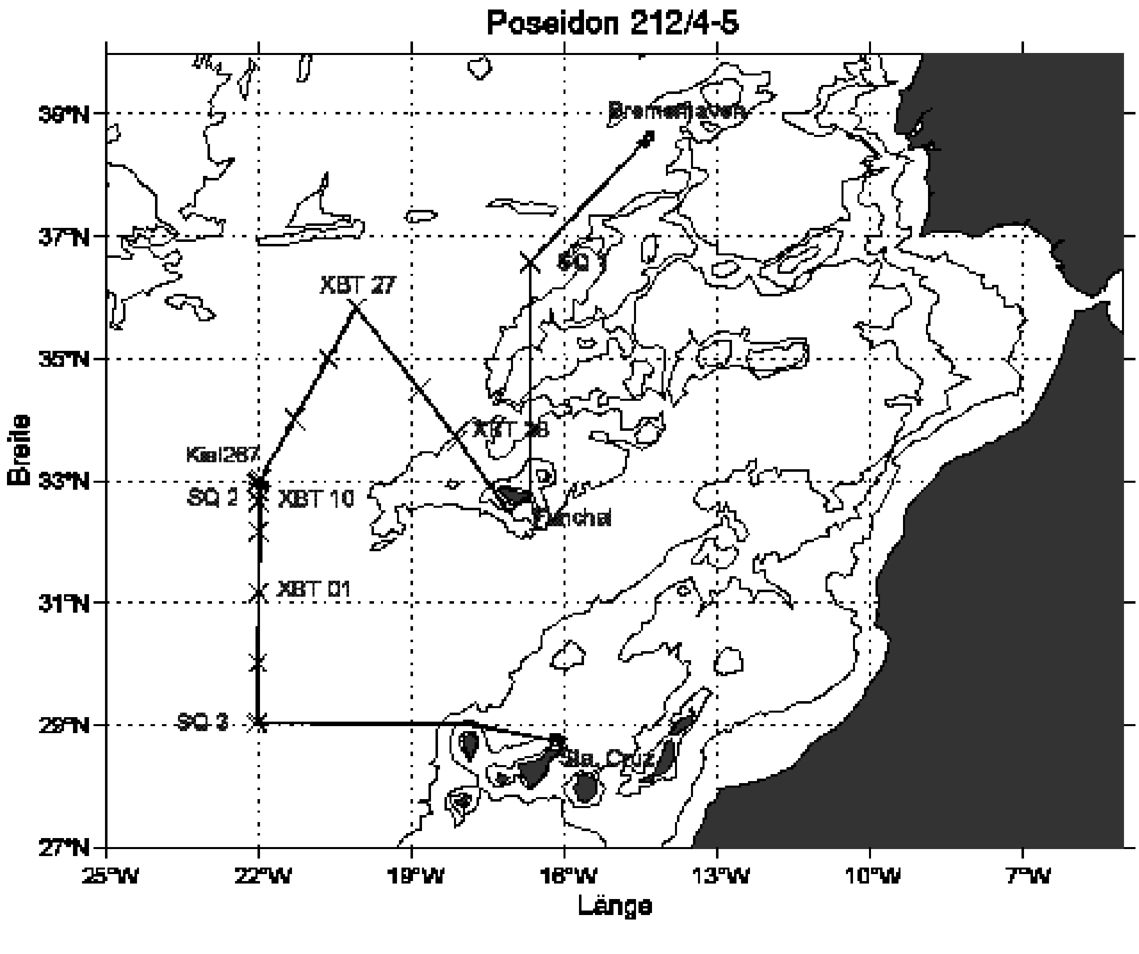
The two guest scientists from AINCO and the two members of the IfM marine chemistry group left early in the morning of 20.10. The 3rd sound source was delivered onboard, and POSEIDON sailed on 20.10., 09.00. Almost on the way at position SQ1, the 3rd sound source was placed in mooring V368 (station 892) at 36°35'N, 016°40.5'W (see map in Sec. 5.2 and the station list in Sec 5.3). The final CTD cast was taken close to the mooring (station 893). Heading directly to Bremerhaven and supported by strong to stormy southerly winds in the Gulf of Biscay, POSEIDON was in port of Bremerhaven on 29.10. in the afternoon.

5.2. Cruise tracks of P212






Poseidon 212/3
Sedimentfalle/ESTOC
Breite
Länge
30°N
29°N
28°N
27°N
19°W
18°W
17°W
16°W
15°W
14°W
13°W
12°W


Poseidon 212/4-5
Bremerhaven
SQ 1
XBT 27
XBT 36
Kiel267
SQ 2
XBT 10
Funchal
XBT 01
SQ 3
Sta. Cruz
Breite
Länge
39°N
37°N
35°N
33°N
31°N
29°N
27°N
25°W
22°W
19°W
16°W
13°W
10°W
7°W

5.3. Moorings during P212

STATION NO.	DATE 1995	TIME (UTC) start	stop	POSITION φ (°N)	λ (°W)	DEPTH corr. (m)	INSTRUMENTS
792	17.09.	13.00	15.05	29°09.8	14°40.8	3513	Recovery Mooring 367-01 (ESTOC)
794	18.09.	05.57	08.32	29°09.5	15°40.2	3655	Launching Mooring 367-02 (ESTOC)
875	12.10.	08.15	10.44	29°00.05	22°00.97	4860	Launch mooring V370 (SQ3 sound source)
880		15.44	18.11	32°43.12	21°58.81	5270	Launch mooring V369 (SQ2 sound source)
882	14.10.	08.35	10.55	32°57.41	22°01.30	5272	Recover mooring 276-15 (current meters, particle traps)
883	15.10.	08.20	12.00	33°00.14	21°57.85	5270	Launch mooring V276-16 (current meters, particle traps)
892	21.10.	14.12	16.25	36°33.14	16°39.24	4180	Launch mooring V368 (SQ1 sound source)

5.4. Station list for P212

STATION NO.	DATE 1995	TIME (UTC) start	stop	POSITION φ (°N)	λ (°W)	DEPTH corr. (m)	INSTRUMENTS
<u>**P212/1**</u>							
786	15.09.	08.08	11.50	35°23.2	11°37.3	4855	NB1 (test)
787	15.09.	20.00	22.00	34°15.9	12°20.7	4453	Float 1, ICTD-cable (test)
788	16.09.	05.00	05.01	33°20.5	12°57.9	4358	Float 2
789	16.09.	11.58	11.59	32°24.4	13°34.9	4261	Float 3
790	16.09.	19.00 19.30	19.02 21.10	31°25.0	14°13.5	3790	Float 4 ICTD-intern
791	17.09.	05.00	05.02	30°16.8	14°58.3	3138	Float 5
792	17.09.	13.00	15.05	29°09.8	14°40.8	3513	Recovery Mooring 367-01
793	17.09.	15.02	2348	29°09.7	15°40.1	3615	Release test Multinet (test) NB1 (test) ICTD-intern (test) NB1 (test)
794	18.09.	05.57	08.32	29°09.5	15°40.2	3655	Launching Mooring 367-02
<u>**P212/2**</u>							
795	20.09.	21.48	23.35	28°55.0	17°51.0	1989	CTD/LADCP
796	21.09.	00.55	03.27	29°05.9	17°51.0	3472	CTD/LADCP Plankton net
797	21.09.	04.50	07.20	29°16.9	17°51.0	3966	CTD/LADCP
798	21.09.	08.50	12.02	29°28.0	17°50.9	4184	CTD/LADCP
799	21.09.	13.20	20.00	29°39.0	17°51.1	4306	CTD/LADCP, Cocco Plankton net CTD/LADCP
800	21.09.	21.30	00.55	29°36.8	17°39.9	4276	CTD/LADCP Multi net
801	22.09.	01.55	04.08	29°34.5	17°28.6	4216	CTD/LADCP
802	22.09.	05.14	07.39	29°32.3	17°17.4	4092	CTD/LADCP
		07.42	08.10	29°31.9	17°16.0	4091	Plankton net
803	22.09.	09.11	11.21	29°30.0	17°06.2	4004	CTD/LADCP
		11.25	12.25	29°30.4	17°04.9	3982	Multinet
804	22.09.	13.50	16.13	29°27.8	16°54.8	4017	CTD/LADCP

Station list P212 (continued)

STATION NO.	DATE 1995	TIME (UTC) start	stop	POSITION φ (°N)	λ (°W)	DEPTH corr. (m)	INSTRUMENTS
805	22.09.	17.15	20.17	29°25.7	16°44.3	3815	CTD/LADCP
		20.24	20.40	29°25.9	16°42.5	3806	
806	22.09.	21.44	00.05	29°23.4	16°32.9	3780	CTD/LADCP, Cocco
807	23.09.	01.00	03.10	29°21.0	16°21.6	3708	CTD/LADCP
808	23.09.	05.00	07.23	29°18.8	16°10.2	3672	CTD/LADCP
		07.32	08.39	29°18.5	16°09.8	3678	Multinet
		08.46	09.05	29°14.6	16°10.2	3681	Plankton net
809	23.09.	10.15	12.22	29°16.6	15°59.2	3653	CTD/LADCP
810	23.09.	13.35	15.40	29°14.2	15°48.0	3650	CTD/LADCP
		16.19	19.00	29°14.3	15°48.1	3644	ICTD-cable
811	23.09.	20.10	22.08	29°12.1	15°36.9	3632	CTD/LADCP
		22.20	22.37	29°12.4	15°36.1	3641	Plankton net
812	23.09.	23.45	01.50	29°09.8	15°25.8	3622	CTD/LADCP
	24.09.	02.02	04.17	29°09.8	15°25.6	3623	ICTD-cable (ESTOC position)
813	24.09.	05.26	07.38	29°07.6	15°14.7	3523	CTD/LADCP
		07.48	08.45	29°08.1	15°13.9	3525	Multinet ICTD-cable
814	24.09.	10.04	12.32	29°05.4	15°03.5	3596	CTD/LADCP, Cocco
		14.48	13.04	29°05.2	15°03.3	3601	Plankton net
815	24.09.	14.21	16.50	29°03.1	14°52.3	3574	CTD/LADCP
		17.08	19.28	29°03.1	14°52.1	3571	ICTD-cable
816	24.09.	20.50	23.35	29°00.9	14°41.3	3390	CTD/LADCP
817	25.09.	01.25	03.48	28°58.5	14°30.0	3064	CTD/LADCP
		03.53	04.10	28°58.9	14°30.2	3071	Plankton net
818	25.09.	06.17	08.40	28°56.4	14°18.8	3081	CTD/LADCP
		08.50	09.55	28°56.7	14°18.7	3068	Multinet
819	25.09.	11.32	13.15	28°54.1	14°07.7	2184	TD/LADCP, Cocco
		13.37	15.07	28°54.1	14°07.6	2189	ICTD-cable
820	25.09.	16.39	17.55	28°51.9	13°56.6	1204	CTD/LADCP
		18.00	18.20	28°51.8	13°56.5	1195	Plankton net
821	25.09.	19.25	19.55	28°50.6	13°52.0	83	CTD/LADCP (Strait of Bocayna)
822	25.09.	20.30	20.45	28°49.4	13°47.7	25	disbanded because of depth too shallow
823	25.09.	21.27	22.21	28°48.9	13°42.2	853	CTD/LADCP
	25.09.	23.09	.	28°48.6	13°42.0	883	XBT 01
		23.21	.	28°48.6	13°40.1	1001	XBT 02
		23.37	.	28°48.0	13°38.1	1083	XBT 03
824	25.09.	23.55	00.53	28°47.6	13°35.5	1135	CTD/LADCP
	26.09.	01.00	01.55	28°47.5	13°35.4	1137	Multinet
		02.05	.	28°47.5	13°35.4	1142	XBT 04
		02.31	.	28°46.8	13°31.7	1242	XBT 05
		02.55	.	28°46.1	13°27.9	1297	XBT 06

Station list P212 (continued)

STATION NO.	DATE 1995	TIME (UTC) start	stop	POSITION φ (°N)	λ (°W)	DEPTH corr. (m)	INSTRUMENTS
825	26.09.	03.22	05.28	28°45.2	13°24.3	1335	CTD/LADCP
		05.04	05.29	28°45.4	13°24.4	1334	Plankton net
		05.32	06.26	28°45.3	13°24.8	1334	ICTD-cable
		06.50	.	28°44.9	13°22.1	1348	XBT 07
		06.59	.	28°44.6	13°20.8	1240	XBT 08
		07.25	.	28°43.9	13°17.2	1231	XBT 09
826	26.09.	08.03	09.10	28°43.1	13°13.2	1080	CTD/LADCP
		09.21	.	28°43.0	13°13.1	1064	XBT 10
		09.47	.	28°42.6	13°09.7	1036	XBT 11
		10.12	.	28°41.6	13°06.0	838	XBT 12
827	26.09.	10.41	11.40	28°40.9	13°02.1	708	CTD/LADCP
		12.25	.	28°40.9	13°02.0	712	XBT 13
		12.51	.	28°40.1	12°58.4	553	XBT 14
		13.16	.	28°39.4	12°54.5	397	XBT 15
828	26.09.	13.42	14.11	28°38.6	12°51.0	308	CTD/LADCP
		14.17	14.39	28°38.7	12°50.9	315	Multinet
		14.45	15.10	28°38.8	12°51.0	318	Plankton net
		15.29	.	28°38.6	12°51.0	309	XBT 16
		15.58	.	28°41.7	12°52.2	459	XBT 17
		16.25	18	28°44.9	12°53.4	718	XBT 18
829	26.09.	16.55	19.55	28°48.0	12°54.6	877	CTD/LADCP, Cocco
		19.00	19.01	28°48.2	12°54.5	888	XBT 19
		19.25	.	28°51.3	12°55.7	1005	XBT 20
		19.56	.	28°54.3	12°56.8	1009	XBT 21
830	26.09.	20.25	22.11	28°57.4	12°58.0	1251	CTD/LADCP
		22.20	.	28°57.6	12°58.0	1256	XBT 22
		22.45	.	29°00.8	12°59.2	1351	XBT 23
		23.16	.	29°03.9	13°00.4	1451	XBT 24
831	26.09.	23.45	00.53	29°06.9	13°01.6	1435	CTD/LADCP
	27.09.	01.00	01.55	29°07.2	13°01.2	1444	Multinet
		02.03	02.20	29°07.7	13°01.2	1455	Plankton net
		03.29	.	29°13.4	13°03.9	1483	XBT 28
832	27.09.	04.00	06.10	29°16.5	13°05.2	1483	CTD/LADCP
		06.16	.	29°16.5	13°05.2	1489	XBT 29
		06.41	.	29°19.8	13°06.3	1455	XBT 30
		07.05	07.10	29°22.4	13°07.4	1473	XBT 31
833	27.09.	07.42	09.07	29°26.2	13°08.7	1443	CTD/LADCP
		09.14	10.25	29°26.4	13°08.6	1446	Multinet
		10.28	10.50	29°27.0	13°08.9	1447	Plankton net
		11.07	11.12	29°26.0	13°08.7	1446	XBT 32

Station list P212 (continued)

STATION NO.	DATE 1995	TIME (UTC) start	stop	POSITION φ (°N)	λ (°W)	DEPTH corr. (m)	INSTRUMENTS
834	27.09.	20.36	21.40	27°57.0	13°33.6	1208	CTD/LADCP
		21.47	23.05	27°57.0	13°33.2	1194	Multinet
		23.10	23.30	27°57.5	13°33.7	1217	Plankton net
		23.39	23.44	27°57.0	13°33.7	1217	XBT 33
		23.53	.	27°58.4	13°35.5	1303	XBT 34
	28.09.	00.07	.	27°50.6	13°37.4	1366	XBT 35
835	28.09.	00.27	01.35	28°01.1	13°39.1	1406	CTD/ADCP
		01.50	.	28°01.1	13°39.2	1422	XBT 36
		02.06	.	28°02.5	13°41.1	1449	XBT 37
		02.19	03.	28°03.7	13°42.9	1556	XBT 38
836	28.09.	02.47	03.59	28°05.1	13°44.8	1562	CTD/ADCP
		04.05	.	28°05.2	13°44.8	1563	XBT 39
		04.19	.	28°06.6	13°46.6	1404	XBT 40
		04.32	.	28°07.9	13°48.3	966	XBT 41
837	28.09.	04.54	ß5.38	28°09.2	13°50.2	756	CTD/ADCP
		05.43	06.34	28°09.0	13°50.4	692	Multinet
		06.45	07.03	28°09.3	13°50.2	698	Plankton net
		07.08	.	28°09.2	13°50.2	750	XBT 42
838	28.09.	13.13	14.19	27°48.1	14°29.2	2069	ICTD-intern
		15.17	15.26	27°48.9	14°28.9	2061	ICTD-intern
		16.55	17.42	27°49.0	14°29.1	2063	ICTD-intern
		22.00	.	28°05.0	14°36.0	107	XBT 43
		22.22	.	28°05.0	14°39.5	586	XBT44
		22.36	.	28°05.0	14°43.0	966	XBT 45
		22.55	.	28°05.0	14°46.4	900	XBT 46
		23.06	.	28°05.0	14°49.8	1334	XBT 47
		23.36	.	28°05.0	14°53.4	1434	XBT 48
839	29.09.	00.20	01.33	28°04.9	14°59.0	1567	CTD/LADCP
		01.58	.	28°05.0	14°58.0	1564	XBT 49
		02.38	.	28°05.1	15°01.0	1601	XBT 50
		03.24	.	28°05.5	15°04.5	1696	XBT 51
		04.11	.	28°05.0	15°08.0	1770	XBT 52
		05.01	.	28°10.0	15°11.4	1484	XBT 53
		05.53	.	28°05.0	15°14.8	1318	XBT 54
		06.31	.	28°05.0	15°18.3	1121	XBT 55
		07.07	.	28°05.0	15°20.5	699	XBT 56
P212/3							
840	01.10.	02.00	02.32	29°09.9	15°40.0	3513	CTD/ADCP
		02.40	04.15	29°10.0	15°40.0	3513	ICTD
		04.26	07.07	29°10.0	15°40.1	3513	CTD
841	01.10.	08.20	08.39	29°10.0	15°40.1	3638	Launching drifting particle trap no.7848

Station list P212 (continued)

STATION NO.	DATE 1995	TIME (UTC) start	stop	POSITION φ (°N)	λ (°W)	DEPTH corr. (m)	INSTRUMENTS
842	01.10.	16.55	18.32	28°24.0	14°32.0	2010	CTD/ADCP
		19.34	19.55	28°24.0	14°31.9	3014	CTD (30 m)
843	01.10.	22.00	23.38	28°39.0	14°21.5	1905	CTD/ADCP
844	02.10.	01.45	03.23	20°53.9	14°10.5	2289	CTD/ADCP
845	02.10.	05.50	07.34	29°09.0	13°55.9	2089	CTD/ADCP
846	02.10.	09.46	11.20	29°23.0	13°41.5	1908	CTD/ADCP
		12.41	13.15	29°23.0	13°41.6	1872	CTD
847	02.10.	15.18	17.37	29°23.0	14°02.8	3305	CTD/ADCP
848	02.10.	19.44	22.16	29°23.0	14°23.1	3442	CTD/ADCP
849	03.10.	00.25	02.28	29°22.9	14°44.4	3538	CTD/ADCP
850	03.10.	04.30	06.45	29°23.0	15°05.8	3587	CTD/ADCP
851	03.10.	08.55	11.38	29°23.0	15°26.6	3619	CTD/ADCP
		12.15	12.40	29°23.0	15°26.6	3618	CTD/ADCP (500m)
852	03.10.	15.15	15.35	29°08.7	15°48.5	3638	Retrieval drifting particle trap
853	03.10.	17.30	17.46	29°12.0	15°30.0	3622	Launching drifting particle trap
		18.00	18.12	29°11.8	15°29.5	3622	CTD/LADCP (30m)
		19.45	22.02	29°11.9	15°29.5	3623	CTD/LADCP
854	04.10.	00.20	02.10	29°23.0	15°47.5	3641	CTD/LADCP
855	04.10.	03.48	06.05	29°14.7	15°51.2	3644	CTD/LADCP
856	04.10.	07.20	10.28	29°.05.7	15°54.8	3638	CTD/LADCP
857	04.10.	11.47	13.57	28°56.5	15°58.5	3611	CTD/LADCP
858	04.10.	15.15	17.27	28°47.2	16°02.3	3381	CTD/LADCP
859	04.10.	18.45	19.30	28°38.4	16°06.0	466	CTD/LADCP
860	04.10.	20.54	23.30	28°29.5	15°58.4	2929	CTD/LADCP
861	05.10.	05.20	07.54	28°20.4	15°51.4	3272	CTD/LADCP
862	05.10.	09.25	10.12	28°12.0	15°44.1	463	CTD/LADCP
863	05.10.	13.10	13.50	28°05.0	15°20.5	543	CTD/LADCP
864	05.10.	15.05	16.34	28°05.0	15°09.3	1690	CTD/LADCP
865	05.10.	18.00	19.27	28°05.0	14°58.0	1569	CTD/LADCP
866	05.10.	20.40	21.55	28°05.0	14°47.0	988	CTD/LADCP
867	06.10.	00.10	01.30	28°17.9	14°37.1	1414	CTD/LADCP
868	06.10.	08.08	09.20	28°58.0	15°40.2	3624	Retrieval drifting particle trap
869	06.10.	11.55	12.10	29°11.9	15°30.0	3625	CTD/LADCP (200m)
		12.48	15.18	29°12.0	15°30.0	3624	CTD/LADCP
		16.24	16.55	29°12.0	15°29.7	3623	CTD/LADCP (300m)
870	07.10.	06.16	07.56	28°55.1	17°51.5	1946	CTD/LADCP
871	07.10.	10.13	12.19	28°51.3	17°30.5	3168	CTD/LADCP
872	07.10.	14.30	16.27	28°48.1	17°09.2	3563	CTD/LADCP
		16.35	16.47	28°47.9	17°09.2	3565	ICTD (test)
873	07.10.	18.57	21.00	28°45.1	16°48.0	3239	CTD/LADCP
874	07.10.	23.00	00.45	28°41.5	16°26.8	2688	CTD/LADCP

Station list P212 (continued)

STATION NO.	DATE 1995	TIME (UTC) start	stop	POSITION φ (°N)	λ (°W)	DEPTH corr. (m)	INSTRUMENTS
P212/4							
	10.10.	19.00					Sail Sta. Cruz
875	12.10.	08.15	10.44	29°00.05	22°00.97	4860	Launch mooring V370 (sound source)
876	12.10.	11.26	14.36	29°02.07	22°01.11	4929	CTD
		14.41		29°03.43	22°00.94	4917	Float 01
		16.34		29°22.04	22°00.81	4930	XBT 00, test launch
877	12.10.	20.24		29°59.99	22°00.71	5043	Float 02
	13.10.	03.54		31°10.00	22°00.50	5070	Float 03
		05.06		31°20.00	22°00.41	5058	XBT 01
		06.08		31°30.00	22°00.28	5074	XBT 02
		07.18		31°40.00	22°00.25	5085	XBT 03
		08.24		31°50.00	22°00.25	5083	XBT 04
		09.32		32°00.00	22°00.26	5099	XBT 05
879	13.10.	10.45	11.53	32°10.00	22°00.22	5132	Check acoustic release
		11.56		32°09.77	22°01.22	5149	Float 04
		11.59		32°09.82	22°01.32	5154	XBT 06
		13.08		32°20.01	22°00.70	5180	XBT 07
		14.17		32°30.00	22°00.20	5222	XBT 08
		15.23		32°39.98	21°59.96	5210	XBT 09
880	13.10.	15.44	18.11	32°43.12	21°58.81	5270	Launch mooring V369 (sound source)
		19.51		32°50.00	22°00.12	5256	XBT 10
881	13.10.	20.28	00.20	32°55.00	22°00.01	5266	2 x hydrocast, GoFlo, (1000m, 2000m)
882	14.10.	08.35	10.55	32°57.41	22°01.30	5272	Recover mooring 276-15 (current meters, particle traps)
883	15.10.	08.20	12.00	33°00.14	21°57.85	5270	Launch mooring V276-16 (current meters, particle traps)
884	15.10.	12.25	15.21	33°02.35	21°57.89	5271	CTD
		15.26		33°02.26	21°56.89	5275	Float 05
		16.24		33°10.00	21°51.32	5302	XBT 11
		17.33		33°20.00	21°44.75	5317	XBT 12
		18.43		33°30.00	21°38.40	5324	XBT 13
		19.55		33°40.00	21°31.44	5336	XBT 14
		21.04		33°50.00	21°24.68	5276	XBT 15
		22.15		34°00.00	21°17.92	5266	XBT 16

