MARIA S. MERIAN-CRUISE MSM04/4

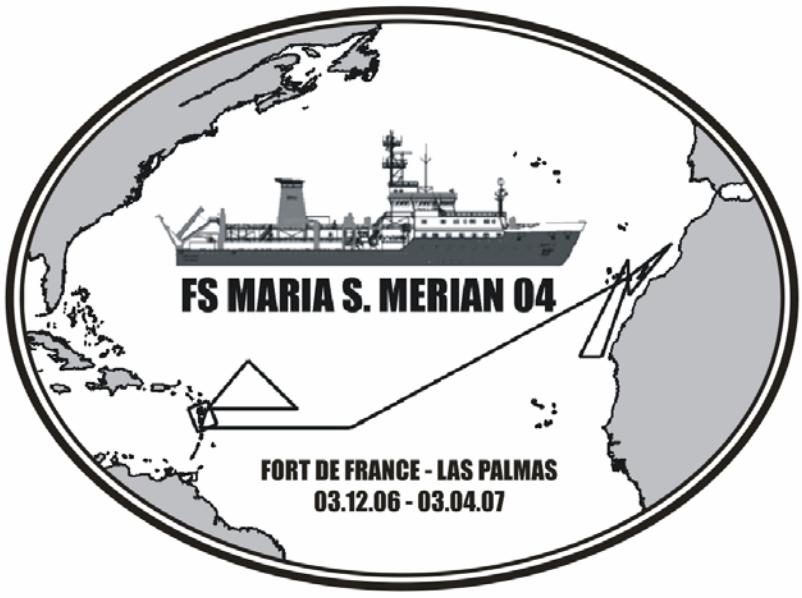
Las Palmas – Las Palmas, 27.02.2007 - 16.03.2007 (MSM04/4a)

Chiefscientist: Dr. Tim Freudenthal

Las Palmas – Las Palmas, 19.03.2007 - 01.04.2007 (MSM04/4b)

Chiefscientist: Dr. Gerhard Fischer

Short Cruise Report



Research Program

The eastern boundary current region off NW Africa is one of the four high productive coastal upwelling regions in the world. Upwelling in this region is mainly driven by trade winds blowing parallel to the coastline. This region is also characterised by high terrigenous input from the Sahara by dust. Understanding the processes responsible for sedimentation and sediment transport in relation to the climatic conditions is crucial for the interpretation of sedimentary records as paleoclimatic archives. The aims of this cruise were therefore the continuation of long term investigations of modern environmental conditions and particle dynamics and the recovery of high quality sediment cores for paleoclimatic reconstructions at the NW African continental margin. These studies were conducted within the research program of the DFG Research Center Ocean Margins (RCOM) and the EU funded project MERSEA.

Four moorings equipped with sediment traps for collecting sinking particulate matter and a variety of sensors had to be served during leg MSM04/4. One of the moorings is equipped with a surface buoy (DOLAN) and satellite telemetry for online access of the collected data. The investigation of the particle transport dynamics was supported by profiles taken with the particle camera ParCa, in-situ pumps and CTD-water sampler on three transects at 21°N, 26°N, and 31°N. The sea floor drill rig MeBo was used for sediment sampling at the two northern transects. Up to 50 m long cores can be recovered from soft sediments and hard rocks with this drill rig that was developed at the University of Bremen. The MeBo was deployed during leg MSM04/4 off Cape Ghir at 31°N in order to obtain climate archives in this region characterised by extremely high sedimentation rates for the investigation of abrupt changes during the last glacial period and cyclic variations during the Holocene.

Due to a big slide event there is only a thin quaternary sediment cover in the region off Cape Bojador at 26°N. The underlying Neogene sediments were drilled during this cruise with MeBo using rotary drilling technique in order to investigate the climate evolution and related upwelling history of the Miocene and early Pliocene in connection to the tectonic closure/opening of gateways and circulation changes.

The different kinds of technical equipment used during MSM04/4 required a large amount of space and personnel. Leg MSM04/4 was therefore subdivided into two parts. The first part focussed on sediment sampling with the sea floor drill rig MeBo. The mooring stations and the DOLAN buoy were served during the second part. The investigation of particle transport processes in the water column was conducted at both parts.

Narrative of the cruise, MSM04/4a

On February 23, six containers stood ready for embarkation at the Pier. The launch and recovery system for the sea floor rig MeBo (MeBo-LARS) was already installed by two technicians from the Motorenwerke Bremerhaven MWB and the decks crew. MWB has constructed for this deployment an adaptation frame to the decks raster of research vessel MARIA S. MERIAN since the MeBo-LARS was initially constructed for the decks lay-out of research vessel METEOR. The containers were brought on board and the setup of the MeBo-system began. On 25 March the main group of the scientists arrived, the laboratories were equipped and the particle camera ParCa and the rosette sampler were prepared for deployment. A first test of the Launch and the Recovery system for the MeBo revealed a malfunction of the chain drive at tension which required modification the next day. After a successful test of the Launch and the Recovery procedure the MARIA S. MERIAN left the harbour at 2pm on February 27.

