

**Short Cruise Report**  
**RV METEOR cruise M57/2**

**Dates:** February 11 to March 12, 2003

**Port calls:** Walvis Bay (Namibia) – Walvis Bay

**Chief scientist:** Dr. Matthias Zabel

**Participating Institutions:** RCOM, Research Center “Ocean Margins”  
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Max Planck Institute for Marine Microbiology, Germany  
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**Summary of the cruise**

METEOR 57/2 was the second leg out of three of METEOR expedition M57. The program of this cruise were determined by the interests of several research projects. Their general aims were to investigate the water column by different sensors devices, to retrieve water and suspended particle samples, and to recover surface sediments and long sediment cores at the middle and upper continental slope off Namibia between 23° and 27° South. The works concentrated along four down-slope transects within this region (Fig. 1). A main scientific objective were biogeochemical investigations close to the sediment-water interface. The primary questions concentrate on the influence of the quantity and quality of lateral transported, biogenic particles on biogeochemical transformation processes at the sea floor. In this regard, the characterization of the suspension load according to provenance and reactivity is also of high significance. The aim of the geochemical and geophysical investigations were detailed examination of the early diagenetic modification of the primary composition and the rock magnetic properties of the sediment within the sulfate/methane transition zone. One aim of the geological investigations were reconstructions of changes in the circulation pattern, in the hydrographic structure of the water column and in the biological production of the Namibia upwelling area during extreme climatic states of the Quaternary, and to represent them in climate models. The major goal of the oceanographic work was the detailed recording of the water column from surface waters close to the coast line down to the Eastern South Atlantic Central Water (ESACW) to describe the temporal and regional variability within the mix layer between the ESACW and the South Atlantic Central Water (SACW).

After one days of uploading and storage of scientific and technical equipment, RV METEOR left Walvis Bay at February 11, with 29 scientists from German research institutes. Unfortunately, our guest from the Namibian National Marine Information and Research Centre (NATMIRC) had to reject his participation just before sailing. The scientific work began four hours after leaving the harbour with the recovery of a mooring which has been deployed two month before by the NATMIRC. All sensors worked fine, giving a high resolution time series of the highly variable

and complex composition of the water column and its circulation. After successful tests of the new digital positioning system, installed on board of RV METEOR during the shipyard time one month before in Cape Town, and some preparative scientific works the program was continued with a first transit on the hydrographic transect at 23°S. Water samples, CTD-, and LADCP-profiles were taken at 14 locations from 44 m down to about 2700 m water depth. To optimise the scheduling of this cruise in regard to the short time changes in the current system and the upwelling intensity, SeaWiFS satellite pictures could be used. These information on the distribution patterns of temperature, chlorophyll a, and true colour were transferred to the ship by e-mail with a delay of only one day. Coastal surface water temperatures around 23°C off Walvis Bay at the beginning of this cruise indicated to a temporary intermission of the upwelling process which was supported also by measurements of other water parameters (salinity, oxygen, and nutrient concentrations). At the same time, the permanent Luderiz Cell (at 27°S) exhibited temperatures of about 13°C. This scenario changed over the cruise time, whereas the warm waters retreated to the north and moderate temperatures of 17° – 18°C prevailed off Walvis Bay.

On the fourth day sampling start on transect 1 between 24,1° and 24,5°S which has been chosen by hydroacoustic surveying with the shipboard systems PARASOUND and HYDROSWEEP already within the first two days on sea. Like to be expected from former cruises the continental slope was relatively steep between water depths of about 400 and 800 m. Showing a lot of outcropping beds, sediment structures exhibited that erosion dominates within this interval. Therefore the seven long sediment cores from this transect originate from the shallower (300 m) or deeper interval (800 – 2000 m). With core length between 3,7 and 10,8 m the total recovery amounted to 50 m. According to a preliminary age model which is based on geophysical measurements, oldest sediments sequences recovered have been accumulated just before the marine isotope stage (MIS) 5.5, 125.000 year ago. Besides the common type of sediment sampling with gravity corer and multicorer a free-falling Benthic Chamber Lander was deployed three times on transect 1. The long operating times of this lander system (up to more than 40 hours at the sea floor) and the four investigation-series at the hydrographic transect account for a repeated take up of the works on transects 1 and 2.

The first part of the program on transect 1 took four days and was followed by further surveying towards the south. Promising sediment structures were found between 25,5° and 26°S. In contrast to the northern transect PARASOUND profiles indicated to continuous sedimentation also in the sphere of the immediate water masses. So, seven locations between 400 m and 2500 m water depth were chosen for the deployment of the gravity corer. The total recovery amounted to about 100 m. Although these cores are longer in comparison to those from transect 1 (7,8 – 14 m), apart from the deepest location preliminary results indicated a significant younger age and therefore higher sedimentation rates. The lander system was deployed four times at this transect 2. Interrupted by the exposure of two drifters for the NATMIRC at 25,0°S/13,9°E and 25,0°S/14,5°E, a second set of oceanographic investigations on the hydrographic transect at 23°S, and a deep water station for in situ pumping at 24,9°S/11,9°E, the scientific work on transect 2 took a net time of about five to six days.

At the end of the 17<sup>th</sup> day the program was continued by acoustic surveying of the continental slope between 25,4°S and 26,8°S. Again the sediment structures gave evidence that this area is unsuitable for the purpose of sediment sampling between water depths of 500 – 900 m. Therefore, only three gravity cores were recovered from 430m, 940m, and 1480 m. Although the third transect is closer to the upwelling cell off Luderiz, sedimentation rates seem to be lower than more to the north, at least during the last 60.000 yrs. First results suggested that the deepest core resolve the last 140.000 yrs. Based on this findings and the acoustic profiles from the beginning of this cruise we made the decision to extend the geological program onto the 23<sup>rd</sup> latitude. After the third repeat of sampling at the hydrographic transect, works were completed at transect 1 and 2 by deployment of the Bottom Water Sampler (BWS), the CTD-Rosette, the multicorer, and the Benthic Chamber Lander.

During the last four days before the transit back to Walvis Bay, sediments at 23°S were sampled at seven locations between 600 m and 2700 m. The cores length amount about 4 to 11 m. In comparison to the other samples recovered on transects 1, 2, and 3 first shipboard results generally indicate to the lowest sedimentation rates. The completion of a successful cruise were performed by last extensive water column sampling at the hydrographic transect. RV METEOR arrived at March 12, 2003, the end of this second leg of M57.

In total about 3300 nm of hydroacoustic surveys with the shipboard PARASOUND, HYDROSWEEP, and ADCP systems were achieved during M57-2. At 24 locations 28 gravity cores were recovered for further geological, geochemical and geophysical investigations. This set was completed by 40 multicorer deployments. The water column was sampled 94 times with 12 water bottles, CTD, and LADCP at 32 locations, and 10 in situ pump deployments at 5 locations. The benthic nepheloid layer was sampled at 17 BWS-stations. At seven Benthic Chamber Lander deployments in situ incubations were performed. One mooring was recovered. And last but not least, 17 plankton net hauls and 10 shipboard membrane pump samples from the surface waters were taken. A detailed listing and documentation of the scientific program achieved during M57/2 can be found in the regular reports of the “Leitstelle METEOR” ([www.ifm.uni-hamburg.de](http://www.ifm.uni-hamburg.de)) which should be available in late summer 2003.

Dr. Matthias Zabel (chief scientist)

Fig. 1 Map of M57-2 cruise track with the investigated stations