Station list P212 (continued)

STATION NO.	DATE 1995	TIME (UTC) start	stop	POSITION φ (°N)	λ (°W)	DEPTH corr. (m)	INSTRUMENTS
885	15.10.	22.24		34°00.33	21°17.78	5252	Float 06
		23.42		34°10.00	21°11.55	5237	XBT 17
	16.10.	00.56		34°20.05	21°05.01	5214	XBT 18
		02.11		34°30.00	20°58.17	5244	XBT 19
		03.27		34°40.02	20°53.51	5194	XBT 20
		04.38		34°50.00	20°45.00	5235	XBT 21
		05.55		35°00.00	20°38.46	5024	XBT 22
886	16.10.	06.00		35°00.33	20°38.36	5129	Float 07
		07.22		35°10.00	20°31.52	5235	XBT 23
		08.39		35°20.00	20°25.11	5222	XBT 24
		09.53		35°30.00	20°18.33	5263	XBT 25
		11.06		35°40.00	20°11.49	5135	XBT 26
887	16.10.	12.26	15.35	35°49.97	20°04.84	5366	CTD
		15.38		35°50.05	20°04.62	5364	Float 08
		17.05		35°40.00	19°55.63	5327	XBT 27, bad
		18.20		35°30.00	19°46.66	5298	XBT 28
		19.40		35°20.00	19°37.30	5271	XBT 29
		21.00		35°10.00	19°27.94	5150	XBT 30
		22.21		35°00.00	19°18.71	5123	XBT 31
		23.41		34°50.00	19°09.61	5086	XBT 32
	17.10.	01.05		34°40.00	19°00.24	5018	XBT 33, failed
		01.14		34°39.05	18°59.28	5033	XBT 34, internally no. 33
		02.29		34°30.00	18°50.58	5047	XBT 35
888	17.10.	02.37		34°29.42	18°50.21	5046	Float 09
		03.54		34°20.00	18°41.61	4976	XBT 36
		05.20		34°10.00	18°32.70	4842	XBT 37
		06.37		34°00.00	18°23.46	4668	XBT 38
		08.18		33°50.00	18°14.28	4394	XBT 39
889	17.10.	10.00	12.39	33°40.09	18°04.97	3907	CTD
890	17.10.	12.48		33°39.99	18°05.55	3931	Float 10
	18.10.	09.00					Funchal
P212/5							
	20.10.	09.00					Sail Funchal
891	20.10.	19.00	19.36	33°53.60	16°33.50		Check acoustic release
892	21.10.	14.12	16.25	36°33.14	16°39.24	4180	Launch mooring V368 (sound source)
893	21.10.	16.50	19.15	36°35.09	16°39.13	4117	CTD
	29.10.						Bremerhaven

5.5. Sampling during P212 Samples in addition to salinity

Station no.	Oxygen	Nutrients	Chlorophyll	Zooplankton
795	XXX	XXX		
796	XXX	XXX	XXX	XXX
797	XXX	XXX		
798	XXX	XXX		
799	XXX	XXX	XXX	XXX
800	XXX	XXX		
801	XXX	XXX		
802	XXX	XXX	XXX	XXX
803	XXX	XXX		
804	XXX	XXX		
805	XXX	XXX	XXX	XXX
806	XXX	XXX		
807	XXX	XXX		
808	XXX	XXX	XXX	XXX
809	XXX	XXX		
810	XXX	XXX		
811	XXX	XXX	XXX	XXX
812	XXX	XXX		
813	XXX	XXX		
814	XXX	XXX	XXX	XXX
815	XXX	XXX		
816	XXX	XXX		
817	XXX	XXX	XXX	XXX
818	XXX	XXX		
819	XXX	XXX		
820	XXX	XXX	XXX	XXX
821	b. opened			
822	too shallow			
823	XXX	XXX		
824	XXX	XXX		
825	XXX	XXX	XXX	XXX
826	XXX	XXX		
827	XXX	XXX		
828	XXX	XXX		XXX
829	XXX	XXX		
830	XXX	XXX		
831	XXX	XXX		XXX
832	XXX	XXX	XXX	
833	XXX	XXX	XXX	XXX
834	XXX	XXX	XXX	XXX
835	XXX	XXX		
836	XXX	XXX		
837	XXX	XXX	XXX	XXX
838	not samples			
839	XXX	XXX		

P212 samples in addition to salinity (continued)

Station no.	Oxygen	TCO_2, TALK, pH	Dissolved metals (Al)	Particulate matter (Al)	Nutrients	Chlorophyll
840	XXX	XXX	XXX		XXX	XXX
841						
842	XXX	XXX	XXX	XXX	XXX	XXX
843	XXX	XXX	XXX	XXX	XXX	XXX
844	XXX	XXX	XXX		XXX	XXX
845	XXX	XXX	XXX		XXX	XXX
846	XXX	XXX	XXX	XXX	XXX	XXX
847					XXX	XXX
848	XXX	XXX	XXX		XXX	XXX
849	XXX				XXX	XXX
850	XXX	XXX	XXX	XXX	XXX	XXX
851					XXX	XXX
852						
853	XXX	XXX	XXX	XXX	XXX	XXX
854	XXX	XXX	XXX	XXX	XXX	XXX
855	XXX	XXX	XXX		XXX	XXX
856					XXX	XXX
857	XXX	XXX	XXX	XXX	XXX	XXX
858					XXX	XXX
859	XXX	XXX			XXX	XXX
860	XXX	XXX			XXX	XXX
861	XXX	XXX			XXX	XXX
862					XXX	XXX
863					XXX	XXX
864	XXX	XXX	XXX	XXX	XXX	XXX
865	XXX	XXX			XXX	XXX
866	XXX	XXX	XXX	XXX	XXX	XXX
867	XXX	XXX			XXX	XXX
868						
869	XXX	XXX		XXX	XXX	XXX
870	XXX	XXX			XXX	XXX
871	XXX	XXX			XXX	XXX
872	XXX	XXX			XXX	XXX
873					XXX	XXX
874	XXX	XXX			XXX	XXX

6. POSEIDON cruise P233

6.1. Cuise narrative of P233

P233a, 05.09. - 21.09.1997, Lisbon - Las Palmas

POSEIDON left Lisbon on 05.09.1997 at 09:00 heading southwestward. Due to a request from the Instituto de Oceanografia, Univ. de Lisboa, (CANIGO Task 4.3.3: Dynamics of Mediterranean Outflow and meddies - Lagrangian measurements) two moorings (IO1, IO2), which were both equipped with a sound source at about 1000 m and a release, were deployed during the approach to the hydrographic CANIGO box (see map in Sec. 6.3 and the station list in Sec. 6.4). The position of mooring IO2 was reached on 06.09.1997 in the early morning and the mooring was deployed immediately. About 6 hours later POSEIDON reached the position, where the mooring IO1 was set at a water depth of about 4000 m. Just south of the mooring position IO1 a CTD test station was carried out down to a water depth of 3000 m. Afterwards, POSEIDON headed to the position close to the African shelf to start the work on the hydrographic CANIGO box. The new POSEIDON GG24 receiver from Ashtec was installed and four antennas of the ADU2 were mounted on the very top of the mast. Both units improved the vessel-mounted ADCP data.

On the hydrographic box, which extends from the African shelf towards Madeira, then southward to La Palma and back to the African shelf, CTD/LADCP stations were made. Most of the stations were already sampled during the METEOR cruise M37/2 in January 1997. The CTD was equipped with an oxygen sensor. At stations with a water depth of less than 3000_m an *in-situ* fluorometer was also attached. On each station water samples were obtained with a GO-rosette equipped with 21 x 10 l Niskin bottles. The water samples were analyzed for salinity, oxygen, nutrients, chlorophyll a and coccolithophorids. At five stations the water samples were also analyzed for diatoms and stable isotopes. Samples of oxygen and nutrients were taken from every bottle, while chlorophyll a and coccolithophorids were only analyzed from the upper 200 m and 300 m, respectively. The exact sampling levels for each station and parameter are shown in Section 6.5. The salinity samples, which were mainly taken from the uppermost and lowest bottle were analyzed on board using an Guildline Autosal salinometer.

On 14.09.1997 the ship´s gyro started to fail, but since it is essential for good vessel-mounted ADCP measurements, we decided to have it repaired in port. POSEIDON left the hydrographic box after station 592 and headed for Las Palmas, where we arrived on 15.09.1997 at 09:30. After the installation of a new ball within the gyro, POSEIDON left Las Palmas again on 16.09.1997 at 19:30 and headed back to station 593 to complete the hydrographic station work. After the CANIGO box was finished, two further sections were made between Fuerteventura and Africa. A total of 73 CTD profiles were carried out on 70 stations.

After the last CTD station was completed POSEIDON continued the vessel-mounted ADCP-section northward along the African shelf to the position of station 608. The section between the stations 608 and 595 was repeated with the vessel-mounted ADCP. Afterwards, POSEIDON returned to Las Palmas, where it arrived on 21.09.1997 at 09:00.

P233b, 23.09. - 26.09.1997, Las Palmas - Las Palmas

In port, the scientific crew partially changed: Chief scientist M. Knoll, the group of chemists from the ICCM and the observer from Morocco disembarked, the new chief scientist T.J. Müller took over, and four bio-geochemists from GeoB and a physical oceanographer from the IEO embarked. POSEIDON sailed in the morning of 26.09.1997 heading for the mooring position LP north of La Palma (see map in Sec. 6.3 and the station list in Sec. 6.4).

Close to LP, station 632 was obtained with the CTD/rosette on 24.09.1997 early in the morning, sampling water was to be sent to J. Scholten (Univ. Kiel). Later the same day, GeoB mooring LP-1 was recovered, and GeoB mooring LP-2 was set at almost the same position without any problems. After the mooring work, water samples were taken down to 200 m with the CTD/rosette. In the evening, POSEIDON headed for GeoB mooring CI-7 at ESTOC. On the way, water samples were taken from the upper 500 m of the water column to start the incubation experiment onboard.

In the morning of 25.09.1997, the GeoB particle trap mooring CI-7 was recovered. In the afternoon at a position about 10 nm northeast of the CI, two systems with drifting particle traps were launched for 4 days to measure the particle flux in the upper water column which cannot be achieved with moored instruments. Close to the drifting traps, water samples were taken from the upper 200 m to perform incubation experiments on plankton growth rates. On the return to the mooring position, a deep CTD/rosette profile was obtained to sample water for salinity (IfMK) and nutrient analysis (IEO).

In the morning of 26.09.1997, GeoB mooring CI-8 was set. The same day late in the afternoon, POSEIDON called port of Las Palmas to exchange personnel and equipment.

P233c, 28.09. - 05.10.1997, Las Palmas - Las Palmas

In port, two scientists from IfMK, two from GeoB and the physical oceanographer from IEO disembarked, and two scientists from each, IfMK, IEO and ULPGC embarked to perform the planned mooring work. The vessel sailed 28.09.1997 in the morning heading for the position of ESTOC/367-3 (see map in Sec. 6.3 and the station list in Sec. 6.4). This IfMK mooring was recovered in the afternoon without any problems. Again, water samples were taken from the upper 200 m for the incubation experiment, and a CTD/rosette profile was obtained close to the bottom. Next morning, 29.09.1997, IfMK mooring ESTOC/367-4 was launched. However, the upper buoyancy did not dive after the anchor was slipped since one of the Kevlar ropes had broken next to a fitting due to wiggling of the rope around that fitting. Thus, the mooring needed to be recovered and reset. Later in the evening of the same day, the two drifting particle trap systems were recovered and reset close to the position of the first launch next morning, 30.09.1997.

POSEIDON then headed towards the EBC array of 5 moorings east of Lanzarote. The vessel reached the array in the evening. Here, the first two stations of a CTD section were obtained close to the mooring section. On 01.10.1997 in the morning we recovered IfMK mooring EBC2/378-1 without any problems. However, the next mooring EBC1-1 of ULPGC which had been set on the continental shelf break off Africa in January 1997 with METEOR did not surface although the release confirmed release several times with different deck units. A survey with GPS/GLONASS positioning (better 50 m) and hydrophone ranging from 4 positions between the vessel and the release resulted in a position of the release at 28°39.925' N, 012°56.808', very close to its nominal position estimated during the launching procedure from METEOR (28°39.9' N, 012°56.8' W). Another ranging above the releaser's position gave a distance of 486 m, which is the same value as the depth measured with POSEIDON's echo sounding system. It therefore was concluded that mooring EBC1-1 had been cut below the deepest buoyancy causing the releaser to stay at the bottom. The upper part of the mooring obviously was no longer in site and had to be given up.

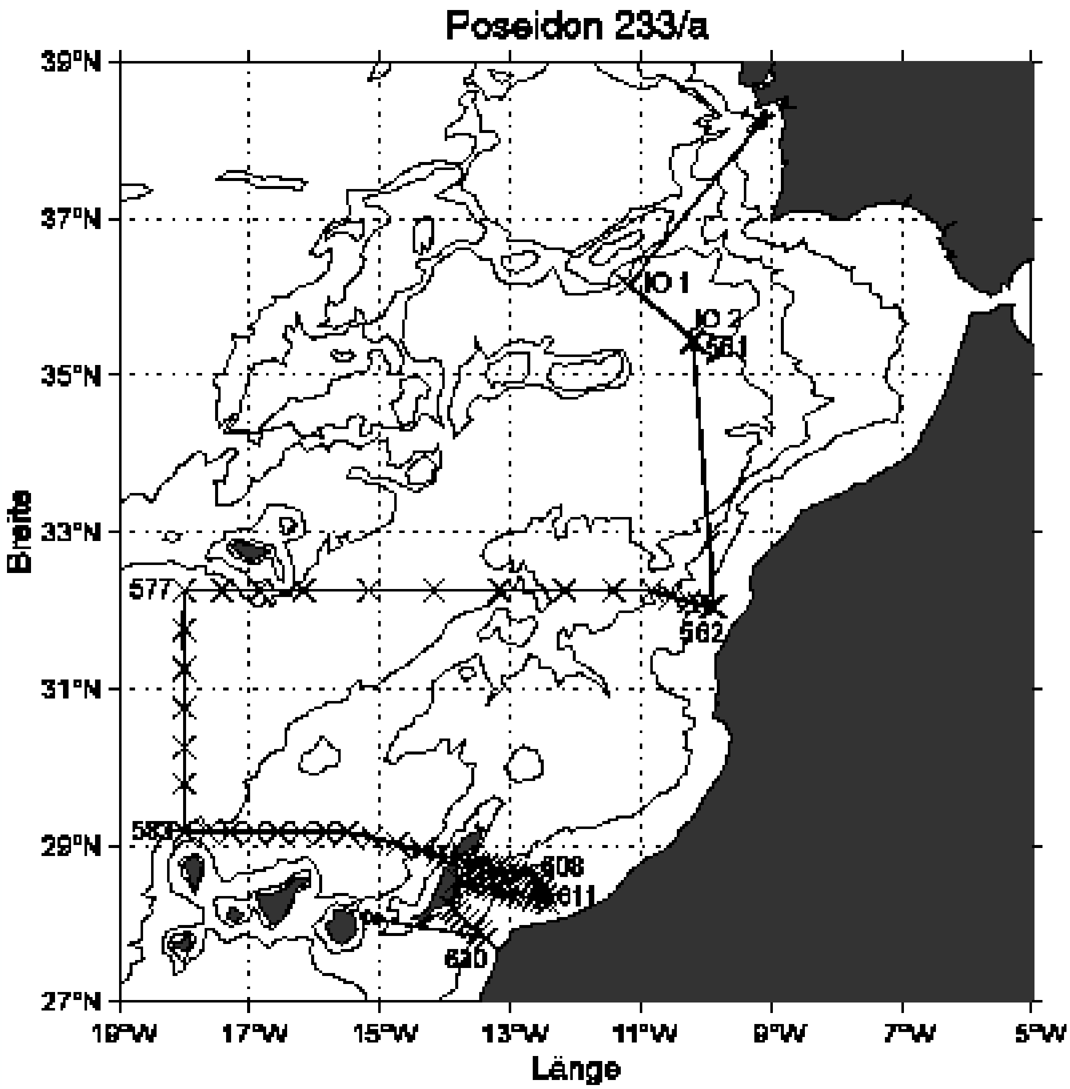
With five CTD stations, the section was continued. Next day, moorings EBC3/377-1, EBC4-1, and EBC5-1 were recovered. Mooring EBC3/377-2 was set with an optical sensing nutrient recorder. With three CTD stations the section was completed. Next day, the setting of moorings EBC4-2 and EBC5-2 completed the work east of the islands in the afternoon of 03.10.1997. We then sailed towards the drifting traps and took the occasion for a grill party on deck celebrating Germany's unification day.

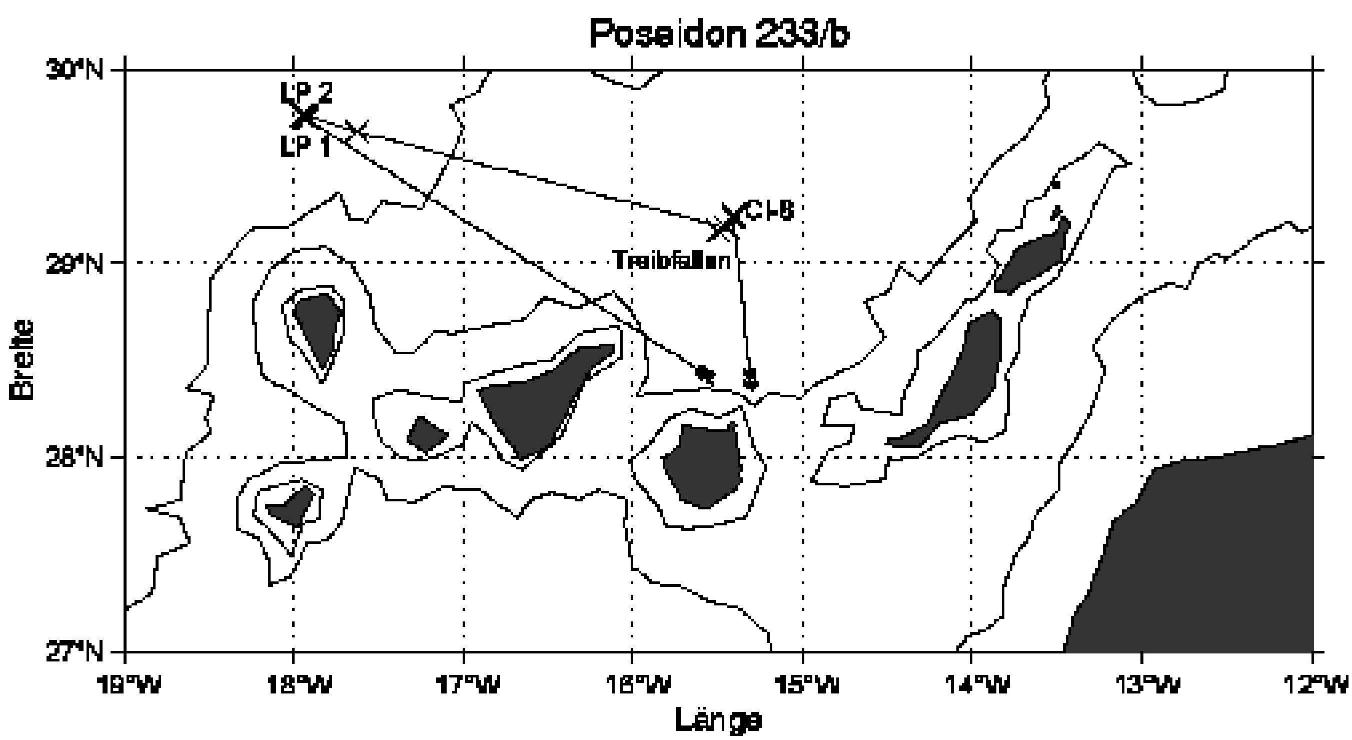
Near ESTOC we successfully recovered the drifting traps, and then finished the work of this leg with the ESTOC October 1997 station. POSEIDON called in to Las Palmas on the 06.10.1997 in the morning.

P233d, 07.10. - 10.10.1997, Las Palmas - Portimao

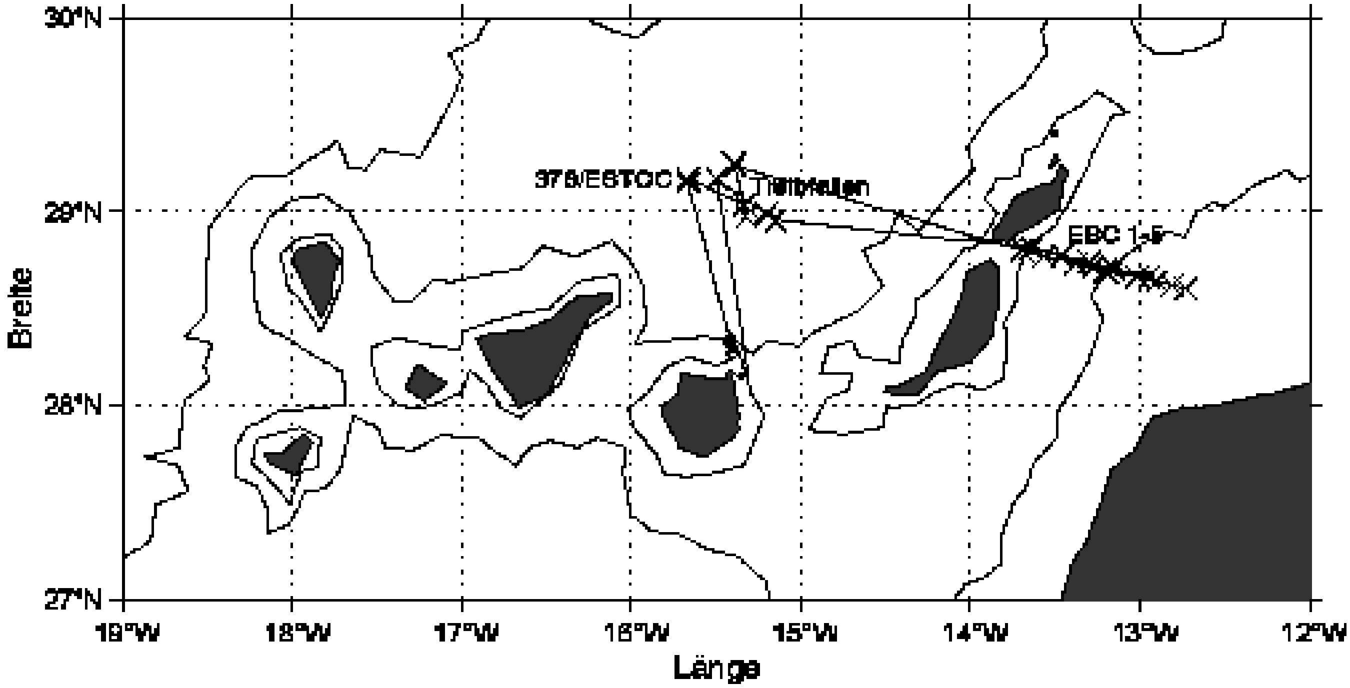
After unloading, exchange of personnel and loading we sailed again in the evening of 07.10.1997 for the short leg to Portimao. On the ESTOC position (see map in Sec. 6.3 and the station list in Sec. 6.4), a CTD/rosette station was taken for anthropogenic tracers (CFCs) followed by trace metal sampling with in-situ pumps and a special rosette, and by a plankton net haul to 30 m. Steaming east to the EBC array on the African shelf and then towards Portimao to close the CANIGO box with ADCP measurements, we took two further plankton hauls. We called port of Portimao on 10.10.1997 in the morning.