We reached the first investigation area at the continental slope off Morocco in the vicinity of Cape Ghir in the afternoon of the next day (Fig. 1). We started with Multibeam and Parasound survey and continued with the investigation of particle dynamics by ParCa and rosette sampler profiles in the night. In the morning of March 1 a test deployment of MeBo was started in 370 m water depth. After recovery of the drill rig in the afternoon and inspection of the recovered core the MeBo was deployed at the same station in the evening again. Sediments were sampled by push core technique down to a depth of 41.55 m below sea floor until the drill rig was recovered after 53 hrs of operation time. The time required for unloading the core barrels out of the MeBo magazines and for preparation of the next deployment was used for mapping with Multibeam and Parasound echosoundings and for further profiles with ParCa and rosette sampler. The next MeBo deployment started in the afternoon of March 4 in 900 m water depth. This deployment had to be stopped when a drill depth of 26.5 m was reached due to a failure of the MeBo hydraulics. Finally the drill rig was recovered in the evening of the next day and the hydraulics were repaired within the next day. Since the weather deteriorated mapping and investigation of particle dynamics were finished in the morning of March 7 and we steamed in south direction for the second investigation area off Cape Bojador (Fig. 1).

After arrival in the second investigation area in the evening of March 8 Multibeam and Parasound survey in combination with particle dynamics investigation was conducted until

wind calmed down and the next MeBo deployment in the afternoon of March 10 was possible. This deployment was conducted in 920 m water depth and Pliocene sands were sampled down to a depth of 38.65 m below sea floor by rotary drilling within a deployment time of 41 hrs. The next MeBo deployment in the evening of March 12 had to be stopped after the Launch procedure due to a malfunction of the MeBo winch. After the winch repair MeBo was deployed again on March 13. Miocene marls were sampled down to a depth of 38.4 m below sea floor by rotary drilling within a MeBo deployment time of 42 hrs. Preparation time between the MeBo deployments was again used for Multibeam and Parasound survey as well as for profiles with ParCa and rosette sampler. Scientific work was finished after completion of the Multibeam survey off Cape Bojador.

A valuable data set for the study of particle transport dynamics was collected during leg MSM04/4a. More than 3500 pictures were shot during 27 casts with ParCa and the CTD/water rosette was deployed 24 times. High quality bathymetric maps of the upper Agadir Canyon region off Cape Ghir and of a slide off Cape Bojador were generated while information about the structure of the upper sediments was collected with Parasound. Altogether about 154 m sediments were drilled with MeBo and about 120 m sediment cores were recovered. The MeBo system has proven its functionality and reliability. With this worldwide unique system scientists are now able to recover more than 40 m long sediment cores not only from soft sediments but also from older consolidated marls from a multipurpose research vessel like RV MERIAN which is a major progress for marine geosciences.

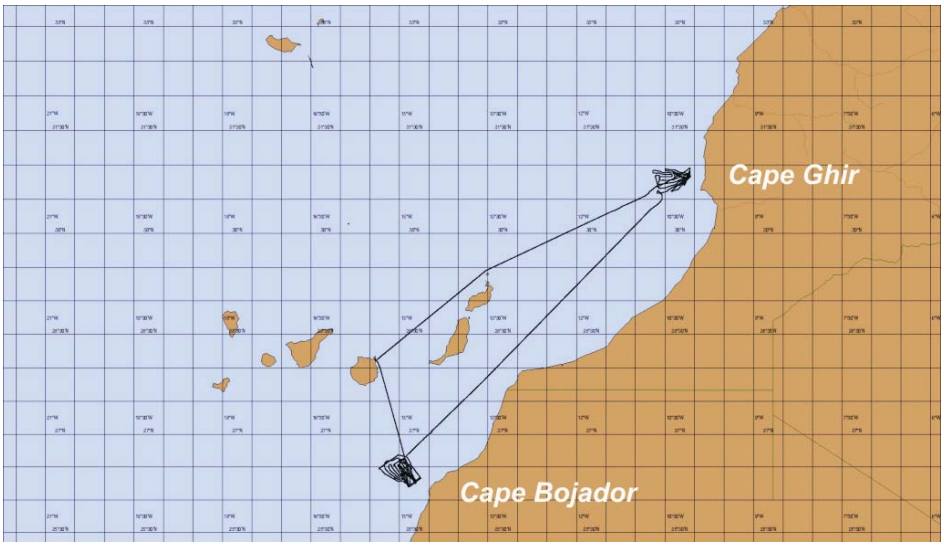


Figure 1. Track of R/V MARIA S. MERIAN Cruise MSM04/4a.