6.2. Cruise Tracks P233

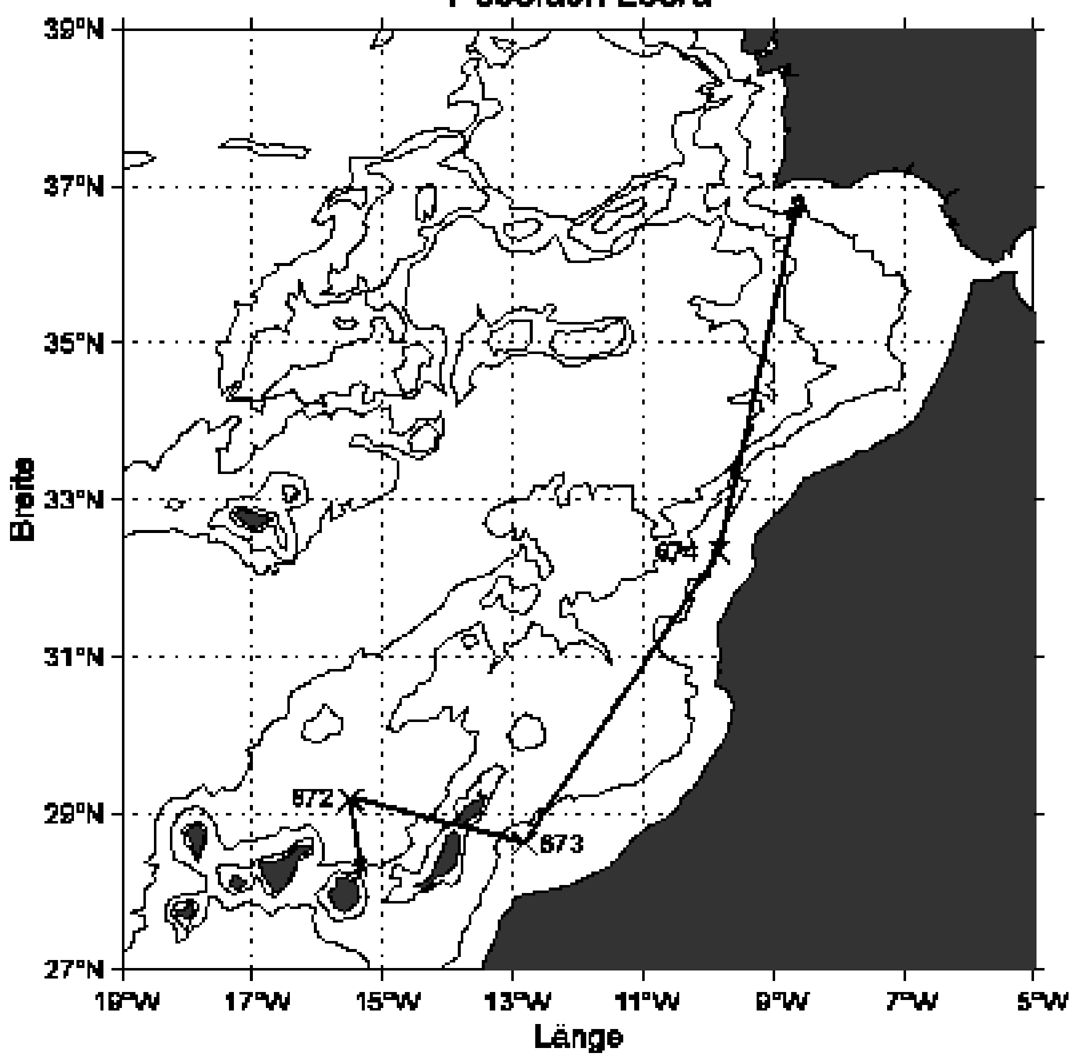




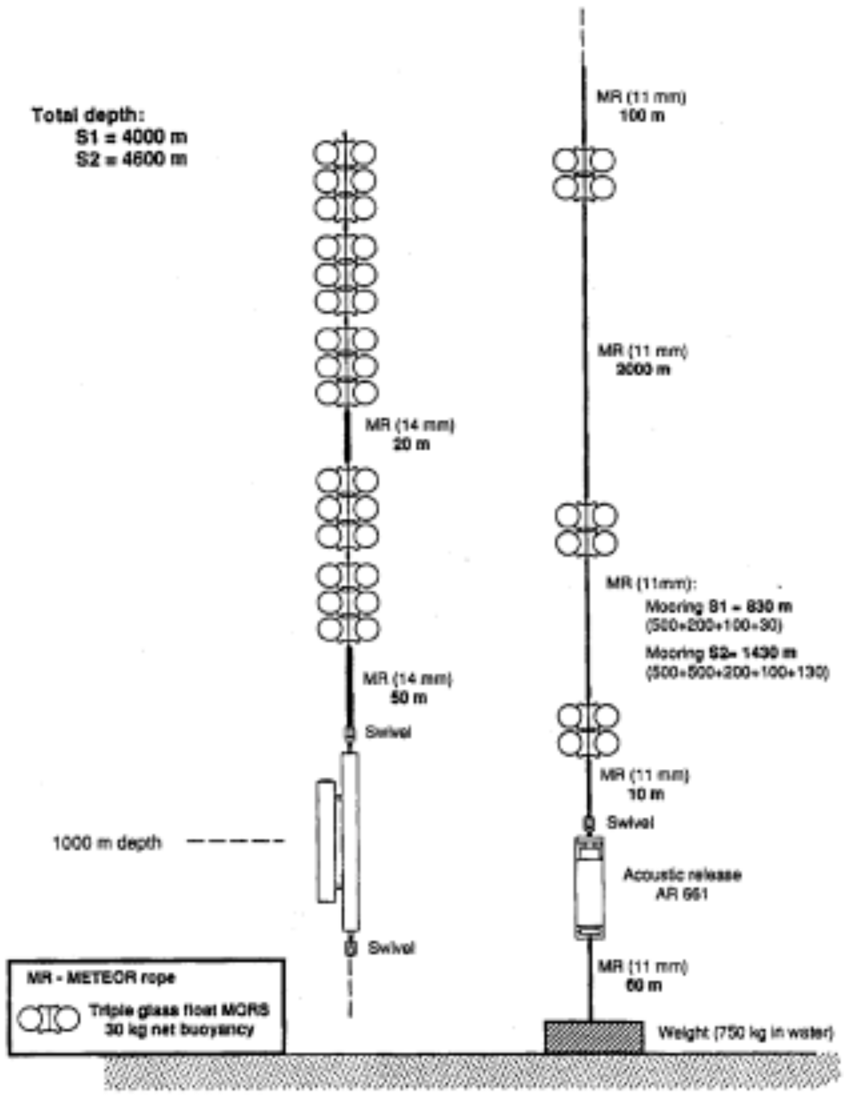
Poseidon 233/c



Poseidon 233/d



6.3. Moorings during P233 Schemes of moorings IO1, IO2



Launching information:

	IO1	**IO2**
Top buoy in water:	06.09.1997 15:12 UTC 35° 27.00´N 10° 11.73´W	06.09.1997 05:33 UTC 36° 06.63´N 11° 11.38´W
Anchor slipped:	06.09.1997 16:46 UTC 35° 28.67´N 10° 11.57´W	06.09.97 07:55 UTC 36°09.28´N 11° 10.59´W
Nylon rope below 2000 m	500+200+30 m	500+500+200+130+100+100 m
Release		
S/N	201	61
interrogate	9113	5128
release	9114	5129

Moorings
Index:

r: mooring recovered　　s: mooring set　　f: failed to recovered

ADCP: Acoustic Doppler Current Profiler
ACM: Aanderaa current meters
ICM: Influx current meters (AWI type)
ISP: in-situ pumps for trace metal samples
ST: particle flux trap
SoSo: sound sources, transmission times are UTC

ID	Date 1997	set/ rec.	Latitude N Longitude W	Depth m	Instrumentation
P233a					
IO1	06.09.	s	35°28.5' 10°11.6'	4027	SoSo34 in 1127 m, transmitting 01:00, 09:00, 17:00
IO2	06.09.	s	36°09.0' 11°10.7'	4812	SoSo35 in 1112 m, transmitting 01:32, 09:32, 17:32
P233b					
LP-1	24.09.	r	29°45.7' 17°57.3'	4327	ACM in 859, 1551, 3798 m; ICM in 1029 m ST in 1109, 3778 m
LP-2	24.09.	s	29°45.7' 17°55.8'	4348	ACM in 517, 1190, 2991 m; ICM in 717 m; ST in 692, 2966 m
ESTOC/CI-7	25.09.	r	29°11.0' 15°27.0'	3610	ACM in 3070 m; ICM in 770, 1030 m; ST in 750, 1010, 3050 m; ISP in 870, 890 m
ESTOC/CI-8	26.09.	s	29°11.2' 15°27.3'	3610	ACM in 3070 m; ICM in 770 m, 1030m; ST in 750, 1010, 3050 m; ISP in 870 m
P233c					
ESTOC/367-3	28.09.	r	29°09.0' 15°40.0'	3610	ADCP in 190 m; ACM in 270, 500, 800, 1200, 2000, 3550 m
ESTOC/367-4	29.09.	s	29°10.1' 15°40.2'	3610	ADCP in 190 m; ACM in 270, 500, 800, 1200, 2000, 3550 m
EBC2/378-1	01.10.	r	28°42.5' 13°09.3'	996	ACM in 160, 300, 500, 720, 950 m; ST in 700 m
EBC1-1	01.10.	f	28°39.9' 12°56.8'	493	mooring with 3 ACM lost
EBC2/378-2	01.10.	s	28°42.2' 13°09.8'	998	ACM in 160, 300, 500, 720, 950 m; ST in 700 m
EBC3/377-1	02.10.	r	28°44.5' 13°18.0'	1157	ACM in 160, 300, 500, 870, 1230 m; ICM in 720 m; ST in 700 m
EBC4-1	02.10.	r	28°46.4' 13°28.0'	1287	ACM in 150, 300, 500, 800, 1230 m
EBC5-1	02.10.	r	28°48.4 13°38.8'	1044	ACM in 150, 300, 520, 950 m
EBC3/377-2	02.10.	s	28°44.3' 13°17.9'	1180	ACM in 160, 300, 500, 870, 1230 m; ICM in 720 m; ST in 700 m
EBC4-2	03.10.	s	28°46.5' 13°27.6'	1270	ACM in 150, 300, 520, 800, 1230 m
EBC5-2	03.10.	s	28°48.6' 13°38.4'	1030	ACM in 150, 300, 520, 950 m

6.4. Station list for P233

Instruments: CTD, (lowered) LADCP, fluorometer (fl), multinet, plankton net (diatoms/coccolithophorids)
*: stations on the CANIGO box not carried out during METEOR cruise 37/2b in January 1997.

Date	Time (UTC) start	end	Sta-tion	Pro-file	Position φ (N)	λ (W)	Uncorr. water depth (m)	Instruments
P233/a								
06.09.97	05:33	07:55	559		36° 09.01'	11° 10.67'	4780	IO2 mooring
06.09.97	15:12	16:46	560		35° 28.50'	10° 11.59'	4000	IO1 mooring
06.09.97	17:54	20:08	561	1	35° 25.07'	10° 12.13'	4106	CTD/LADCP/fl (3000 m)
	20:15	20:45			35° 25.96'	10° 11.81'	4093	plankton net coc. (100 m)
07.09.97	16:04	16:29	562	2	32° 02.08'	9° 52.11'	113	CTD/LADCP/fl
	17:08	17:57	563	3	32° 02.14'	9° 54.20'	446	CTD/LADCP/fl
	18:20	19:00			32° 02.10'	9° 54.50'	511	plankton net coc. (100 m)
	19:20	20:34	564	4	32° 02.67'	9° 55.54'	1022	CTD/LADCP/fl
	21:31	22:43	565	5	32° 05.04'	10° 05.86'	1251	CTD/LADCP/fl
	23:45	01:46	566	6	32° 06.96'	10° 15.00'	2043	CTD/LADCP/fl
08.09.97	03:30	06:06	567	7	32° 10.01'	10° 31.82'	3004	CTD/LADCP/fl
	07:43	11:22	568	8	32° 15.00'	10° 49.98'	3228	CTD/LADCP
	13:42	16:22	569	9	32° 15.00'	11° 24.83'	3330	CTD/LADCP
	20:20	23:49	570	10	32° 15.13'	12° 09.92'	3379	CTD/LADCP
09.09.97	04:15	08:18	571	11	32° 15.09'	13° 09.84'	3999	CTD
	12:32	16:33	572	12	32° 14.93'	14° 09.88'	4330	CTD
	20:56	00:16	573	13	32° 15.10'	15° 09.80'	4364	CTD/LADCP
10.09.97	05:26	08:59	574	14	32° 15.06'	16° 09.88'	4299	CTD/LADCP
	12:29	15:24	575	15	32° 15.08'	16° 49.87'	3564	CTD/LADCP
	18:26	21:41	576	16	32° 15.08'	17° 24.87'	4215	CTD/LADCP
11.09.97	00:37	03:51	577	17	32° 14.98'	17° 59.89'	4421	CTD/LADCP
	07:00	10:33	578	18	31° 45.12'	18° 00.20'	4550	CTD/LADCP
	13:42	17:28	579	19	31° 15.09'	17° 59.96'	4572	CTD/LADCP
	20:31	23:58	580	20	30° 45.09'	18° 00.13'	4538	CTD/LADCP
12.09.97	3:34	07:03	581	21	30° 15.12'	18° 00.01'	4488	CTD/LADCP
	10:00	11:08	582		29° 47.00'	18° 00.00'	4370	multi net (500 m)
	11:45	11:55			29° 46.00'	17° 59.90'	4363	plankton net dia. (100 m)
	12:23	14:11		22	29° 47.01'	18° 00.03'	4367	CTD/fl (500 m)
	15:15	18:25		23	29° 46.84'	17° 59.95'	4368	CTD/LADCP
	22:04	01:53	583	24	29° 10.07'	18° 00.10'	3768	CTD/LADCP
13.09.97	04:00	06:50	584	25	29° 10.00'	17° 39.07'	3745	CTD/LADCP
	06:50	07:05			29° 09.80'	17° 39.40'	3740	plankton net dia. (100 m)
	09:01	11:43	585	26	29° 10.08'	17° 17.01'	3914	CTD/LADCP
	13:52	17:18	586	27	29° 10.06'	16° 55.03'	3835	CTD/LADCP
	19:05	22:04	587	28	29° 09.91'	16° 34.05'	3703	CTD/LADCP
	22:07	22:55			29° 10.40'	16° 32.80'	3704	multi net (500 m)
	23:03	23:14			29° 10.40'	16° 32.90'	3705	plankton net dia. (100 m)
	23:19	00:01		29	29° 10.45'	16° 32.97'	3705	CTD/fl (500 m)

Station list P233 (continued)

Date	Time (UTC) start	end	Sta-tion	Pro-file	Position φ (N)	λ (W)	Uncorr. water depth (m)	Instruments
14.09.97	01:51	05:09	588	30	29° 10.09'	16° 12.05'	3655	CTD/LADCP
	07:04	10:04	589	31	29° 10.14'	15° 50.53'	3624	CTD/LADCP
	11:47	14:32	590	32	29° 10.22'	15° 30.03'	3609	CTD/LADCP
	14:55	15:55			29° 10.00'	15° 30.00'	3608	multi net (500 m)
	15:55	16:09			29° 10.00'	15° 30.00'	3608	plankton net dia. (100 m)
	16:09	17:00		33	29° 09.80'	15° 29.67'	3607	CTD/fl (500 m)
	18:58	21:54	591	34	29° 05.68'	15° 06.82'	3576	CTD/LADCP
	23:50	02:22	592	35	29° 01.07'	14° 44.01'	3513	CTD/LADCP
15.09.97	02:30	02:41			29° 00.40'	14° 43.40'	3505	plankton net dia. (100 m)
17.09.97	02:14	05:03	593	36	28° 55.99'	14° 22.00'	2966	CTD/LADCP/fl
	06:30	08:22	594	37	28° 52.61'	14° 06.16'	2090	CTD/LADCP/fl
	09:15	10:33	595	38	28° 50.96'	13° 56.21'	1067	CTD/LADCP/fl
	10:37	11:40			28° 50.80'	13° 58.00'	977	multi net (500 m)
	11:40	11:52			28° 50.80'	13° 58.00'	977	plankton net dia. (100 m)
	13:16	14:06	596	39	28° 47.97'	13° 42.53'	871	CTD/LADCP/fl
	15:19	16:33	597	40	28° 46.03'	13° 33.11'	1213	CTD/LADCP/fl
	16:39	16:49			28° 45.60'	13° 33.20'	1212	plankton net dia. (100 m)
	17:47	19:06	*598	41	28° 44.78'	13° 29.25'	1276	CTD/LADCP/fl
	19:59	21:16	599	42	28° 44.13'	13° 22.22'	1308	CTD/LADCP/fl
	22:00	23:11	*600	43	28° 43.01'	13° 17.12'	995	CTD/LADCP/fl
	23:43	00:40			28° 43.10'	13° 17.10'	993	multi net (500 m)
18.09.97	00:43	01:00			28° 44.00'	13° 17.10'	1175	plankton net dia. (100 m)
	01:50	02:40	601		28° 42.20'	13° 11.90'	1055	multi net (500 m)
	02:58	04:11		44	28° 41.97'	13° 12.14'	1055	CTD/LADCP/fl
	04:14	04:25			28° 42.20'	13° 11.10'	1038	plankton net dia. (100 m)
	05:22	06:18	602	45	28° 40.29'	13° 06.10'	798	CTD/LADCP/fl
	07:10	07:58	603	46	28° 39.52'	13° 00.51'	591	CTD/LADCP/fl
	08:57	09:31	604	47	28° 38.04'	12° 54.55'	358	CTD/fl
	10:19	10:50	605	48	28° 36.99'	12° 49.17'	248	CTD/fl
	10:55	11:07			28° 37.00'	12° 49.20'	248	plankton net dia. (100 m)
	12:06	12:35	606	49	28° 36.53'	12° 43.46'	174	CTD/fl
	13:28	13:51	*607	50	28° 35.02'	12° 37.06'	102	CTD/fl
	14:35	14:59	608	51	28° 33.53'	12° 31.99'	98	CTD/fl
	15:00	15:10			28° 33.50'	12° 32.00'	98	plankton net dia. (100 m)
	16:00	16:24	*609	52	28° 28.04'	12° 29.47'	97	CTD/fl
	17:18	17:34	*610	53	28° 22.10'	12° 27.58'	59	CTD/fl
	18:33	18:46	*611	54	28° 15.55'	12° 25.05'	48	CTD/fl
	19:36	20:48	*612	55	28° 16.98'	12° 31.90'	53	CTD/fl
	20:37	20:48	*613	56	28° 18.55'	12° 38.83'	70	CTD/fl
	21:43	21:51	*614	57	28° 19.99'	12° 45.88'	86	CTD/fl
	22:49	23:10	*615	58	28° 21.46'	12° 52.83'	98	CTD/fl
19.09.97	00:10	00:30	*616	59	28° 23.03'	12° 59.99'	121	CTD/fl
	01:51	02:53	*617	60	28° 24.78'	13° 06.87'	773	CTD/LADCP/fl
	04:01	05:14	*618	61	28° 26.03'	13° 13.97'	980	CTD/LADCP/fl

Station list P233 (continued)

Date	Time (UTC) start	end	Station	Profile	Position φ (N)	λ (W)	Uncorr. water depth (m)	Instruments
19.09.97	06:22	07:35	*619	62	28° 27.53'	13° 20.80'	1116	CTD/LADCP/fl
	08:38	09:52	*620	63	28° 29.06'	13° 27.98'	1271	CTD/LADCP/fl
	10:54	12:11	*621	64	28° 30.48'	13° 34.91'	1248	CTD/LADCP/fl
	13:11	14:20	*622	65	28° 32.02'	13° 41.98'	1049	CTD/LADCP/fl
	15:08	15:35	*623	66	28° 33.59'	13° 48.01'	342	CTD/fl
	17:48	17:59	*624	67	28° 12.05'	13° 53.71'	51	CTD/fl
	18:44	19:53	*625	68	28° 09.05'	13° 50.15'	726	CTD/LADCP/fl
	20:27	21:52	*626	69	28° 05.14'	13° 45.03'	1560	CTD/LADCP/fl
	22:44	00:07	*627	70	28° 01.14'	13° 40.01'	1413	CTD/LADCP/fl
20.09.97	01:10	02:34	*628	71	27° 57.07'	13° 33.98'	1219	CTD/LADCP/fl
	03:37	04:36	*629	72	27° 53.03'	13° 27.99'	813	CTD/LADCP/fl
	05:45	06:20	*630	73	27° 48.06'	13° 22.13'	95	CTD/fl
P233/b								
23.09.97	16:00							sail Las Palmas start P233b
24.09.97	02:58	06:30	632	74	29°44.8'	017°55.4	4325	CTD/rosette; samples for J. Scholten (GPI, Univ. Kiel)
	07:04	11:20	633		29°45.7'	017°57.3'	4331	recover mooring LP-1
	13:07	16:28	634		29°45.7'	017°55.8'	4330	set mooring LP-2
	16:53	17:19	635	75	29°45.9'	017°56.4'	4333	CTD/rosette,;150 m; plankton samples
	19:02	19:34	636	76	29°40.7'	017°37.6'	4232	CTD/rosette; 500 m plankton samples
25.09.97	07:02	12:33	637		29°11.0'	015°27.0'	3610	recover mooring CI-7
	15:00 16:46	 16:30 17:10	638	 77	29°14.9' 29°14.2' 29°14.1'	015°24.9' 015°24.8' 015°24.6'	3610	set drifting traps, 500m; set drifting traps, 200m; CTD/rosette, 200 m, plankton samples
	18:20	21:30	639	78	29°10.0'	015°30.0'	3610	CTD/rosette; sampling nutrients and salinity
26.09.97	07:05	10:41	640		29°11.2'	015°27.3'	3610	set mooring CI-8
	16:00							port of Las Palmas; end P233b
P233/c								
28.09.97	08:00							sailLas Palmas; start P233c
	14:50	17:00	641		29°09.0'	015°40.0'	3610	recover mooring 367-3
	18:06	18:30	642	79	29°10.0'	015°40.0'	3610	CTD/rosette, 200 m plankton samples
	19:26	22:02	643	80	29°10.0'	015°40.0'	3610	CTD/rosette near to the bottom

Station list P233 (continued)