Participants MSM04/4a

Name	Discipline	Institution
Freudenthal, Tim	Chief scientist	GeoB/RCOM
Bergenthal, Markus	MeBo	GeoB/RCOM
Bickert, Torsten	Geology	GeoB/RCOM
Blanchet, Cécile	Geophysics	GeoB/RCOM
Böckel, Babette	Geology	GeoB/RCOM
Buhmann, Sitta	MeBo	GeoB/RCOM
Denecke, Sebastian	MeBo	PB
Düßmann, Ralf	MeBo	GeoB/RCOM
Frederichs, Thomas	Geophysics	GeoB/RCOM
Goldhammer, Tobias	Geochemistry	GeoB/RCOM
Kalweit, Holger	MeBo	GeoB/RCOM
Kerstein, Roland	Documentation	HKB
Klann, Marco	Geology	GeoB/RCOM
Klein, Thorsten	MeBo	GeoB/RCOM
Kniebel, Nicole	Geology	GeoB/RCOM
Kölling, Martin	Geochemistry	GeoB/RCOM
Meyer, Annika	Documentation	HKB
Nowald, Nicolas	Geology	GeoB/RCOM
Renken, Jens	MeBo	GeoB/RCOM
Rehage, Ralf	MeBo	GeoB/RCOM
Reuter, Christian	Geology	GeoB/RCOM
Rosiak, Uwe	MeBo	GeoB/RCOM
Schmidt, Werner	MeBo	GeoB/RCOM
Vogt, Thomas	Geophysics	GeoB/RCOM

GeoB/RCOM	Department of Geosciences / Research Center Ocean Margins, University of Bremen
HKB	Hochschule für Künste, Bremen
PB	Prakla Bohrtechnik GmbH, Peine

Narrative of the cruise, MSM04/4b

MARIA S. MERIAN left the harbour of Las Palmas on Monday 19 of March 2007, for a two-week expedition into the area north of the Canary Islands and off Cape Blanc (Mauretania) (Fig. 2). Scientists from various disciplines from the University of Bremen, the Max-Planck-Institute for marine Microbiology (Bremen) and the Alfred-Wegener-Institute for Polar and Marine Research (Bremerhaven) were on board. In addition, two guest scientists from the Instituto Canario de Ciencas Marinas from Telde (Gran Canaria) joined us, as well as two persons from two german companies (Develogic, Munic. Optimare, Bremerhaven) working with pressure sensors for a tsunami forecast system.

We reached working area A 60 nm north of Gran Canaria with the ESTOC time series site and the DOLAN data buoy ca. 5 hours after departure. In addition to particle flux measurements and other biogeochemical investigations at the ESTOC site, surface-near biogeochemical sensors were used at the DOLAN data buoy since a few years. Due to bad weather conditions and a high swell, it was impossible to recover the DOLAN buoy and the corresponding mooring. We therefore recovered and redeployed the nearby ESTOC mooring equipped with three time-series sediment traps which all worked perfectly. We also launched the rosette sampler equipped with a SEABIRD SBE 21-CTD (with fluorescence and O_2-sensor) to recover water samples for chemical analysis performed by the Institute in Telde (Gran Canaria). Additionally, we deployed the high-resolution particle camera (with a SBE 19-CTD, with fluorescence-O_2-sensor) and launched a NOAA drift buoy to register the geostrophic currents and temperature in the ESTOC area.

As the weather conditions did not improve in the eastern North Atlantic, we decided to leave the study area A and to sail to the south to study area B off Cape Blanc (Mauretania) (Fig. 2). Underway, seven XBT-sensors were launched to measure the temperature down to about 1800m. In the Cape Blanc area, which is characterized by high biological production and giant chlorophyll filaments, a transect with 4-6 stations was planned to conduct optical, micropaleontological, biogeochemical and microbiological studies. On Friday morning, March 23, we successfully recovered the mooring CB-17 which was deployed with RV POSEIDON in fall 2006. The day after, it was redeployed with a similar configuration (CB-18). Additional water and particle sampling was performed with the rosette-CTD, the particle camera ParCa-CTD, the in situ pumps and the GoFlo casts. Also acoustic tests for the tsunami forecast system were done. Closer to the east, about 90 nm off Cape Blanc, another sediment trap-current meter mooring (CBi-4) was recovered completely and redeployed as CBi-5. A

first look to the samples indicates very high particle fluxes during winter-spring in 2007. This time we deployed an MSD sediment trap equipped with 40 sampling cups to monitor the export fluxes at high time resolution. All systems for collecting water/particles and the particle camera ParCa were also used and we could perform station work at 6 sites in the Cape Blanc area (Fig. 2).