Date	Time (UTC) start	end	Sta-tion	Pro-file	Position φ (N)	λ (W)	Uncorr. water depth (m)	Instruments
29.09.97	07:28	17:24	644		29°10.1'	015°40.2'	3610	set mooring 367-4
	19:40	20:05	645		29°02.2'	015°20.1'	3594	recover drifting traps,
30.09.97	07:00 07:25	07:18 08:48	646		29°14.9' 29°14.8'	015°24.0' 015°24.2'	3599 3589	set drifting traps, 200 m; set drifting traps, 500 m;
	07:58	08:50	647	81	29°14.9'	015°23.3'	3598	CTD/rosette, 200 m; plankton samples;
	09:01	09:25	648		29°14.4'	015°23.1'	3598	plankton net IEO
	18:11	18:50	649	82	28°48.1'	013°41.9'	911	CTD
	19:50	20:35	650	83	28°46.0'	013°34.0'	1184	CTD
01.10.97	07:00	08:12	651		28°42.4'	013°09.3'	996	recover mooring EBC2/378-1
	09:30	12:10	652		28°39.9'	012°56.8'	493	try to recover mooring EBC1; search; acoustic release positioned lying at bottom; not recovered
01.10.97	13:31	15:31	653		28°42.2'	013°09.8'	998	set mooring EBC2/378-2
	15:57	16:15	654	84	28°40.9'	013°11.9'	1036	CTD
	18:01	18:30	655	85	28°40.0'	013°01.0'	638	CTD
	19:32	19:32	656	86	28°38.6'	012°54.0'	360	CTD
	20:37	20:54	657	87	28°37.2'	012°49.0'	248	CTD
	21:33	21:46	658	88	28°36.1'	012°44.0'	163	CTD
02.10.97	07:02	08:20	659		28°44.5'	013°18.0'	1195	recover mooring EBC3/377-1
	09:37	10:42	660		28°46.4'	013°28.0'	1280	recover mooring EBC4-1
	12:09	12:40	661		28°48.4'	013°38.8'	1044	recover mooring EBC5-1
	14:18	15:27	662		28°44.3'	013°17.9'	1180	set mooring EBC3/377-2
	16:22	17:08	663	89	28°41.9'	013°12.1'	1051	CTD
	17:55	18:52	664	90	28°42.9'	013°16.8'	1048	CTD/rosette near EBC3; nutrient samples in AAIW core
	20:19	21:14	665	91	28°43.8'	013°22.8'	1308	CTD
03.10.97	08:00	09:02	666		28°46.5'	013°27.6'	1280	set mooring EBC4-2
	11:09	12:30	667		28°48.6'	013°38.4'	1030	set mooring EBC5-2
04.10.97	07:21	07:32	668		28°57.4'	015°09.0'	3581	recover drifting traps, 200 m
	08:10	08:31	669		28°59.5'	015°12.5'	3584	recover drifting traps, 500 m
	08:40	09:05	670	92	28°59.4'	015°12.2'	3584	CTD/rosette, 200 m; plankton samples
	12:41	15:38	671	93	29°10.0'	015°29.9'	3608	CTD/rosette, ESTOC Oct 1997 station; plankton net, 200m, IEO
05.10.97	08:00							port of Las Palmas; end of P233c

Station list P233 (continued)

Date	Time (UTC) start	end	Sta-tion	Pro-file	Position φ (N)	λ (W)	Uncorr. water depth (m)	Instruments
P233/d								
06.10.97	17:00							sail Las Palmas
06.10.97	23:38	00:43	672		29°10.0'	015°29.9'	3607	ESTOC position: flushing rosette bottles; 2000 m;
07.10.97	00:43	03:20		94	29°10.2'	015°29.8'	3607	CTD/rosette near to the bottom; tracer samples; in-situ pumps, 1000 m;
	03:54	07:23			29°10.5'	015°28.7'	3607	trace metal samples; trace metal special
	07:25	08:22			29°10.2'	015°21.4'	3607	rosette, 1000 m; plankton net, 30 m, ETHZ
08.10.97	22:42	23:00	673		28°37.0'	012°49.0'	248	plankton net, 30 m, ETHZ
09.10.97	03:06	03:23	674		32°20.0'	009°50.0'	592	plankton net, 30 m, ETHZ
10.10.97	09:00							port of Portimao

6.5. Sampling during P233

Samples: O (oxygen), N (nutrients), Cl (chlorophyll), S (salinity), Co (Coccolithophorids), D (diatoms), I (stable isotopes), - no bottle closed at indicated depth, * bottle closed while lifting

	Station											
Pres(dbar)	**561**	**562**	**563**	**564**	**565**	**566**	**567**	**568**	**569**	**570**	**571**	**572**
Bucket	-	Co	Co	Co	-	Co	-	Co	Co	Co	-	Co
10	S	O,N,Cl S,Co	O,N,Cl S,Co	-	O,N,Cl S	O,N,Cl S,Co	O,N,Cl S	-	O,N,Cl S,Co	O,N,Cl S,Co	O,N,Cl S,Co	O,N,Cl S,Co
25		O,N,Cl Co	O,N,Cl Co	O,N,Cl S,Co	O,N,Cl	O,N,Cl Co	O,N,Cl	O,N,Cl S,Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co
50		O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl	O,N,Cl Co	O,N,Cl	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co
75		O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	open	O,N,Cl Co	O,N,Cl	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co
100	O	O,N,Cl Co	O,N,Cl Co	O,N.Cl Co	O,N,Cl	O,N,Cl Co	O,N,Cl	O,N,Cl Co	O,N,Cl Co	open	O,N,Cl Co	O,N,Cl Co
125		-	O,N,Cl Co	O,N,Cl Co	O,N,Cl	O,N,Cl Co	O,N,Cl	Co*	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co
150		-	O,N,Cl Co	O,N,Cl Co	O,N,Cl	O,N,Cl Co	O,N,Cl	-	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co
200		-	O,N,Cl Co	O,N,Cl Co	O,N,Cl	O,N,Cl Co	O,N,Cl	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co
250		-	O,N Co	O,N Co	O,N	O,N Co	O,N	O,N Co	O,N Co	O,N Co	O,N Co	O,N Co
300	-	-	O,N Co	O,N Co	O,N	O,N	-	-	-	-	-	-
400		-	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N
500	-	-	-	-	-	-	-	-	-	-	-	-
600		-	-	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N
800	O	-	-	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N
900	-	-	-	-	-	-	-	-	-	-	-	-
1000	O	-	-	-	O,N	O,N	-	O,N	O,N	O,N	O,N	O,N
1100	O	-	-	-	O,N	O,N	O,N	O,N	O,N	O,N	-	-
1150	-	-	-	-	-	-	-	-	-	-	O,N	O,N
1200	O	-	-	-	O,N	O,N	O,N	O,N	O,N	O,N	-	-
1300	O	-	-	-	-	O,N	O,N	O,N	O,N	O,N	O,N	O,N
1500	O	-	-	-	-	O,N,	O,N	O,N	O,N	O,N	O,N	O,N
1800		-	-	-	-	O,N	O,N	-	-	-	-	-
2000		-	-	-	-	O,NS	O,N	O,N	O,N	O,N	O,N	O,N
2500		-	-	-	-	-	O,N	O,N	O,N	O,N	O,N	O,N
2800	-	-	-	-	-	-	-	-	-	-	-	-
3000	O,S	-	-	-	-	-	-	O,N	O,N	O,N	O,N	O,N
3500	-	-	-	-	-	-	-	-	-	-	O,N	O,N
4000	-	-	-	-	-	-	-	-	-	-	-	-
Bottom	-	O,N,Cl S,Co	O,N S	O,N S	O,N S	-	O,N S	O,N S	O,N S	O,N S	O,N S	O,N S

Sampling P233 (continued)

Samples: O (oxygen), N (nutrients), Cl (chlorophyll), S (salinity), Co (Coccolithophorids), D (diatoms), I (stable isotopes), - no bottle closed

Station												
Pres (dbar)	**573**	**574**	**575**	**576**	**577**	**578**	**579**	**580**	**581**	**582**	**583**	**584**
Bucket	Co	Co	Co	Co	Co	-	Co	-	-	Co,D,I	Co	Co,D
10	O,N,Cl S,Co	O,N,Cl S,Co	O,N,Cl S,Co	-	O,N,Cl S,Co	O,N,Cl S	O,N,Cl Co	open	O,N,Cl S	O,N,Cl S,CoD	open	O,N,Cl S,Co,D
25	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl S,Co	O,N,Cl Co	O,N,Cl	O,N,Cl Co	O,N,Cl S	O,N,Cl	O,N,Cl Co,D,I	O,N,Cl S,Co	O,N,Cl Co,D
50	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl	O,N,Cl Co	O,N,Cl	O,N,Cl	O,N,Cl Co,D,I	O,N,Cl Co	O,N,Cl Co,D
75	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl	O,N,Cl Co	O,N,Cl	O,N,Cl	O,N,Cl Co,D	O,N,Cl Co	O,N,Cl Co,D
100	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl	O,N,Cl Co	open	open	O,N,Cl Co,D	O,N,Cl Co	O,N,Cl Co,D
125	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	open	O,N,Cl Co	O,N,Cl	O,N,Cl Co	O,N,Cl	O,N,Cl	O,N,Cl Co,D	O,N,Cl S, Co	O,N,Cl Co,D
150	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl	O,N,Cl Co	O,N,Cl	O,N,Cl	O,N,Cl Co,D,I	O,N,Cl Co	O,N,Cl Co,D
200	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co	O,N,Cl	O,N,Cl Co	O,N,Cl	O,N,Cl	O,N,Cl Co,D	O,N,Cl Co	O,N,Cl Co,D
250	O,N Co	O,N Co	O,N Co	-	O,N Co	O,N	O,N Co	O,N	O,N	O,N Co,D	O,N Co	O,N Co,D
300	-	-	-	-	-	-	-	-	-	O,N Co,D,I	-	-
400	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N
500	-	-	-	-	-	-	-	-	-	O,NS , I	-	-
600	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N
800	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N
900	-	-	-	-	-	-	-	-	-	O,N	-	-
1000	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N
1100	-	-	-	-	-	-	-	-	-	O,N	-	-
1150	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	-	O,N	O,N
1200	-	-	-	-	-	-	-	-	-	O,N	-	-
1300	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N
1500	O,N	O,N	O,N	O,N	O,N	O,N	O,N	open	O,N	O,N	O,N	O,N
1800	-	-	-	-	-	-	-	-	-	O,N	-	-
2000	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N
2500	O,N	O,N	O,N	O,N	O,N	O,N	O,N	open	O,N	O,N	O,N	O,N
2800	-	-	-	-	-	-	-	-	-	O,N	-	-
3000	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N
3500	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,N
4000	-	-	-	-	-	-	-	-	-	O,N	-	-
Bottom	O,N S	O,N S	O,N S	O,N S	O,N S	O,N S	O,N S	O,N S	O,N S	O,N S	O,N S	O,N S

Sampling P233 (continued)

Samples: O (oxygen), N (nutrients), Cl (chlorophyll), S (salinity), Co (Coccolithophorids), D (diatoms), I (stable isotopes), - no bottle closed

	Station										
Pres (dbar)	**585**	**586**	**587**	**588**	**589**	**590**	**591**	**592**	**593**	**594**	**595**
Bucket	-	Co	Co,D,I	Co	-	Co,D,I	-	Co,D	Co	Co	Co,D,I
10	O,N,Cl S	O,N,Cl S,Co	O,N,Cl S,Co,D	O,N,Cl S,Co	O,N,Cl S	O,N,Cl S,Co,D	O,N,Cl S	-	O,N,Cl S,Co	O,N,Cl S,Co	O,N,Cl S,Co,D
25	O,N,Cl	O,N,Cl Co	O,N,Cl Co,D,I	O,N,Cl Co	O,N,C	O,N,Cl Co,D,I	O,N,Cl	O,N,Cl S,Co,D	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co,D,I
50	O,N,Cl	O,N,Cl Co	O,N,Cl S,Co,D,I	O,N,Cl Co	O,N,C	O,N,Cl Co,D,I	O,N,Cl	O,N,Cl Co,D	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co,D,I
75	O,N,Cl	O,N,Cl Co	O,N,Cl Co,D	O,N,Cl Co	O,N,Cl	O,N,Cl Co,D	O,N,Cl	O,N,Cl Co,D	O,N,Cl Co	O,N,Cl Co	O,N,Cl S,Co,D
100	O,N,Cl	O,N,Cl Co	O,N,Cl S,Co,D	O,N,Cl Co	O,N,Cl	O,N,Cl Co,D	O,N,Cl	O,N,Cl Co,D	O,N,Cl Co	O,N,Cl Co	O,N,Cl S,Co,D
125	O,N,Cl	O,N,Cl Co	O,N,Cl S,Co,D,I	O,N,Cl Co	O,N,Cl	O,N,Cl Co,D	O,N,Cl	O,N,Cl Co,D	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co,D
150	O,N,Cl	O,N,Cl Co	-	O,N,Cl Co	O,N,Cl	O,N,Cl Co,D,I	O,N,Cl S	O,N,Cl Co,D	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co,D,I
200	O,N,Cl	O,N,Cl Co	O,N,Cl Co,D	O,N,Cl Co	O,N,Cl	O,N,Cl Co,D	O,N,Cl	O,N,Cl Co,D	O,N,Cl Co	O,N,Cl Co	O,N,Cl Co,D
250	O,N	O,N Co	O,N S,Co,D	O,N Co	O,N S	O,N Co,D	O,N	O,N Co,D	O,N Co	O,N Co	O,N Co,D
300	-	-	O,N Co,D,I	-	-	O,N Co,D,I	-	-	-	O,N Co	O,N S,Co,D,I
400	O,N	O,N	O,N S	O,N	-	O,N	O,N	O,N S,Co,D	O,N	O,N	O,N
500	-	-	O,N S, I	-	-	O,N S, I	-	-	-	-	O,N S, I
600	O,N	O,N	O,NS	O,N	O,N	O,N	O,N	O,N	O,N	O,N	O,NS
800	O,N	O,N	O,NS	O,N	O,N	O,N	O,N	O,N	broken	O,N	-
900	-	-	O,NS	-	-	O,N	-	-	-	-	-
1000	O,NS	O,N	-	O,N	O,N	O,N	O,NS	O,N	O,NS	O,N	O,N
1100	-	-	O,NS	-	-	O,N	-	-	-	O,N	-
1150	O,N	O,N	-	O,N	O,N	-	O,N	O,N	O,N	-	-
1200	-	-	O,NS	-	-	O,N	-	-	-	O,N	-
1300	O,N	O,N	O,NS	O,N	O,N	O,N	O,N	O,N	O,N	O,N	-
1500	O,N	O,N	O,NS	O,N	O,NS	O,N	O,N	O,N	O,N	O,N	-
1800	-	-	O,NS	-	-	O,N	-	-	-	O,N	-
2000	O,N	O,N	O,NS	O,N	O,N	O,N	O,N	O,NS	O,N	O,N	-
2500	O,N	O,N	O,NS	O,N	O,N	O,N	O,N	O,N	O,N	-	-
2800	-	-	O,NS	-	-	O,N	-	-	-	-	-
3000	O,N	O,N	O,NS	O,N	O,N	O,N	O,N	O,N	O,N	-	-
3500	O,N	O,N	O,NS	O,N	O,N	O,N	O,N	O,N	O,N	-	-
4000	-	-	-	-	-	-	-	-	-	-	-
Bottom	O,NS	O,NS	O,NS	O,NS	O,NS	O,NS	O,NS	O,NS	O,NS	O,NS	O,NS

Sampling P233 (continued)

Samples: O (oxygen), N (nutrients), Cl (chlorophyll), S (salinity), Co (Coccolithophorids), D (diatoms), I (stable isotopes), - no bottle closed

	Station											
Pres (dbar)	**596**	**597**	**598**	**599**	**600**	**601**	**602**	**603**	**604**	**605**	**606**	**607**
Bucket	-	Co,D	-	-	Co,D, I	Co,D, I	-	Co	-	Co,D	-	-
10	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl
25	O,N, Cl	O,N, ClS,C	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl
50	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl
75	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl
100	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	-
125	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	-
150	O,N, Cl	-	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	-
200	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	-	O,N, ClS,C	-	-
250	O,N	O,N S,Co,	O,N	O,N	O,N Co,D	O,N Co,D	O,N	O,N Co	O,N	-	-	-
300	-	O,N S,Co,	O,N	O,N	O,N Co,D,	O,N Co,D,	O,N	O,N	O,N S	-	-	-
400	O,N	O,N S,Co	O,N	O,N	O,N	O,N	O,N	O,N	-	-	-	-
500	-	-	-	-	O,N I	O,N I	-	-	-	-	-	-
600	O,N	O,N S	O,N	O,N	O,N	O,N	O,N	-	-	-	-	-
800	O,N	O,N S	O,N	O,N	O,N	O,N	-	-	-	-	-	-
900	-	-	-	-	-	-	-	-	-	-	-	-
1000	-	O,N S	O,N	-	O,N	O,N	-	-	-	-	-	-
1100	-	O,N S	O,N	open	-	-	-	-	-	-	-	-
1150	-	-	-	-	-	-	-	-	-	-	-	-
1200	-	O,N S	O,N	O,N	-	-	-	-	-	-	-	-
1300	-	-	-	O,N	-	-	-	-	-	-	-	-
1500	-	-	-	-	-	-	-	-	-	-	-	-
1800	-	-	-	-	-	-	-	-	-	-	-	-
2000	-	-	-	-	-	-	-	-	-	-	-	-
2500	-	-	-	-	-	-	-	-	-	-	-	-
2800	-	-	-	-	-	-	-	-	-	-	-	-
3000	-	-	-	-	-	-	-	-	-	-	-	-
3500	-	-	-	-	-	-	-	-	-	-	-	-
4000	-	-	-	-	-	-	-	-	-	-	-	-
Bottom	O,N S	O,N S	O,N S	O,N S	O,N S	O,N S	O,N S	O,N S	-	-	O,N, Cl	O,N, Cl

Sampling P233 (continued)

Samples: O (oxygen), N (nutrients), Cl (chlorophyll), S (salinity), Co (Coccolithophorids), D (diatoms), I (stable isotopes), - no bottle closed

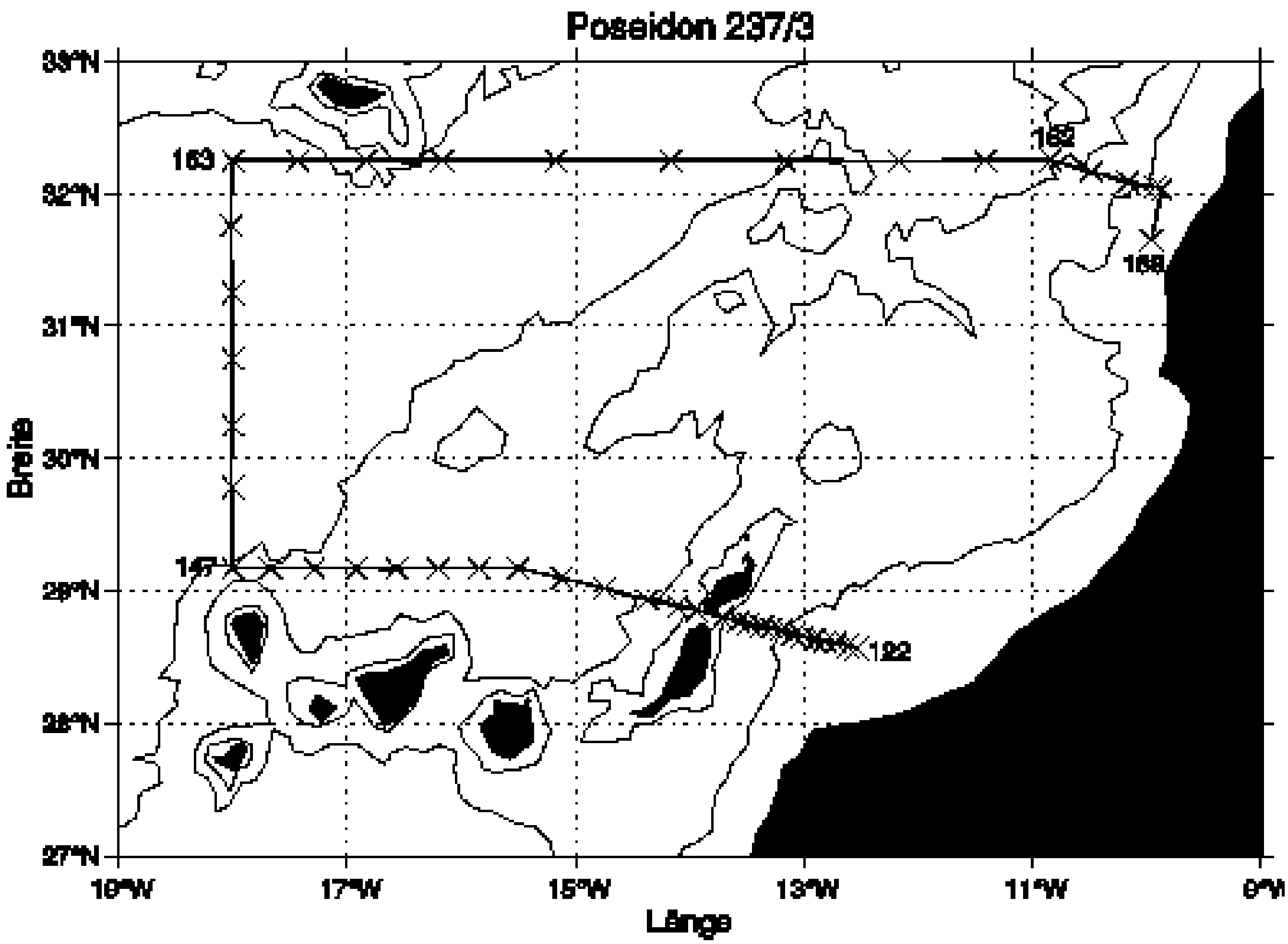
	Station											
Pres (dbar)	**608**	**609**	**610**	**611**	**612**	**613**	**614**	**615**	**616**	**617**	**618**	**619**
Bucket	Co,D	-	-	-	-	-	-	-	-	-	-	-
10	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	N S	O,N, Cl	open	N S	O,N, Cl	N S	O,N, Cl	N S
25	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	N	O,N, Cl	N S	N	O,N, Cl	N	O,N, Cl	N
50	O,N, Cl	O,N, Cl	O,N, Cl	-	N	O,N, Cl	N	N	O,N, Cl	N	O,N, Cl	N
75	O,N, Cl	O,N, Cl	-	-	-	-	N	N	O,N, Cl	N	O,N, Cl	N
100	-	-	-	-		-	-	-	O,N, Cl	N	O,N, Cl	N
125	-	-	-	-	-	-	-	-	-	N	O,N, Cl	N
150	-	-	-	-	-	-	-	-	-	N	O,N, Cl	N
200	-	-	-	-	-	-	-	-	-	N	O,N, Cl	N S
250	-	-	-	-	-	-	-	-	-	N	O,N	N
300	-	-	-	-	-	-	-	-	-	N	O,N	N
400	-	-	-	-	-	-	-	-	-	N	O,N	N
500	-	-	-	-	-	-	-	-	-	-	-	-
600	-	-	-	-	-	-	-	-	-	N	O,N	N
800	-	-	-	-	-	-	-	-	-	-	O,N	N
900	-	-	-	-	-	-	-	-	-	-	-	-
1000	-	-	-	-	-	-	-	-	-	-	-	N
1100	-	-	-	-	-	-	-	-	-	-	-	N
1150	-	-	-	-	-	-	-	-	-	-	-	-
1200	-	-	-	-	-	-	-	-	-	-	-	-
1300	-	-	-	-	-	-	-	-	-	-	-	-
1500	-	-	-	-	-	-	-	-	-	-	-	-
1800	-	-	-	-	-	-	-	-	-	-	-	-
2000	-	-	-	-	-	-	-	-	-	-	-	-
2500	-	-	-	-	-	-	-	-	-	-	-	-
2800	-	-	-	-	-	-	-	-	-	-	-	-
3000	-	-	-	-	-	-	-	-	-	-	-	-
3500	-	-	-	-	-	-	-	-	-	-	-	-
4000	-	-	-	-	-	-	-	-	-	-	-	-
Bottom	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	N S	O,N, Cl	N S	N S	O,N, Cl	N S	O,N S	N S

Sampling P233 (continued)

Samples: O (oxygen), N (nutrients), Cl (chlorophyll), S (salinity), Co (Coccolithophorids), D (diatoms), I (stable isotopes), - no bottle closed

	Station										
Pres (dbar)	**620**	**621**	**622**	**623**	**624**	**625**	**626**	**627**	**628**	**629**	**630**
Bucket	-	-	-	-	-	-	Co	-	-	-	-
10	O,N, Cl	N S	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	N S	O,N, Cl	O,N, Cl	-
25	O,N, Cl	N	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	N	O,N, Cl	O,N, Cl	O,N, Cl
50	O,N, Cl	N	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	O,N, Cl	N	O,N, Cl	O,N, Cl	O,N, Cl
75	O,N, Cl	N	O,N, Cl	O,N, Cl	-	O,N, Cl	O,N, Cl	N	O,N, Cl	O,N, Cl	O,N, Cl
100	O,N, Cl	N	O,N, Cl	O,N, Cl	-	O,N, Cl	O,N, Cl	N	O,N, Cl	O,N, Cl	-
125	O,N, Cl	N	O,N, Cl	O,N, Cl	-	O,N, Cl	O,N, Cl	N	O,N, Cl	O,N, Cl	-
150	O,N, Cl	N	O,N, Cl	O,N, Cl	-	O,N, Cl	O,N, Cl	N	O,N, Cl	O,N, Cl	-
200	O,N, Cl	N	O,N, Cl	O,N, Cl	-	O,N, Cl	O,N, Cl	N	O,N, Cl	O,N, Cl	-
250	O,N	N	O,N	O,N	-	O,N	O,N S,Co	N	O,N	O,N	-
300	O,N S	N	O,N	O,N	-	O,N	-	N	O,N	O,N	-
400	O,N	N	O,N	-	-	O,N	O,N	N	O,N S	O,N	-
500	-	-	-	-	-	-	-	-	-	-	-
600	O,N	N	O,N	-	-	O,N S	O,N	N	O,N	O,N	-
800	O,N	N	O,N	-	-	-	O,N	N	O,N	O,N	-
900	-	-	-	-	-	-	-	-	-	-	-
1000	O,N	open	O,N	-	-	-	O,N	N	O,N	-	-
1100	O,N	N	-	-	-	-	O,N	open	O,N	-	-
1150	-	-	-	-	-	-	-	-	-	-	-
1200	O,N S	N	-	-	-	-	O,N	N	O,N	-	-
1300	-	-	-	-	-	-	O,N	N S	-	-	-
1500	-	-	-	-	-	-	O,N S	-	-	-	-
1800	-	-	-	-	-	-	-	-	-	-	-
2000	-	-	-	-	-	-	-	-	-	-	-
2500	-	-	-	-	-	-	-	-	-	-	-
2800	-	-	-	-	-	-	-	-	-	-	-
3000	-	-	-	-	-	-	-	-	-	-	-
3500	-	-	-	-	-	-	-	-	-	-	-
4000	-	-	-	-	-	-	-	-	-	-	-
Bottom	-	N S	O,N S	O,N S	O,N S	-	-	-	O,N S	O,N S	O,N S

7.2. Cruise track of P237/3



7.3. Moorings during P237/3

All ESTOC and CANIGO mooring work was done during the preceeding cruise leg.