In the night from Tuesday to Wednesday, March 27/28, we steamed back from study area B to the north to the DOLAN buoy (area A) which we reached in the early morning of Friday, March 30. Due to calming down of wind to 5-6 Bt, we started to recover the data buoy and the 4500 m long mooring array equipped with various sensors (e.g. nutrients, chlorophyll fluorescence) and other instruments (e.g. work horse ADCP). In the afternoon, we sailed 25 nm to the ESTOC site to launch another rosette-CTD and to conduct some more acoustic tests for the tsunami forecast system. During the night, we prepared the DOLAN mooring for deployment during the following Saturday. Another rosette-CTD was launched for the calibration of the MicroCats. In the evening of March 31, station work ended and we steamed back to Las Palmas which we reached on early Sunday 1 of April, 2007.

Despite a reduction of the available ship time of two days, we were able to fulfil our complete planned program. We recovered and redeployed all four mooring systems and the seven sediment traps provided complete sampling sets. All other instruments worked perfectly during the entire cruise and we conducted studies of the water column at 6 sites in the Cape Blanc area.

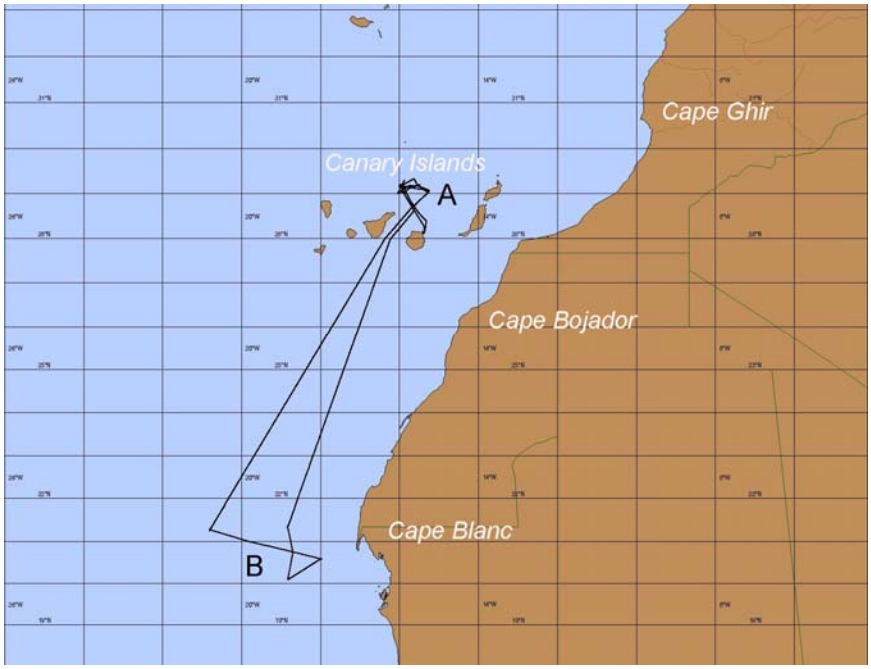


Figure 2. Track of R/V MARIA S. MERIAN Cruise MSM04/4b.

Participants MSM04/4b

Name	Discipline	Institution
Fischer, Gerhard	Chief scientist, Geology	GeoB/RCOM
Baumann, Karl-Heinz	Sedimentology	GeoB/RCOM
Busak, Michael	Marine Technology	Fa. Optimare
Daberkow, Timo	Marine Chemistry	MCB
Hoffmann, Jan	Geochemistry	GeoB/RCOM
Iversen, Morten	Marine Microbiology	AWI/MPI
Kalweit, Holger	Marine Technology	RCOM
Karakas, Gökay	Modelling	AWI
Klann, Marco	Technician	GeoB/RCOM
Klar, Steffen	Marine Technology	RCOM
Kohn, Marion	Micropaleontology	GeoB
Kopiske, Eberhard	Marine Technology	RCOM
Llerandi, Caronlina	Technican	ICCM
Meinecke, Gerrit	Geology	RCOM
Motz, Markus	Marine Technology	Fa. Develogic
Nowald, Nicolas	Geology	RCOM
Ploug, Helle	Marine Microbiology	AWI/MPI
Reuter, Christian	Geolgoy	RCOM
Villagarcia, Marimar	Oceanography	ICCM

GeoB/RCOM	Department of Geosciences / Research Center Ocean Margins, University of Bremen
ICCM	Instituto Canrio de Ciencas Marinas, Telde, Gran Canaria
MPI/AWI	Max-Planck-Institute for marine Microbiology, Bremen
AWI	Alfred-Wegener-Institute for Polar and Marine Research, Bremerhaven
MCB	Marine Chemistry, FB 2, University of Bremen
Fa. Optimare	company Optimare Sensorsysteme, Bremerhaven
Fa. Develogic	company Develogic Sensorsysteme, München

Acknowledgements

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