7. POSEIDON cruise P237/3

7.1. Cruise narrative of P237/3

P237/3, 02.04. - 17.04.1998, Las Palmas - Las Palmas

Thank's to the ship's agent in Las Palmas, Flick Canarias, a spare O-ring for the LADCP that was delivered *last-minute* by the manufacturer and that did not fit, could finally be found in their ship handler's store. Although this unexspected search for the spare caused a delay of a few hours before sailing, it saved the LADCP measurements of the cruise.

On 02 April, 14:00 lt., POSEIDON sailed from Las Palmas. Course was set to north of Gran Canaria where a drifting particle trap that had been launched close to the ESTOC position (see map in Sec. 7.3 and the station list in Sec. 7.4) during the previeous leg, was recovered late evening the same day. Next day in the morning, a test station with CTD/rosette/LADCP was performed east of Lanzarote (Sta. 121) at 1000 m water depth. The 29°N section then began with CTD/rosette/LADCP and sampling (see Sec. 7.5) for oxygen, nutrients and coccolithophores on station 122 on the African shelf. East of Lanzarote, the section runs parallel to an array of 4 moorings with current meters and particle traps that is operated by IFMK, the IEO, the ULPGC, the GeoB, and the ICCM that has installed a nutrient recorder. A fluorometer was attached to the CTD on all stations with water depths less 3000 m, and at the ESTOC and LP stations. In addition, plankton hawls were performed down to 500 m on some stations.

The April ESTOC 1998 station (Sta. 140), close to which a current meter and a particle trap mooring are operated by IFMK and GeoB, was taken with hydrographic parameters (ICCM) on 05 April. The western-most position on the 29°N section was reached on 07 April (Stat. 147). Next was the LP station (Stat. 148), which is close to a CANIGO mooring with particle traps and current meters operated by GeoB. Without major problems we proceeded northwards along 18°W to Station 153 southwest of Madeira where the eastbound section along 32°25'N began.

On 11 April (Sta. 159), we encountered strong northerly winds (galing up to 9 Beaufort) with high swell which forces us to constrain station work to day-light until 14 April (Stat. 163). We completed the section with station 168. The eastern side of the box was closed with vessel-mounted ADCP measurements along approximately the 200 m depth contour until the position of station 122.

Station work finished with a multinet hawl west of Lanzarote that repeated a hawl that had failed at the beginning of the cruise due to closing problems of the net. At this position, also the 12x2 l rosette of the ICCM was tested down to 1100 m.

POSEIDON called port of Las Palmas 17 April, 08:00 lt.

7.4. Station list for P237/3

List of abbreviations:

St : Station no.
Pr : CTD profile no., monotonically increasing during the cruise
Wd : Water Depth
Instr : Type of instrumentation or mooring or equipment
- DTRAP: Drifting particle traps
- MN : Multiple closing plankton net
- NBX : Neil Brown CTD probe no X with 21x10 l bottle rosette

Additional sensors on and samples taken from CTD/rosette:

1 F Fluorometer attached to CTD
2 A lowered ADCP (LADCP) profile taken, ADCP attached to CTD/rosette
3 C selfcontained CTD of ICCM attached to rosette
4 O oxygen
5 N nutrients
6 C chlorophyll
7 S salt
8 C coccolithophores
9 D diatomes
10 I stable isotopes

Date 1998 UTC MMDD	Time UTC hhmm	St	Pr	Latitude North GG MM.MM	Longitude West GGG MM.MM	Wd [m]	Inst	Parameter no 1 2 3 4 5 6 7 8 9 10 / F A C O N C S C D I (0 not sampled, 1 sampled)
0402	1530							Sail from Las Palmas, begin of P237/3
0402	2112	120	-9	28 58.74	015 42.02	3610	DTRAP	Drifting particle trap GeoB recovered
0403	1000	121	-9	28 44.52	013 25.99	1311	NB4	Test Station
0403	1705	122	1	28 33.99	012 31.93	98	NB4	1 0 1 0 1 1 1 1 1 0
0403	1817	123	2	28 35.07	012 36.95	99	NB4	1 0 1 1 1 1 1 0 0 0
0403	2013	124	3	28 36.55	012 43.49	175	NB4	1 0 1 1 1 1 1 0 0 0
0403	2104	125	4	28 37.06	012 48.88	246	NB4	1 0 1 1 1 1 1 1 1 0
0403	2248	126	5	28 37.91	012 54.36	357	NB4	1 0 0 1 1 1 1 0 0 0
0404	0108	127	6	28 39.51	013 00.46	588	NB4	1 1 0 1 1 1 1 1 0 0
0404	0315	128	7	28 40.02	013 05.82	784	NB4	1 1 0 1 1 1 1 0 0 0
0404	0533	129	8	28 42.14	013 11.97	1053	NB4	1 1 0 1 1 1 1 1 1 1
0404	0657	129	-9	28 42.1	013 11.6	1050	MN	500 m
0404	0841	130	9	28 43.16	013 17.02	999	NB4	1 1 0 1 1 1 1 1 1 1
0404	0955	130	-9	28 43.0	013 16.8	1010	MN	500 m
0404	1135	131	10	28 43.97	013 21.94	1233	NB4	1 1 0 1 1 1 1 1 0 0
0404	1455	132	11	28 45.05	013 29.10	1279	NB4	1 1 0 1 1 1 1 0 0 0
0404	1705	133	12	28 46.06	013 34.00	1185	NB4	1 1 0 1 1 1 1 1 1 0
0404	1930	134	13	28 48.05	013 42.98	846	NB4	1 1 0 1 1 1 1 0 0 0
0404	2213	135	-9	28 51.0	013 56.0	978	MN	500 m
0404	2328	135	14	28 51.28	013 56.49	1115	NB4	1 1 0 1 1 1 1 1 1 1

Station list P237/3 (continued)

Parameter no: 0 not sampled, 1 sampled

Date 1998 UTC MMDD	Time UTC hhmm	St	Pr	Latitude North GG MM.MM	Longitude West GGG MM.MM	Wd [m]	Inst	1 F	2 A	3 C	4 O	5 N	6 C	7 S	8 C	9 D	10 I
0405	0217	136	15	28 52.99	014 06.12	2082	NB4	1	1	0	1	1	1	1	1	0	0
0405	0600	137	16	28 56.01	014 22.00	2966	NB4	0	1	0	1	1	1	1	1	0	0
0405	1040	138	17	29 01.29	014 44.60	3513	NB4	0	1	0	1	1	1	1	1	1	0
0405	1705	139	18	29 05.63	015 07.01	3577	NB4	0	1	0	1	1	1	1	1	0	0
0405	2215	140	19	29 09.98	015 30.10	3609	NB4	1	0	0	1	1	1	1	1	1	1
0405	0010	140	-9	29 09.54	015 29.42	3608	MN	500 m									
0406	0155	140	20	29 10.00	015 30.57	3609	NB4	0	1	0	1	1	0	1	0	0	0
0406	0650	141	21	29 10.05	015 50.08	3623	NB4	0	1	0	1	1	1	1	0	0	0
0406	1150	142	22	29 10.00	016 12.04	3653	NB4	0	1	0	1	1	1	1	1	0	0
0406	1913	143	23	29 10.03	016 33.93	3701	NB4	0	0	0	1	1	1	1	1	1	1
0406	2018	143	-9	29 09.8	016 33.1	3702	MN	500 m									
0406	2155	143	24	29 09.54	016 33.07	3702	NB4	0	1	0	1	1	0	1	0	0	0
0407	0314	144	25	29 10.00	016 55.00	3833	NB4	0	1	0	1	1	1	1	0	0	0
0407	0820	145	26	29 10.17	017 17.12	3913	NB4	0	0	0	1	1	1	1	1	0	0
0407	1320	146	27	29 09.99	017 39.98	3739	NB4	0	1	0	1	1	1	1	1	0	0
0407	1718	147	28	29 10.00	018 00.00	3690	NB4	0	1	0	1	1	1	1	0	0	0
0408	0108	148	29	29 47.02	018 00.03	4368	NB4	0	1	0	1	1	1	1	1	1	1
0408	1213	148	-9	29 47.11	018 00.0	4367	MN	500 m									
0408	0340	148	30	29 47.28	018 00.71	4368	NB4	0	1	0	1	1	0	1	0	0	0
0408	0925	149	31	30 14.99	018 00.09	4486	NB4	0	1	0	1	1	1	1	0	0	0
0408	1620	150	32	30 44.94	018 00.00	4536	NB4	0	1	0	1	1	1	1	1	0	0
0408	2355	151	33	31 14.98	017 59.93	4573	NB4	0	1	0	1	1	1	1	1	0	0
0409	0136	151	-9	31 14.75	017 59.2	4574	ICCM	Rosette, test 600 m									
0409	0240	151	34	31 15.31	017 59.85	4574	NB4	0	1	0	1	1	0	1	0	0	0
0409	0941	152	-9	31 44.95	018 00.01	4550	no data, CTD down cast failure										
0409	1405	152	35	31 45.56	018 00.58	4551	NB4	0	1	0	1	1	1	1	1	0	0
0409	2045	153	36	32 14.97	017 59.94	4422	NB4	0	1	0	1	1	1	1	1	0	0
0410	0327	154	37	32 14.96	017 25.51	4219	NB4	0	1	0	1	1	1	1	1	0	0
0410	0956	155	38	32 15.05	016 49.95	3561	NB4	0	1	0	1	1	1	1	1	0	0
0410	1615	156	39	32 15.05	016 10.05	4297	NB4	0	1	0	1	1	1	1	1	0	0
0411	0110	157	40	32 15.08	015 10.22	4358	NB4	0	1	0	1	1	0	1	0	0	0
0411	0552	157	41	32 15.06	015 09.89	4355	NB4	0	0	0	1	1	1	1	1	0	0
0411	1148	158	42	32 15.02	014 10.07	4330	NB4	0	1	0	1	1	1	1	1	0	0
0411	2025	159	43	32 15.03	013 09.91	3995	NB4	0	1	0	1	1	1	1	1	0	0
0412	1420	160	44	32 14.90	012 10.01	3379	NB4	0	1	0	1	1	1	1	1	0	0
0413	0737	161	45	32 14.95	011 24.91	3255	NB4	0	1	0	1	1	1	1	1	0	0
0413	1500	162	46	32 15.11	010 50.07	3242	NB4	0	1	0	1	1	1	1	1	0	0
0414	0554	163	47	32 09.96	010 29.03	2740	NB4	1	1	0	1	1	1	1	1	0	0
0414	1007	164	48	32 05.12	010 09.90	1458	NB4	1	1	0	1	1	1	1	1	0	0
0414	1318	165	49	32 02.94	009 55.29	831	NB4	1	1	0	1	1	1	1	1	1	0
0414	1421	165	-9	32 02.71	009 55.0	640	MN	500 m									
0414	1547	166	50	32 02.01	009 52.09	114	NB4	1	0	0	1	1	1	1	1	0	0
0414	1817	168	51	31 59.19	009 57.73	94	NB4	1	0	0	1	1	1	1	1	0	0
0416	0500	170	-9	28 53.6	014 08.2	2161	MN	500 m									

0416	0612	170	-9	28	54.0	014	08.9	2189	ICCM	Rosette, test 1100 m
0417	0800									Call port of Las Palmas, end of P237/3

7.5. Sampling during P237/3

Sampling levels for each station P237/3

Samples: O (oxygen), N (nutrients), Cl (chlorophyll), S (salinity), Co (Coccolithophorids), D (diatoms), I (stable isotopes), - no bottle closed at that level, * bottle failed closing

	Station / Profile									
Pres. (dbar)	**121 Test**	**122 1**	**123 2**	**124 3**	**125 4**	**126 5**	**127 6**	**128 7**	**129 8**	**130 9**
Bucket		Co D			Co D		Co		Co D I	Co D I
10	S	O N Cl S Co D	N Cl S	O N Cl S	O N Cl S	O N Cl S	O N Cl S	O N Cl S	O N Cl S	O N Cl S
25		O N Cl Co D	N Cl S	O N Cl	O N Cl S	O N Cl	O N Cl Co	O N Cl	O N Cl Co D I	O N Cl Co D I
50		O N Cl Co D	N Cl S	O N Cl	O N Cl S	O N Cl	O N Cl Co	O N Cl	O N Cl Co D I	O N Cl Co D I
75				O N Cl	O N Cl Co D	O N Cl	O N Cl Co	O N Cl	O N Cl Co D	O N Cl Co D
100				O N Cl	O N Cl Co D	O N Cl	O N Cl Co	O N Cl	O N Cl Co D	O N Cl Co D
125				O N Cl	O N Cl Co D	O N Cl	O N Cl Co	O N Cl	O N Cl Co D	O N Cl Co D
150					O N Cl Co D	O N Cl	O N Cl Co	O N Cl	O N Cl Co D I	O N Cl Co D I
200					O N Cl S	O N Cl	O N Cl Co	O N Cl	O N Co D	O N Cl Co D
250						O N	O N Co	O N	O N Co D	O N Co D
300										O N Co D I
400							O N	O N	O N Co D I	O N
500										O N
600								O N	O N	O N
800									O N	O N
900										
1000	S								O N	
1100										
1150										
1200										
1300										
1500										
1800										
2000										
2500										
2800										
3000										
3500										
Bottom		O N Cl Co D	N Cl	O N Cl	O N S	O N S	O N S	O N	O N S	O N S
Depth		100	99	175	246	350	592	780	1052	995

Sampling levels for each station P237/3 (continued)

Samples: O (oxygen), N (nutrients), Cl (chlorophyll), S (salinity), Co (Coccolithophorids), D (diatoms), I (stable isotopes), - no bottle closed at that level, * bottle failed closing

	Station / Profile									
Pres. (dbar)	131 10	132 11	133 12	134 13	135 14	136 15	137 16	138 17	139 18	140 19
Bucket	Co		Co D		Co D I	Co	Co	Co D	Co	Co D
10	O N Cl S	O N Cl S	O N Cl S	O N Cl S	O N Cl S	O N Cl S	O N Cl S	O N Cl S	O N Cl S	O N Cl S
25	O N Cl Co	O N Cl	O N Cl Co D	O N Cl	O N Cl Co D I	O N Cl Co	O N Cl Co	O N Cl Co D	O N Cl Co	O N Cl S
50	O N Cl Co	O N Cl	O N Cl Co D	O N Cl	O N Cl Co D I	O N Cl Co	O N Cl Co	O N Cl Co D	O N Cl Co	O N Cl S
75	O N Cl Co	O N Cl	O N Cl Co D	O N Cl	O N Cl Co D	O N Cl Co	O N Cl Co	O N Cl Co D	O N Cl Co	O N Cl S
100	O N Cl Co	O N Cl	O N Cl Co D	O N Cl	O N Cl Co D	O N Cl Co	O N Cl Co	O N Cl Co D	O N Cl Co	O N Cl S
125	O N Cl Co	O N Cl	O N Cl Co D	O N Cl	O N Cl Co D I	O N Cl Co	O N Cl Co	O N Cl Co D	O N Cl Co	O N Cl S
150	O N Cl Co	O N Cl	O N Cl Co D	O N Cl	O N Cl Co D I	O N Cl Co	O N Cl Co	O N Cl Co D	O N Cl Co	O N Cl S
200	O N Cl Co	O N Cl	O N Cl Co D	O N Cl	O N Cl Co D	O N Cl Co	O N Cl Co	O N Cl Co D	O N Cl Co	O N Cl S
250	O N Co	O N	O N Co D	O N	O N Co D	O N Co	O N Co	O N Co D	O N Cl Co	O N S
300	O N Co	O N	O N Co D	O N	O N Co D I	O N Co				O N S
400	O N	O N	O N	O N	O N	O N	O N	O N	O N Co	O N S
500					O N I					O N S I
600	O N	O N	O N	O N	O N	O N	O N	broken	O N Co	O N S
800	O N	O N	O N	O N	O N	O N	O N	O N	O N	O N S
900										O N S
1000	O N	O N	O N		O N	O N	O N	open	O N	O N S
1100	O N	O N	O N			O N				O N S
1150							O N	O N	O N	
1200	O N	O N				O N				O N S
1300						O N	O N	O N	O N	O N S
1500						O N	O N	broken	O N S	O N S
1800							O N			O N S
2000						O N	O N	O N	O N S	
2500							O N	O N S	O N	
2800										
3000								O N	O N S	
3500									O N	
4000										
Bottom	O N S	O N S	O N S	O N S	O N S	O N S	O N S	O N S	O N S	
Depth	1250	1280	1185	848	1180	2080	2968	3520	3575	3610

Sampling levels for each station P237/3 (continued)

Samples: O (oxygen), N (nutrients), Cl (chlorophyll), S (salinity), Co (Coccolithophorids), D (diatoms), I (stable isotopes), - no bottle closed at that level, * bottle failed closing

	Station / Profile									
Pres. (dbar)	**140 20**	**141 21**	**142 22**	**143 23**	**143 24**	**144 25**	**145 26**	**146 27**	**147 28**	**148 29**
Bucket			Co	Co D I				Co		
10	O N S	O N Cl S	O N Cl Co	O N Cl S	O N S	O N Cl S	O N Cl S	O N Cl S	O N Cl S	O N Cl S
25	O N S	O N Cl	O N Cl S	O N Cl Co D I		O N Cl Co	O N Cl Co	O N Cl Co	O N Cl	O N Cl Co D I
50	O N S	O N Cl	N Cl Co	O N Cl Co D I		O N Cl Co	O N Cl Co	O N Cl Co	O N Cl	O N Cl Co D I
75	O N S	O N Cl	O N Cl Co	O N Cl Co D		O N Cl Co	O N Cl Co	O N Cl Co	O N Cl	O N Cl Co D
100	O N S	O N Cl	O N Cl Co	O N Cl Co D		O N Cl Co	O N Cl Co	O N Cl Co	O N Cl	O N Cl Co D
125	O N	O N Cl	O N Cl Co	O N Cl Co D		O N Cl Co	O N Cl Co	O N Cl Co	O N Cl	O N Cl Co D
150		O N Cl	O N Cl Co	O N Cl Co D I		O N Cl Co	open	O N Cl Co	O N Cl	O N Cl Co D I
200		O N Cl	O N Cl Co	O N Cl Co D		O N Cl Co	O N Cl Co	O N Cl Co	O N Cl	O N Cl Co D
250		O N	O N Co	O N Co D		O N Co	O N Co	O N Co	O N	O N Co D
300				O N Co D I						O N S
400		O N	O N	O N		O N	O N	O N	O N	O N S
500				O N I						O N S I
600		O N	O N	O N		O N	O N	O N	O N	
800		O N	O N	O N		O N	O N	O N	O N	
900				O N						
1000		O N	O N	O N		O N	O N	O N	O N	
1100					O N					
1150		O N	O N		O N	O N	O N	O N	O N	
1200					O N					
1300		O N	O N		O N	O N	O N	O N	O N	
1500		O N	O N		O N	O N	O N	O N	O N	
1800	O N	O N	O N		O N	O N	O N	O N	O N	
2000	O N S	O N S	O N S		O N S	O N S	O N S	O N S	O N S	
2500	O N S	O N	O N		O N	O N	O N	O N	O N S	
2800	O N S				O N					
3000	O N S	O N S	O N		O N S	O N S	O N S	O N S	O N	
3500	O N S				O N					
4000										
Bottom	O N S	O N S	O N S		O N S	O N S	O N S	O N S	O N S	
Depth	3610	3623	3660	3703	3702	3832	3914	3780	3691	4370

Sampling levels for each station P237/3 (continued)

Samples: O (oxygen), N (nutrients), Cl (chlorophyll), S (salinity), Co (Coccolithophorids), D (diatoms), I (stable isotopes), - no bottle closed at that level, * bottle failed closing

Station / Profile										
Pres. (dbar)	**148 30**	**149 31**	**150 32**	**151 33/34**	**152 35**	**153 36**	**154 37**	**155 38**	**156 39**	**157 40/41**
Bucket			Co	Co	Co	Co	Co	Co	Co	Co
10	O N S	O N Cl S	O N Cl S	O N Cl S	O N Cl S	O N Cl S	O N Cl S	O N Cl S	O N Cl S	O N Cl S Co
25		O N Cl	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co
50		O N Cl	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co
75		O N Cl	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co
100		O N Cl	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co
125		O N Cl	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co
150		O N Cl	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co
200		O N Cl	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co
250		O N	O N Co	O N Co	O N Co	O N Co	O N Co	O N Co	O N Co	O N Co
300										O N Co
400		O N	O N	O N	O N	O N	O N	O N	O N	O N
500	O N									O N (double)
600	O N	O N	O N	O N	O N	O N	O N	O N	O N	O N also 700
800	O N	O N	O N	O N	O N	O N	O N	O N	O N	O N
900	O N			O N						O N
1000	O N	O N	O N	O N	O N	O N	O N	O N	O N	O N
1100	O N			O N						O N
1150		O N	O N		O N	O N	O N	O N	O N	O N
1200	O N			O N						O N also 1250
1300	O N	O N	O N	O N	O N	O N	O N	O N	O N	O N also 1400
1500	O N	O N	O N	O N	O N	O N	O N	O N	O N	O N also 1600
1800	O N	O N	O N	O N (double)	O N	O N	O N	O N	O N	O N
2000	O N S	O N S	O N S	O N S	O N S	O N S	O N S	O N S	O N S	O N
2500	O N			O N S (double)						O N
2800	O N	O N	O N S	O N	O N	O N S	O N	O N S	O N	O N S
3000	O N S			O N S (double)						
3500	O N	O N S	O N	O N (double)	O N S	O N S	O N S	O N	O N S	O N S
4000	O N S			O N S (double)						
Bottom	O N S	O N S	O N S	O N S (double)	O N S	O N S	O N S	O N S	O N S	O N S
Depth	4368	4490	4334	4600	4549	4420	4210	3560	4300	4360

Sampling levels for each station P237/3 (continued)

Samples: O (oxygen), N (nutrients), Cl (chlorophyll), S (salinity), Co (Coccolithophorids), D (diatoms), I (stable isotopes), - no bottle closed at that level, * bottle failed closing

	Station / Profile									
Pres. (dbar)	**158 42**	**159 43**	**160 44**	**161 45**	**162 46**	**163 47**	**164 48**	**165 49**	**166 50**	**168 51**
Bucket	Co	Co	Co	Co	Co	Co	Co	Co D	Co	Co
10	O N Cl S	O N Cl S	O N Cl S	O N Cl S	O N Cl S	O N Cl S	O N Cl S	O N Cl S	O N Cl	O N Cl Co
25	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co D	O N Cl	O N Cl Co
50	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co D	O N Cl	O N Cl Co
75	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co D	O N Cl	O N Cl Co
100	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl	
125	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co		
150	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl Co	O N Cl S	O N Cl Co	O N Cl Co	O N Cl Co		
200	O N Cl Co	O N Cl Co	O N Cl Co	open	O N Cl S	O N Cl Co	O N Cl Co	O N Cl Co		
250	O N Co	O N Co	O N Co	O N Co	O N Co	O N Co	O N Co	O N Co		
300							O N Co	O N Co		
400	O N	O N	O N		O N	O N	O N	O N		
500				O N				O N		
600	O N	O N			O N	O N	O N	O N		
800	O N	O N	O N	O N S	O N	O N	O N	O N		
900										
1000	O N	O N	O N	O N S	O N	O N	O N			
1100					O N	O N	O N			
1150	O N	O N	O N							
1200				O N	O N	O N	O N			
1300	O N	O N	O N	O N	O N	O N	O N			
1500	O N	O N	O N	O N	O N	O N				
1800	O N	O N	O N	O N	O N	O N				
2000	O N	O N S	O N S	open	O N S	O N S				
2500			O N			O N				
2800	O N S	O N		O N S	O N S					
3000			O N S							
3500	O N S	O N S								
4000										
Bottom	O N S	O N S	O N S	O N S	O N S	O N S	O N S	O N S	O N Cl	O N Cl Co
Depth	4330	3995	3380	3255	3242	2742	1467	830	100	99

8. Scientific report and first results

8.1. Physical oceanography

Based on the ESTOC and CANIGO cruises and as shown in the sections of potential temperature and salinity below (Fig. 8.1.1. to 8.1.8), we found the following major water masses in the area of the eastern Canary Basin. As expected for the upwelling area off Northwest Africa, the surface temperature and salinity decreased towards the African coast. Therefore, the zonal sections to often show a westward decrease in depth of the isothermes and isohalines. The coastal upwelling is mainly observed during the summer and fall cruises, when the northeasterly trade winds reach north of the Canary Islands. In the winter season the trade wind system is located further south.

Below the surface waters, the North Atlantic Central Water (NACW) with its fixed temperature/salinity relationship is observed in the whole area. The NACW covers a density area of 26.6 kg/m^3 < σ_t < 27.3 kg/m^3. Below the NACW a salinity minimum is observed with lowest salinity values of S < 35.25 south-east of the Canary Islands. This salinity minimum is caused by Antartic Intermediate Water (AAIW), which moves northward along the African shelf in a density layer of about 27.3 kg/m^3 < σ_t < 27.6 kg/m^3. Therefore, the salinity minimum becomes weaker further offshore and northward. North of Gran Canaria the salinity minimum often exceeds 35.4, but some stations show intrusions of fresher AAIW water, which probably has passed the sills between the Canary Islands.

Further below in a density area of 27.6 kg/m^3 < σ_t < 27.8 kg/m^3 the warm and saline Mediterranean Water (MW) is observed. The southward movement of the MW is obstructed by the topography of the Canary Islands. The highest salinity values with S > 35.5 are observed north of the islands. Between the Canary Islands and the African shelf the MW occurs at the bottom with salinity values of more than 35.45 . Several meddy (Mediterranean eddy) observations were made at the ESTOC station as well as during the different cruises. Within a meddy the salinity may exceed 36.2. Southeast of Gran Canaria the influence of MW is small, and within the MW density range the salinity values are less than 35.3. Below the MW the North Atlantic Deep Water (NADW) covers the whole region with only small temperature and salinity variations.

Sections of potential temperature and salinity of the different Poseidon cruises along 29°N, 32°N and 18°W are shown in the following figures.

Fig. 8.1.1 P202/1: Potential temperature and salinity section along 29°N

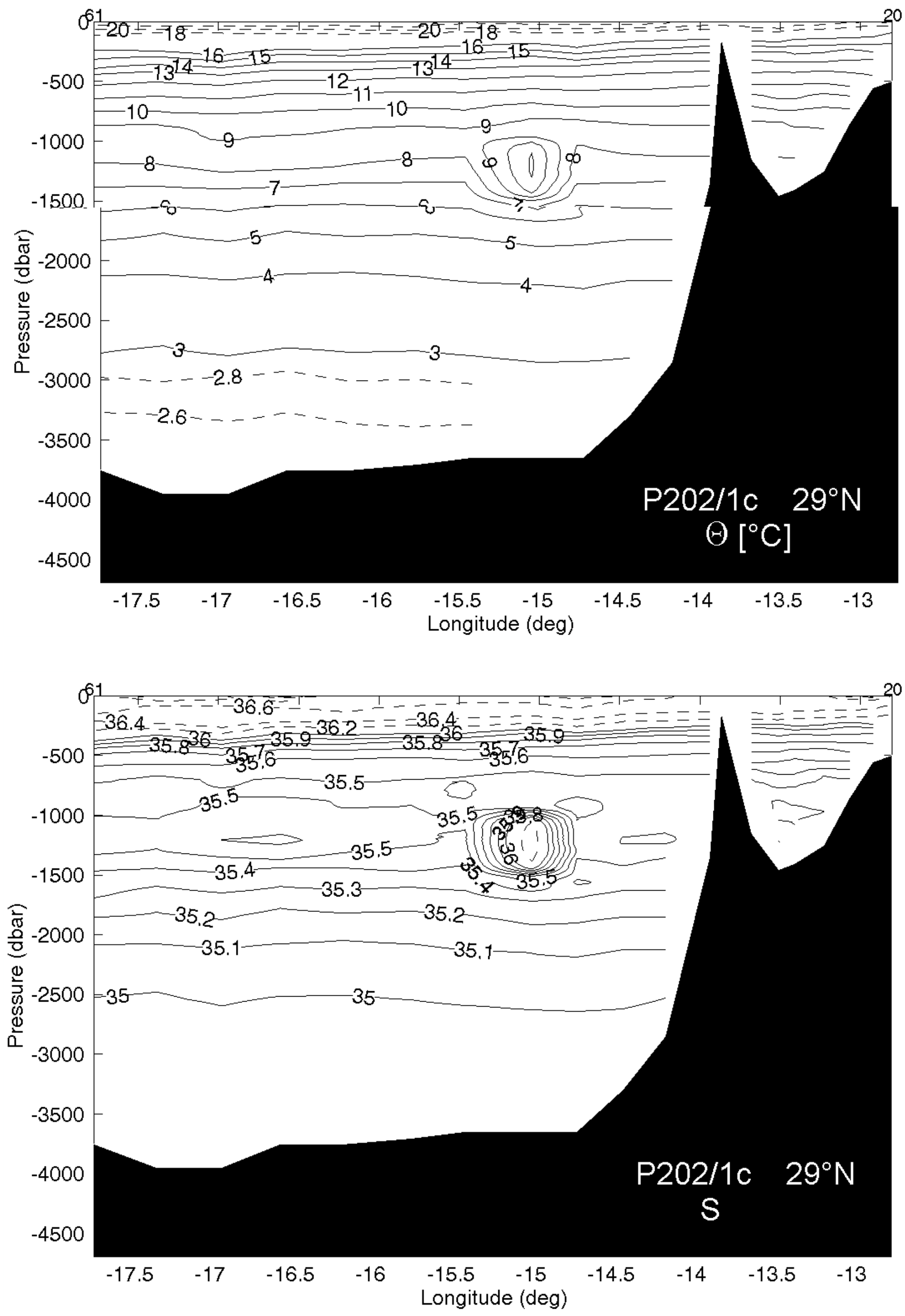
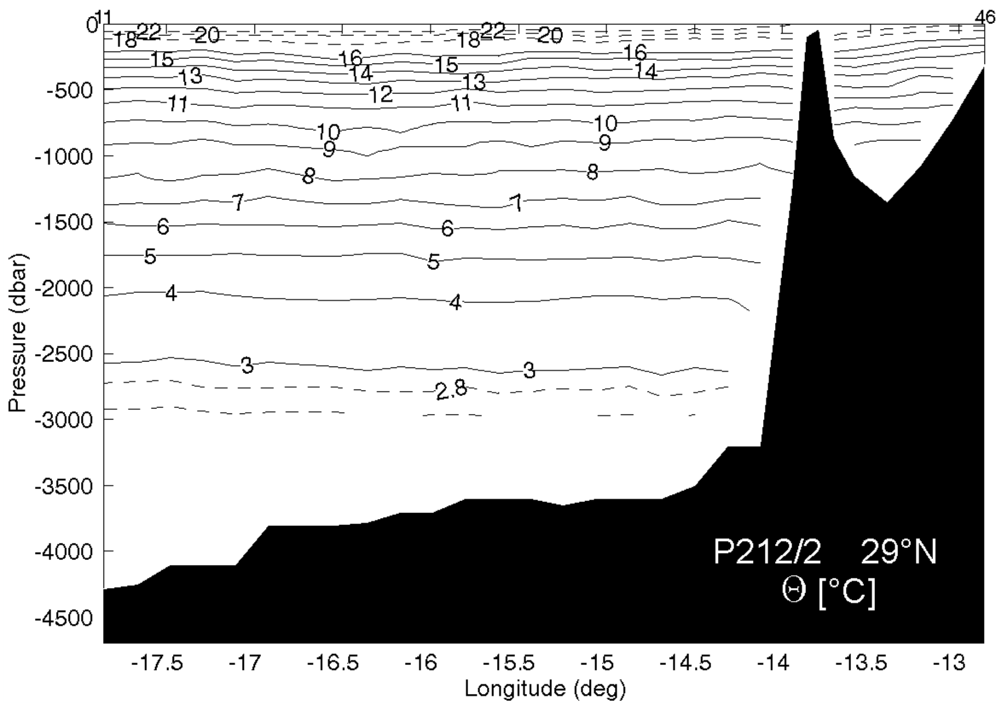


Fig. 8.1.2   P212/2: Potential temperature and salinity section along 29°N



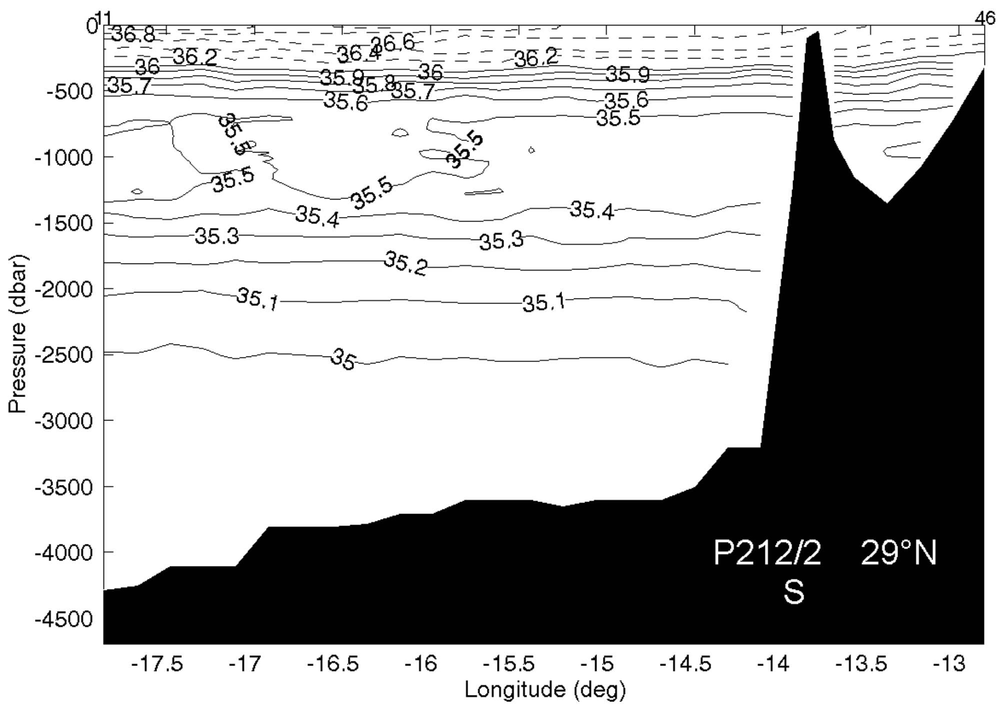


Fig. 8.1.3 P233/a: Potential temperature and salinity section along 29°N

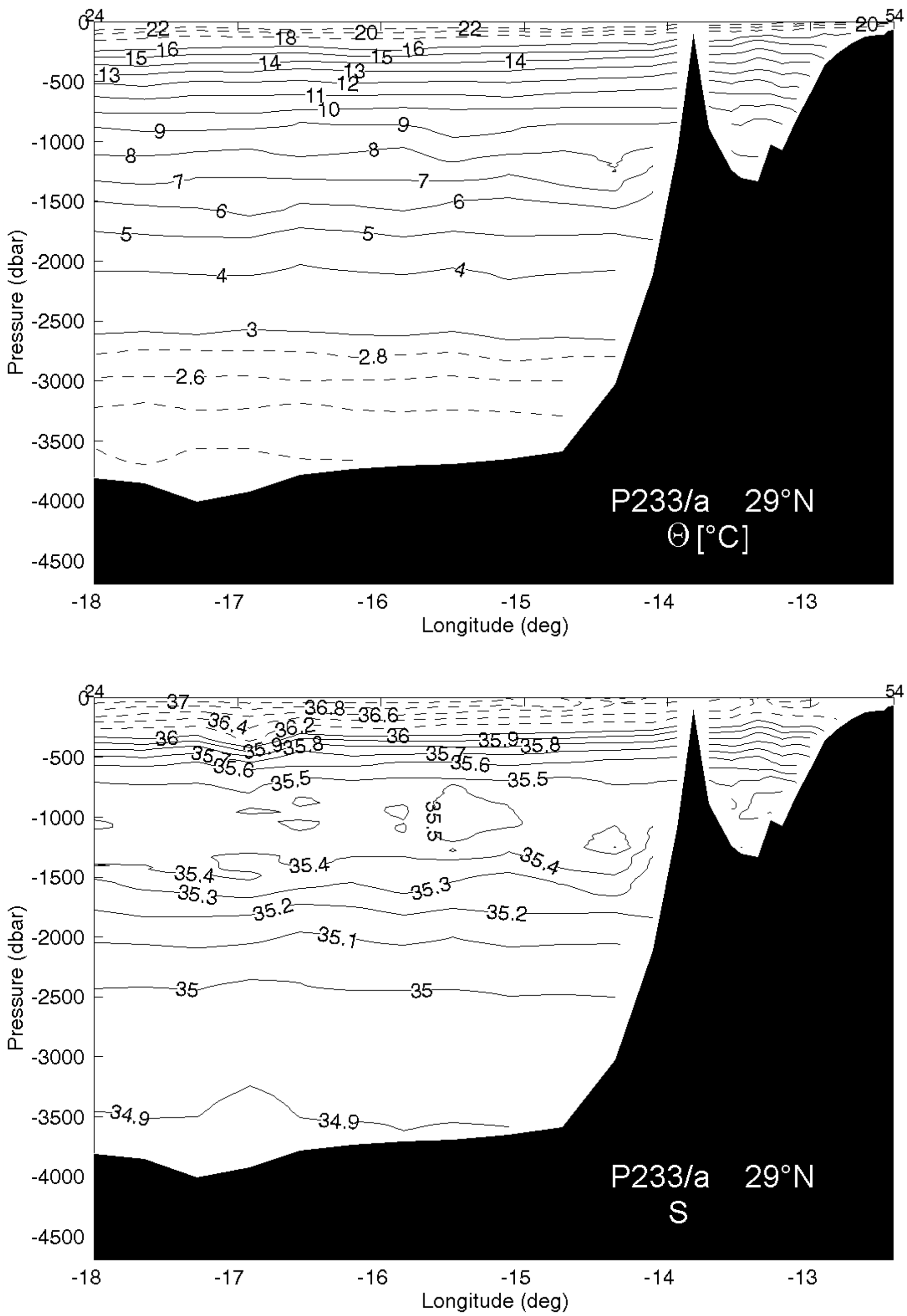


Fig. 8.1.4 P233/a: Potential temperature and salinity section along 32°N

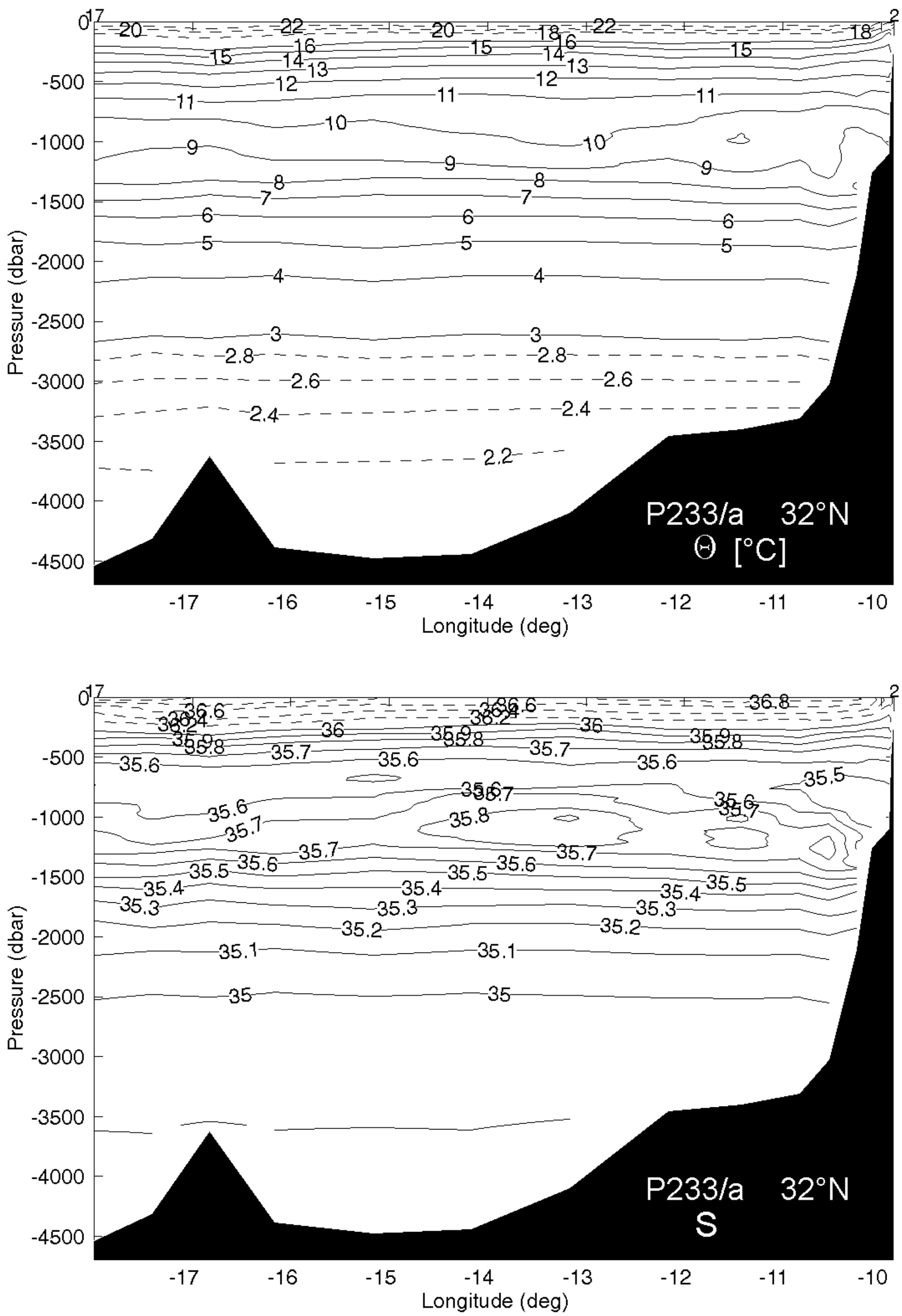
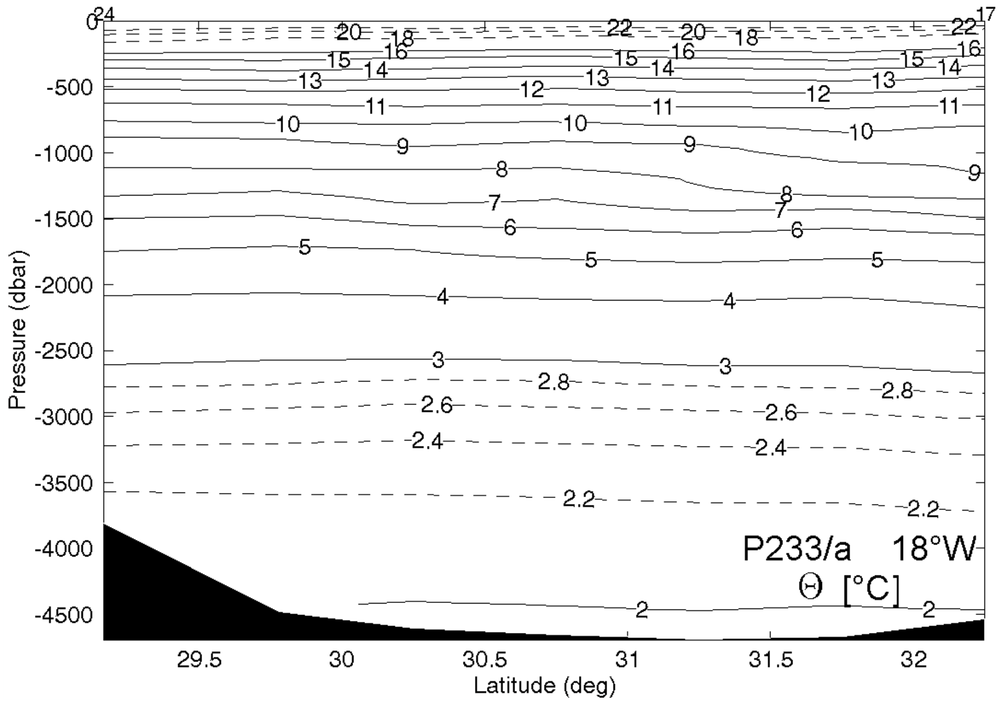


Fig. 8.1.5 P233/a: Potential temperature and salinity section along 18°W



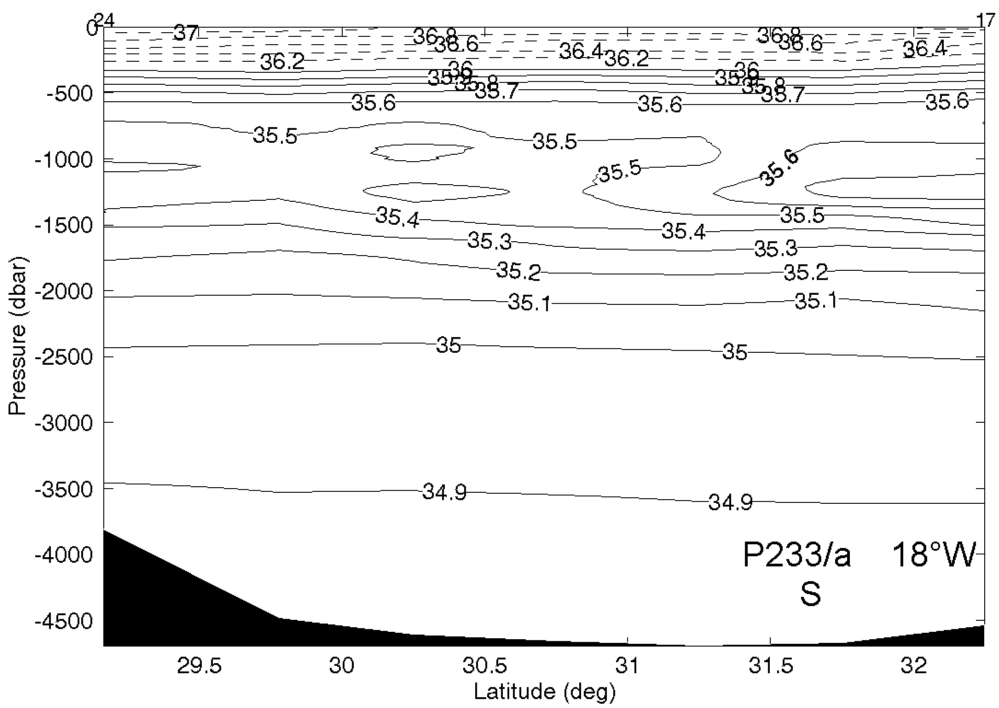
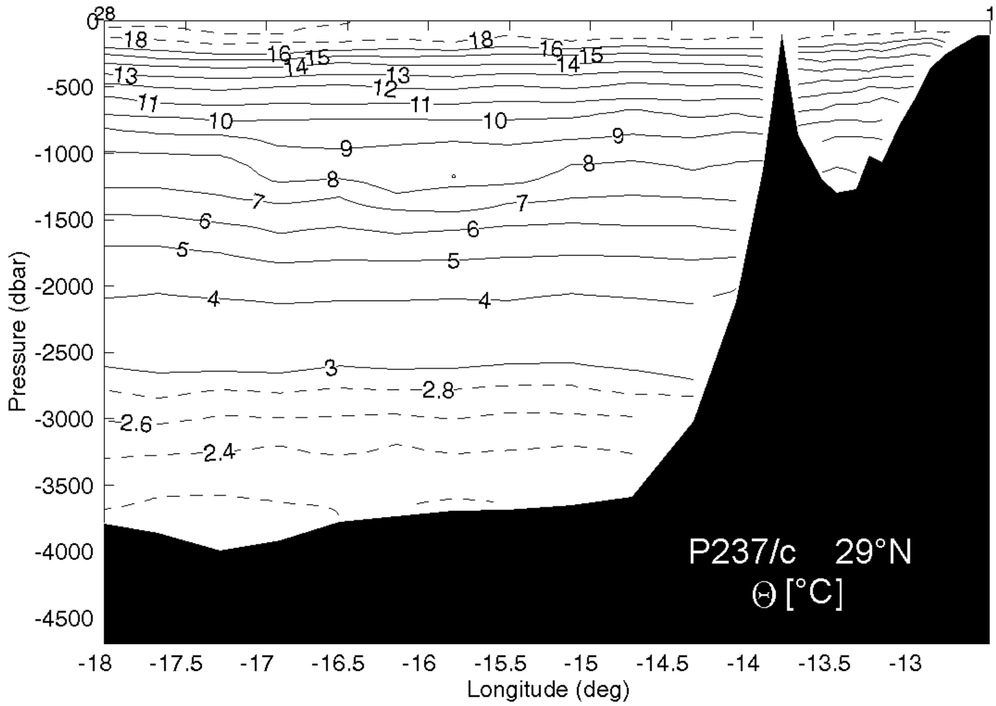


Fig. 8.1.6 P237/3: Potential temperature and salinity section along 29°N



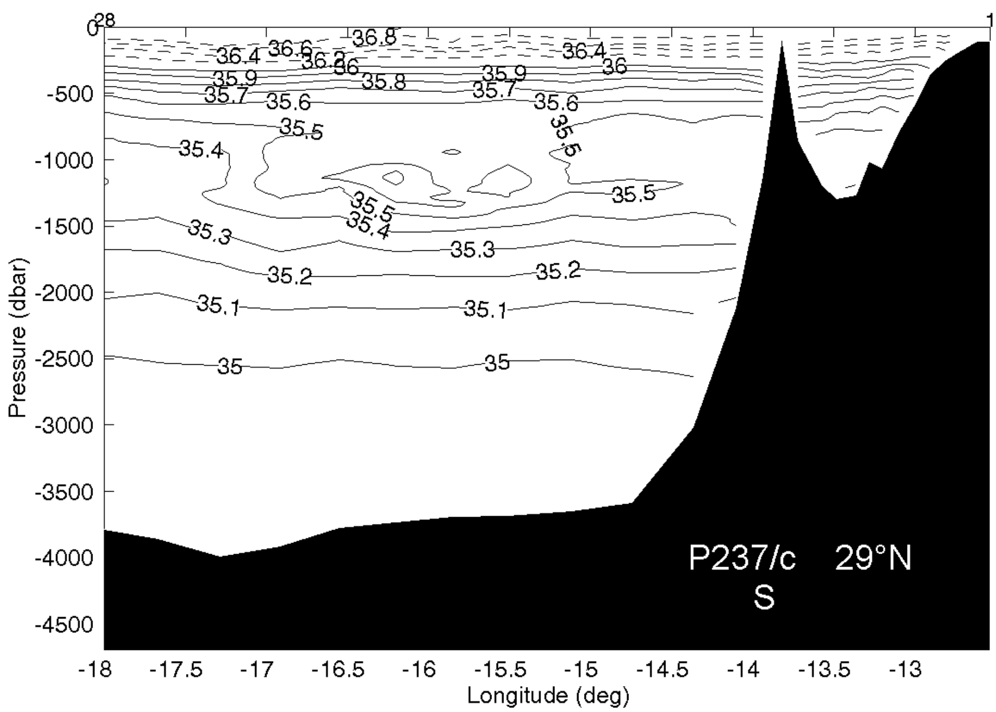


Fig. 8.1.7 P237/3: Potential temperature and salinity section along 32°N

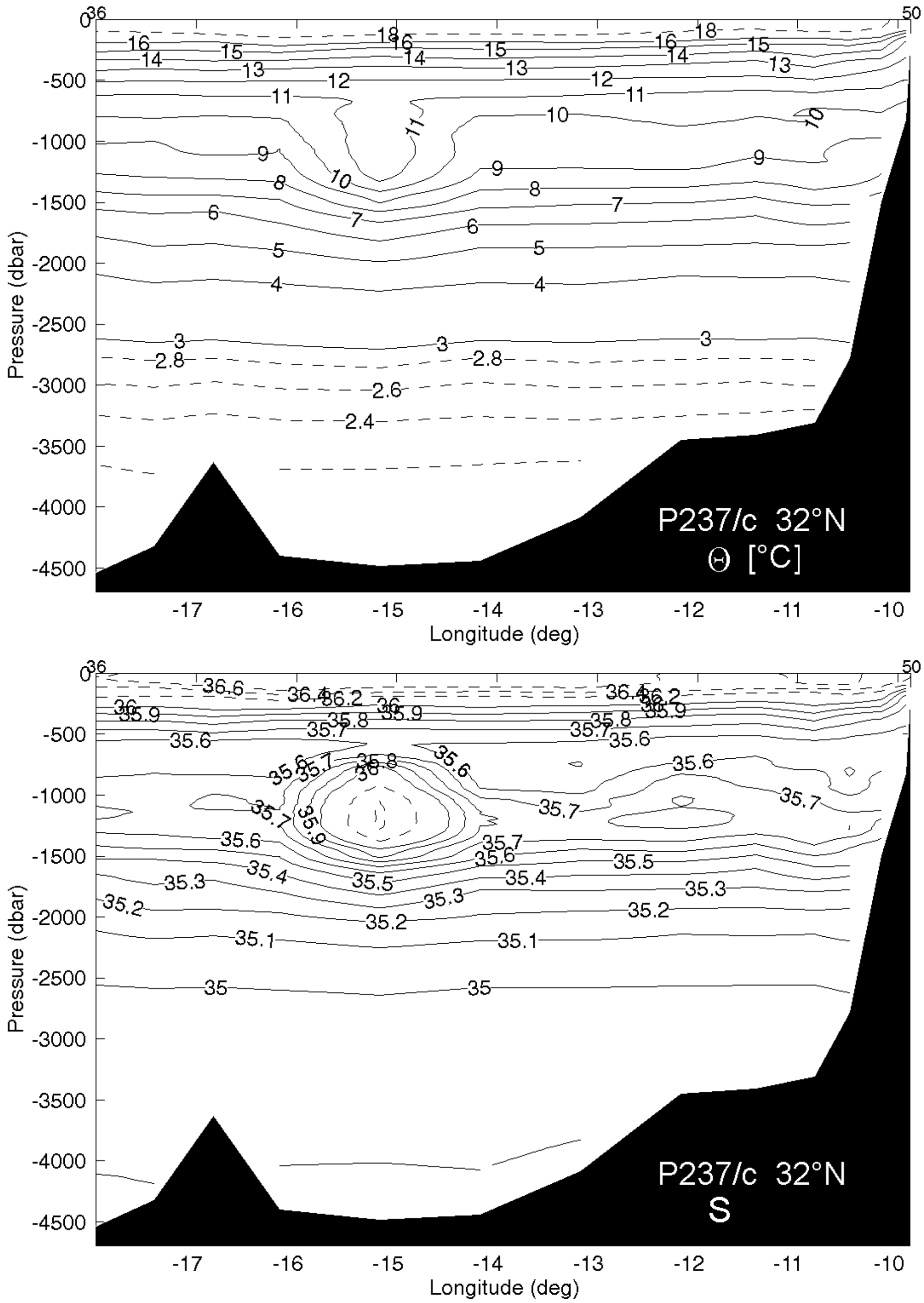
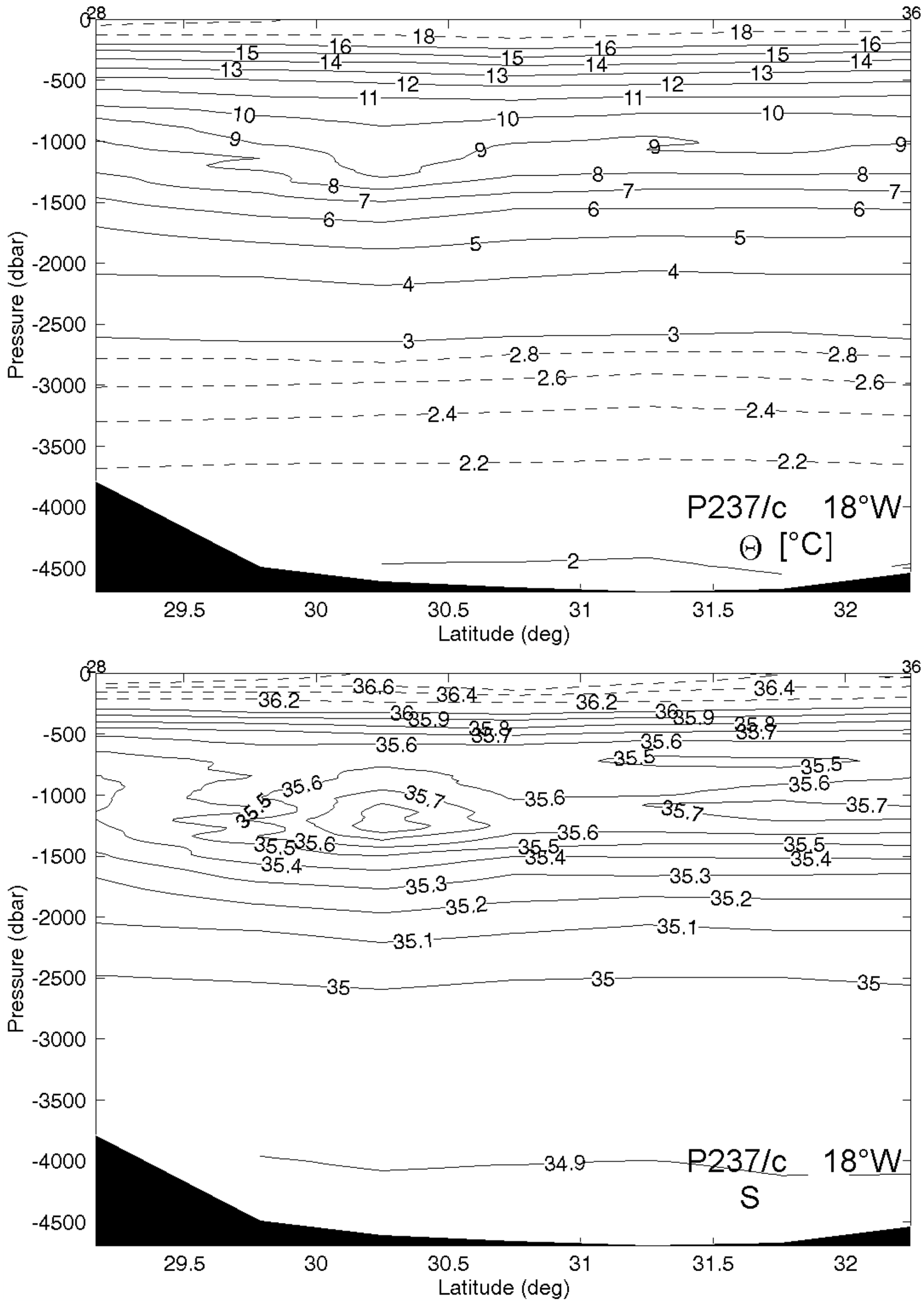


Fig. 8.1.8 P237/3: Potential temperature and salinity section along 18°W



8.2 Chemical oceanography

Oxygen and nutrients

(R. Santana, A. Cianca, M.G. Villagarcia, J. Godoy and M.J. Rueda, ICCM)

Preliminary data of the four cruises show the basic characteristics of the water masses in the area. As an example, we display the oxygen distribution along the ca 29°N section for the four cruises (Fig. 8.2.1-8.2.4). Note that the sections of P233/1 and P237/3 are part of the closed CANIGO box north of the Canary Islands (see Wefer and Müller, 1998).

The oxygen content generally decreases from the upper layers to a minimum which is marked around 600 m to 800 m depth and then increases again to higher values in the deep water. The minimum coincides with a maximum in nutrients (not shown here) indicating its southern origin. The minimum is most pronounced on the eastern part of the section close to the Afican shelf and during P233a (September 1997) when the strongest upwelling was observed. We therefore associate it with rudiments of Antarctic Intermediate Water that is transported northwards with an eastern poleward undercurrent that is intensified by the dynamics of strong upwelling.

Ongoing analysis focuses on seasonal effects (thereby including CANIGO data from M37/2b from January 1997 and M42/1 from July 1998), interannual variability by comparing the three available three sections from late summer/early autumn from P202/1, P212 and P233a, and on the effect of diapycnal mixing between the two intermediate waters of only slightly diffrent densities: the AAIW and the Mediterranean Water (MW).

POSEIDON 202/1
LA PALMA - AFRICAN SHELF SECTION (29ºN)

Oxygen distribution (ml/l)

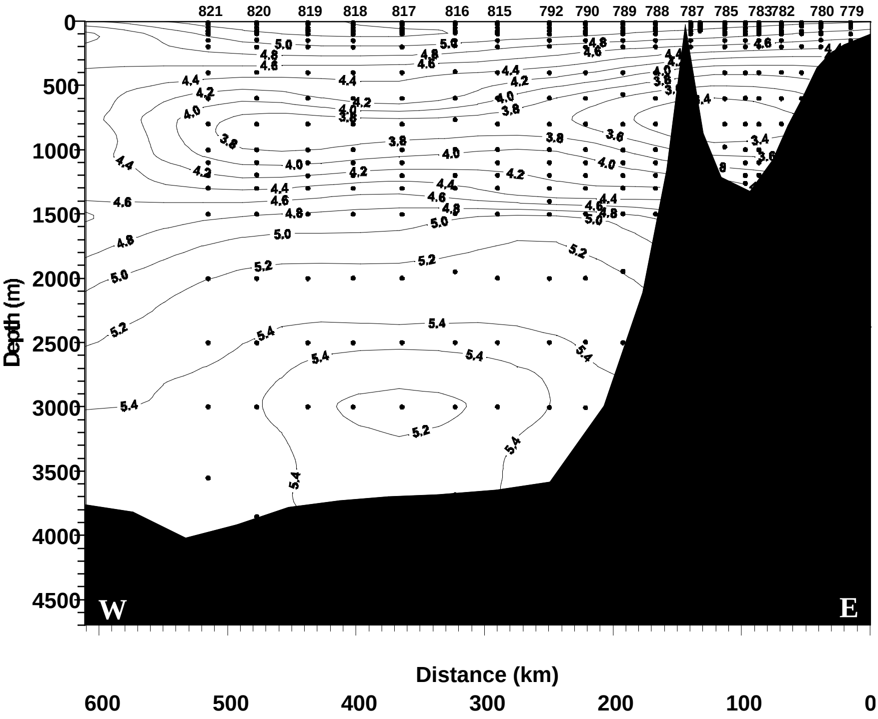


Fig. 8.2.1

POSEIDON 212
RADIAL AT 29º23' N

Oxygen distribution (ml/l)

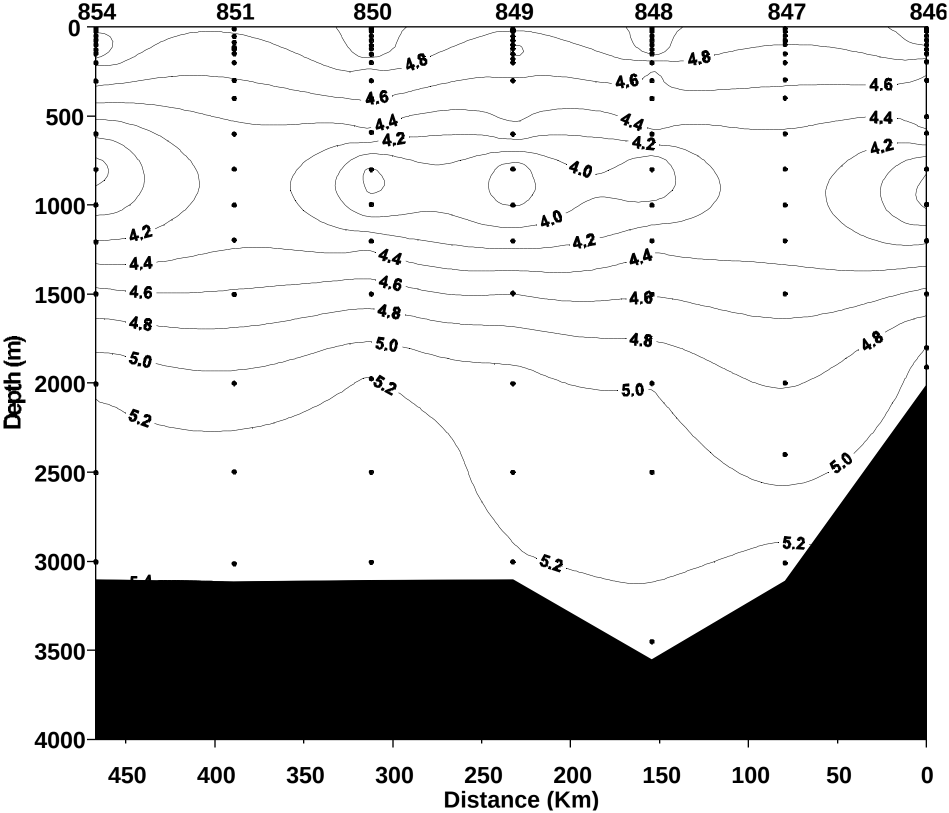


Fig. 8.2.2

POSEIDON 233/A
LA PALMA - AFRICAN SHELF SECTION (29ºN)

Oxygen distribution (ml/l) - Preliminary data

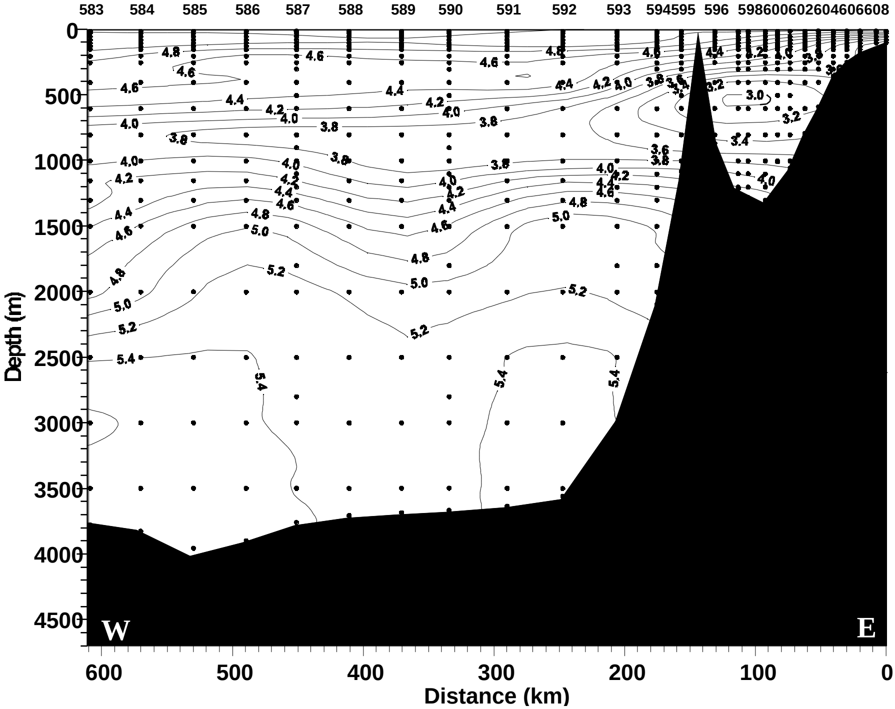


Fig. 8.2.3

POSEIDON 237/3
LA PALMA - AFRICAN SHELF SECTION (29ºN)

Oxygen distribution (ml/l) - Preliminary data

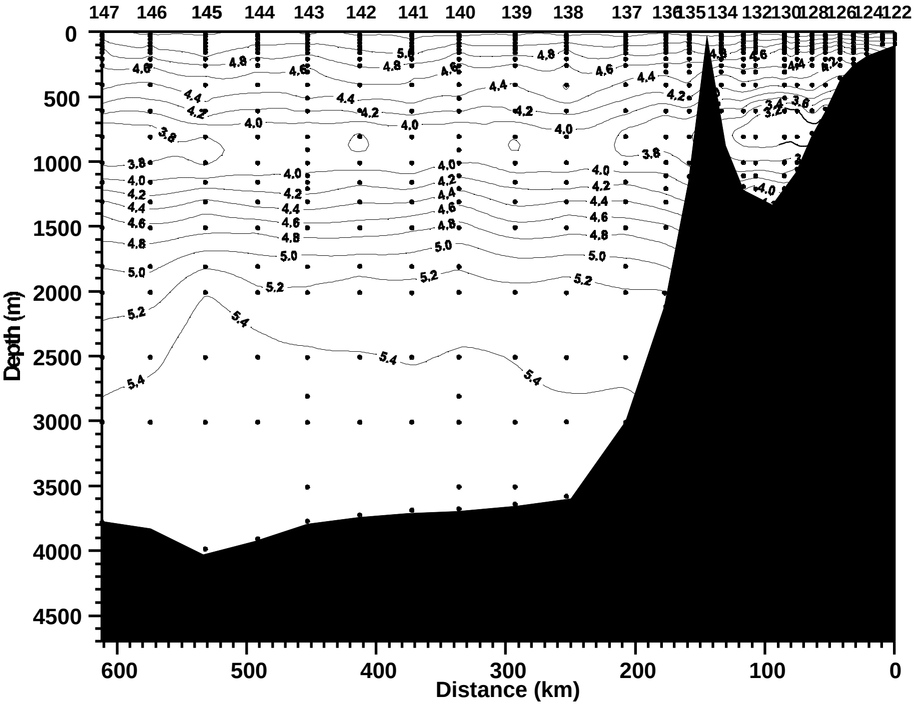


Fig. 8.2.4

8.3 Biological oceanography

Coccolithophores

(J. Bollmann, ETHZ)

Coccolithophores are unicellular gold-brown algae covered with small calcium carbonate plates. The production and burial of these carbonate plates play an important role in the global carbon cycle. Thus a detailed knowledge of their seasonal and interannual production is a pre-requisite for assessing their role in the geosphere-biosphere system. Our general scientific goals are (a) to obtain a better understanding of the seasonal and interannual interaction between coccolithophores and the physical and chemical environment and (b) to compare this interaction with the long-term variability of coccolith composition and flux into the sedimentary archives.

Towards this general goal, cell density and taxonomic composition of living coccolithophore associations were analysed along an East-West temperature and productivity gradient in the North Atlantic eastern boundary current system at three locations near the mooring stations LP1 (29°45.7N, 17° 57.3W), the JGOFS Time-series Station ESTOC (29°10.0N, 15°30.0W) and EBC2 (28°42.5, 13°9.3W) east of Lanzarote (Fig. 8.3.1, for sampling details see section 3.3.2)

The strongest gradient in sea surface temperature and salinity along the zonal transect occurred during late summer (September 1995, POSEIDON cruise P212) and ranged from 24°C and 37.1 in salinity at station LP1 to about 20.2°C and 36.5 in salinity at station EBC2. The weakest gradient occurred during winter (January 1997, METEOR cruise M37/2b) and ranged from 19.5°C and 36.8 in salinity at station LP1 to 19.1°C and 36.7 in salinity at station EBC2.

Total coccolithophore cell densities showed a strong gradient from the open ocean location LP1(~ 40’000 cells/l) to the near-shore location EBC2 (~ 120’000 cells/l) during winter (M37/b) as well as during late summer/fall (P212) (~ 18’000 cells/l to ~ 45’000 cells/l) (Figure 8.3.2). Maximum cell densities usually occurred in the upper photic zone above the deep chlorophyll maximum which was located between 50m and 125m water depth. Four coccolithophore species dominated all assemblages analysed so far.

The most abundant species was *Gephyrocapsa ericsonii* which dominated the upper photic zone during the whole year at the near-shore station EBC2 (Fig. 8.3.3). At the open ocean stations LP1 and ESTOC, *G. ericsonii* was the most abundant species only from 0m to 50m during winter and from 50m to 100m during late summer. *Umbellosphaera tenuis* dominated only during late summer from the surface to 50 m water depth at LP1 and ESTOC, and it was of minor importance at the station EBC2. *Florisphaera profunda* was the third most abundant species during all analyzed seasons at all stations below the deep chlorophyll maximum. *Emiliania huxleyi* was only found to dominate from 50 m to 100 m during winter time at the open ocean stations LP1 and ESTOC.

The processes which control coccolithophore cell densities and species composition environmental parameters like temperature, salinity and nutrients are currently being identified and analyzed.

Figures

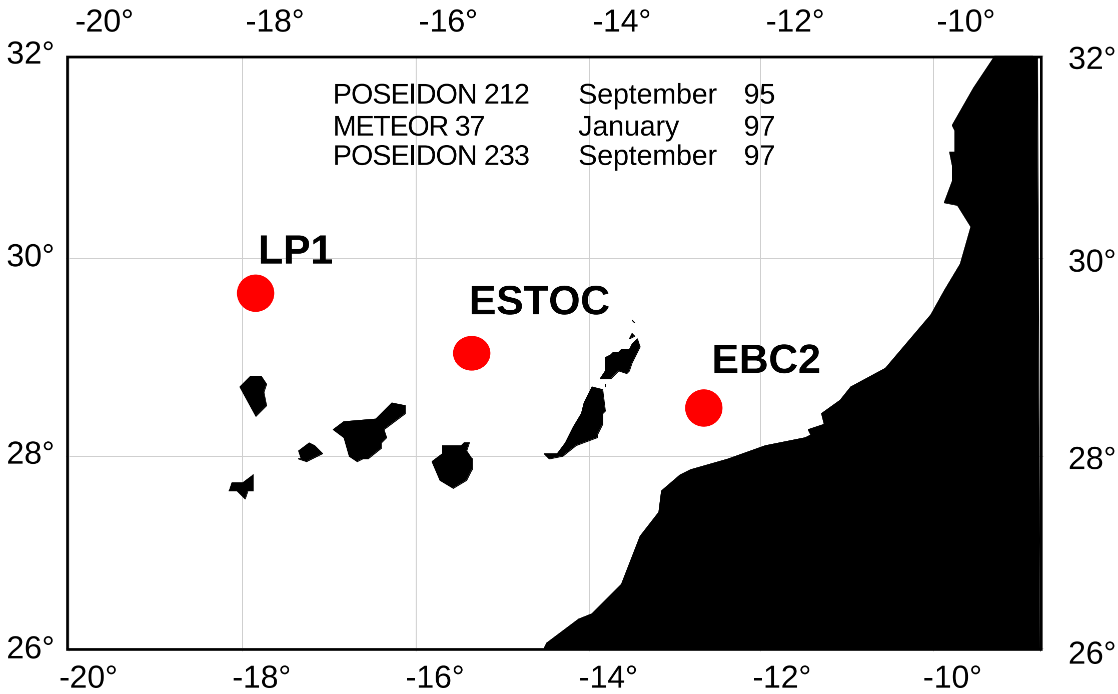


Fig. 8.3.1: Sampling and mooring locations: LP1 (29°45.7N, 17°57.3W), European JGOFS Time-series Station ESTOC (29°10.0N, 15°30.0W) and EBC2 (28°42.5, 13°9.3W).

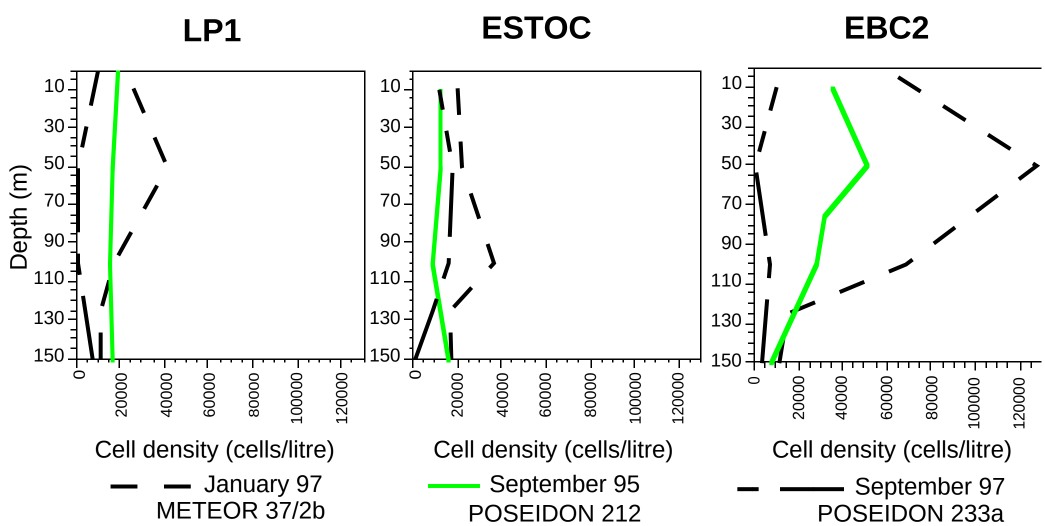


Fig. 8.3.2: Total coccolithophore cell densities during the seasonal cruises.

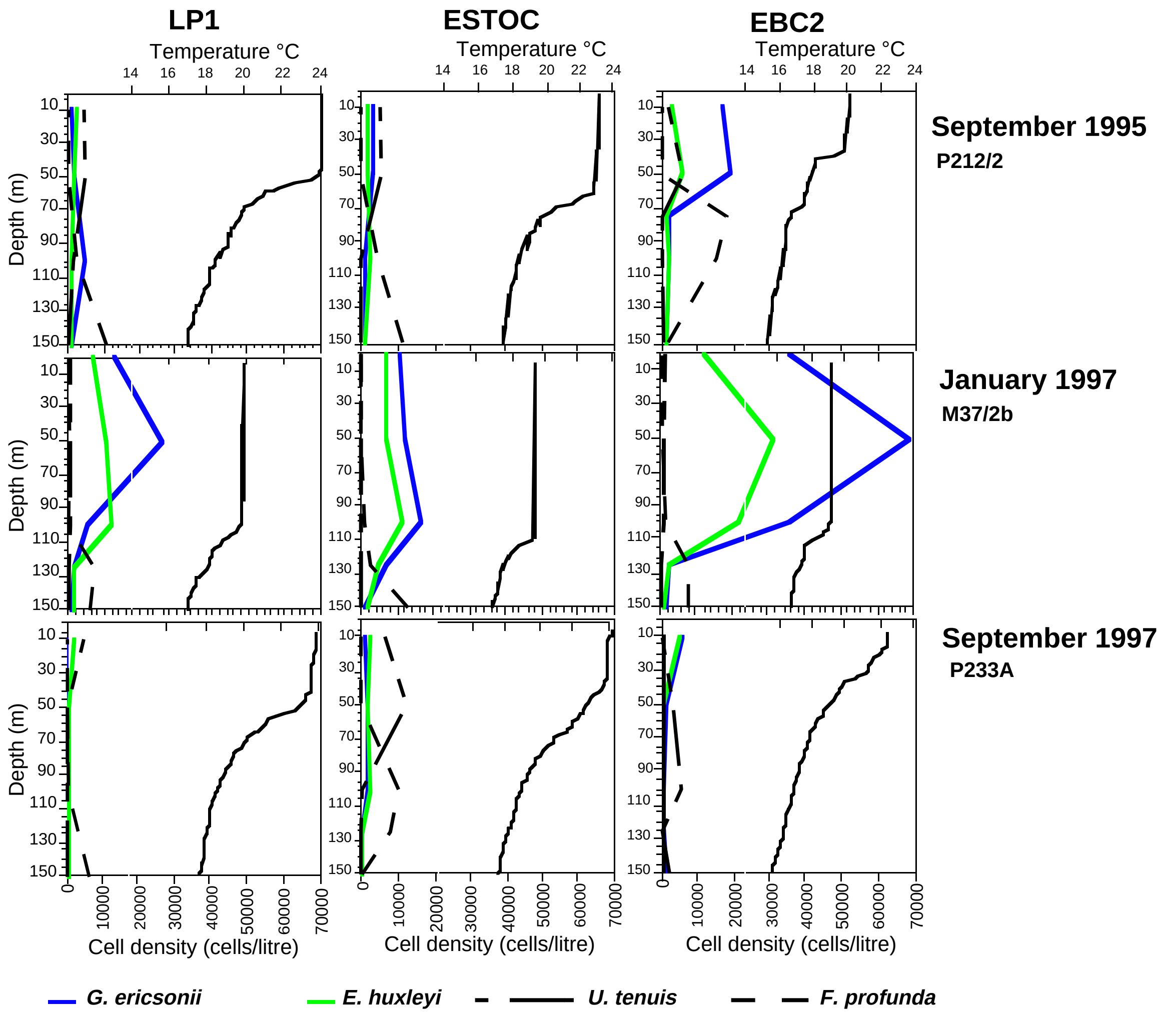
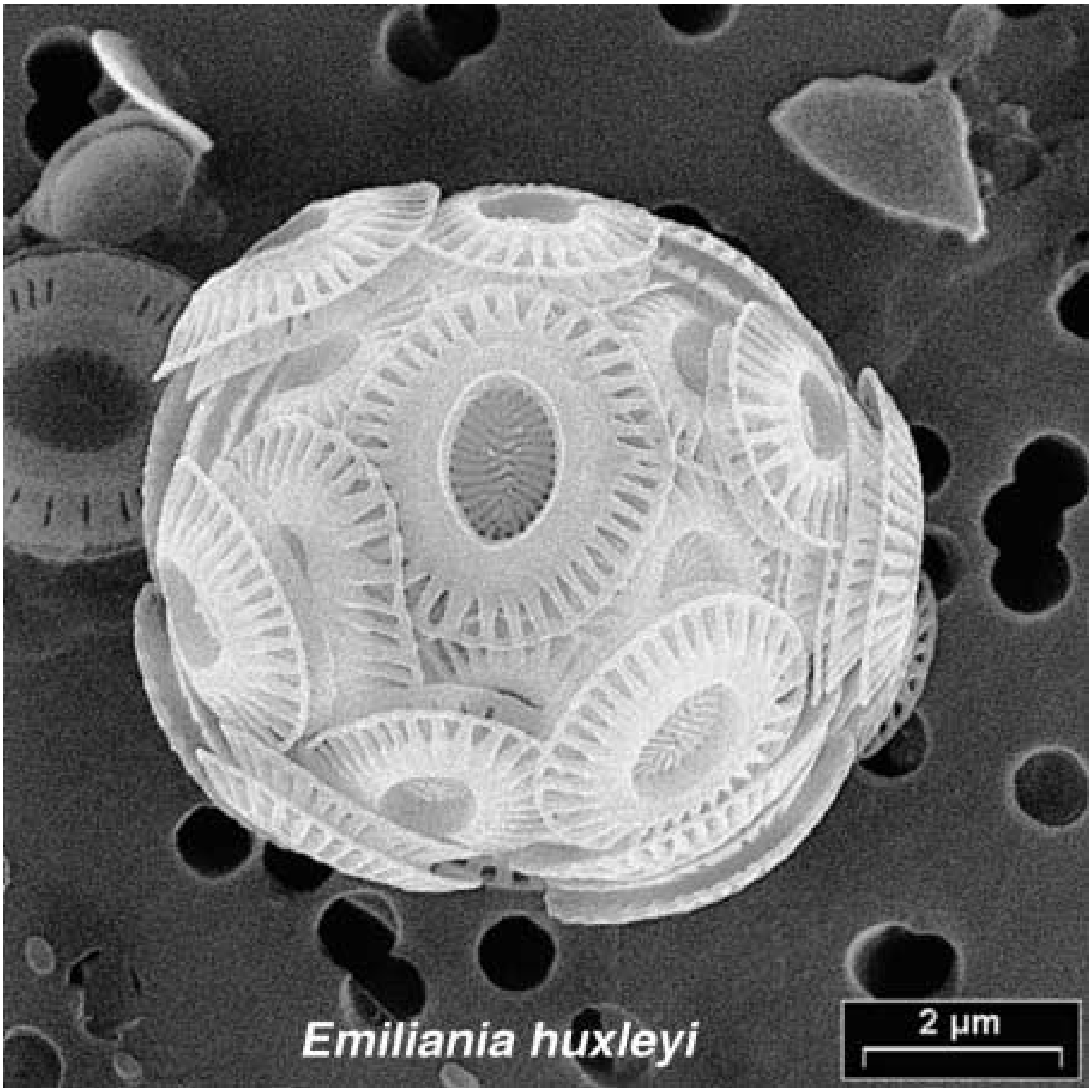
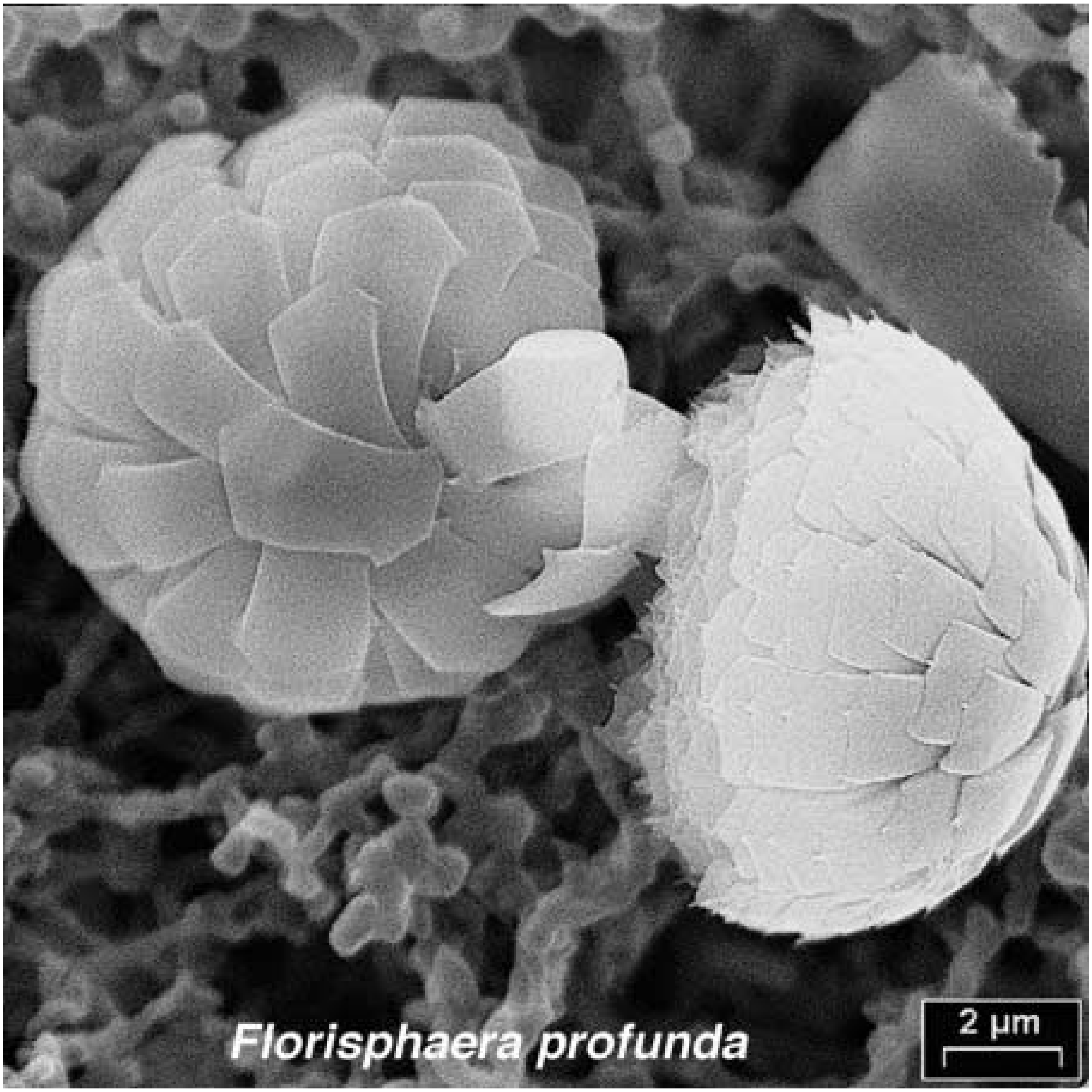


Fig. 8.3.3: Cell densities of the most abundant coccolithophore species in the Canary Island region together with corresponding temperature profiles.


Emiliania huxleyi
2 µm


Florisphaera profunda
2 µm

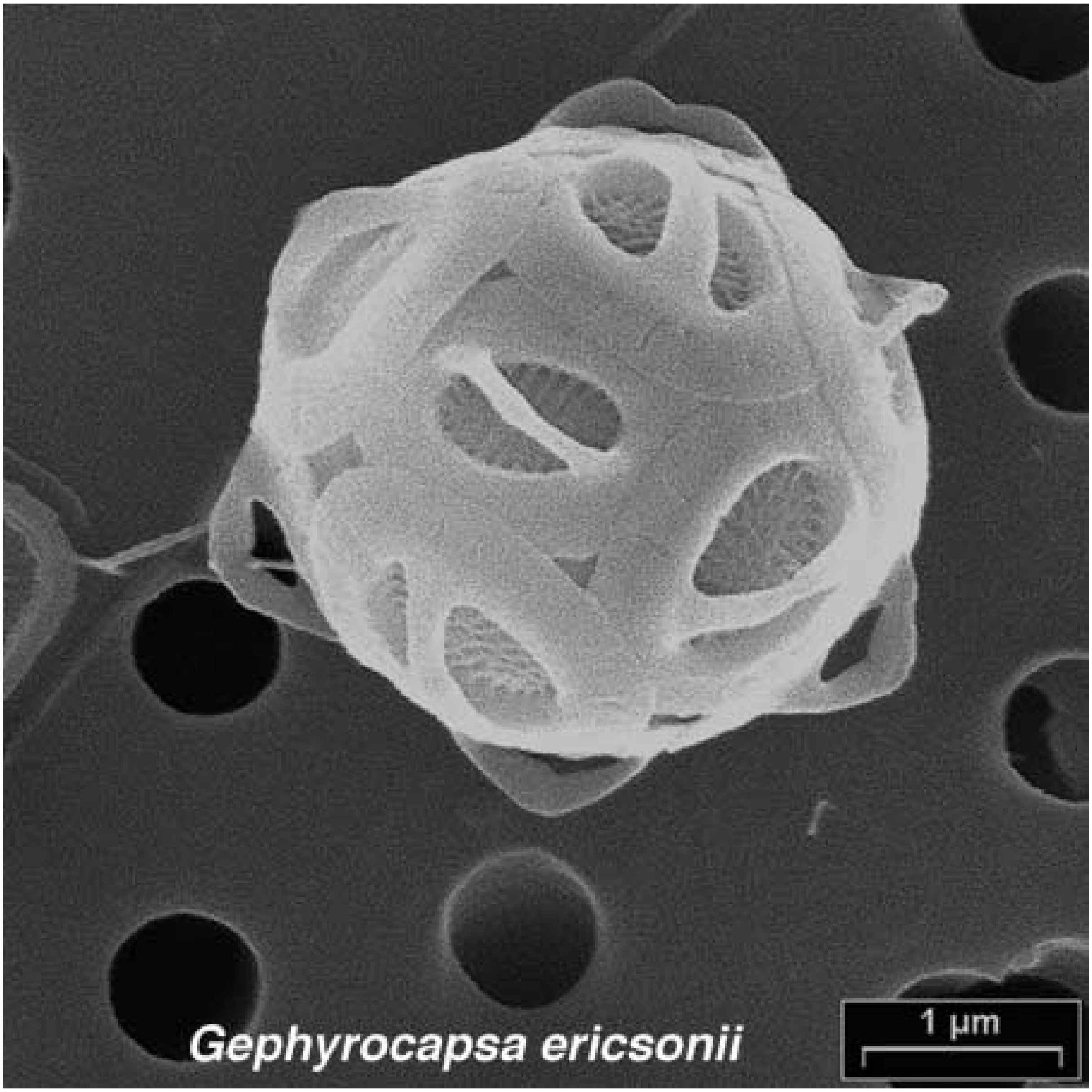


Plate 1: Scanning Electron Microscope pictures of the most abundant coccolithophore species in the Canary Island region.