Summarized Cruise Report

At the end of cruise M57-3 METEOR arrived according to schedule early in the morning of April 13, 2003 in Dakar. The plan was to arrange packing of equipment and samples of the completed cruise section into containers and to send these back home as soon as possible. However if there are no empty containers available nothing can be packed, thus participants of cruise M57-3 had to come back on board on April 14 just before their home flight and pack their material. On the other hand the containers for our cruise section did not arrive on April 14 and all we could do was waiting. Finally, in the evening of April 15, a “first rate” of containers came on board and were unloaded immediately. The next day, April 16, the vessel was shifted to the bunker station to fill up fuel supplies.

We then returned to our former anchorage awaiting a “second rate” of containers. This was first of all the container with liners and core barrels for the next two cruise sections. We were getting more and more nervous when the container was declared as missing on Wednesday evening. As a precaution we ordered by phone more liners to be dispatched by airmail via Paris – while we estimated the quantity of core barrels on board as more or less sufficient. Fortunately just before the replacement shipment left Germany, the missing container could be traced in Dakar, thanks to assistance from Bremen. On Thursday before Easter the container finally arrived on board in the early afternoon.

However these circumstances gave us plenty of time to install and equip our laboratories – none of the participants of former cruises could remember such time luxury. The “next rate” of equipment – an airfreight box – arrived on Friday, 18.04.2003. But in the end our “final rate”, i.e., the container with the seismic compressor, created the main problem, since it turned out to be impossible to arrange for its punctual transportation from Kapstadt via Abidjan to Dakar. First the arrival was announced for April 16, which was then extended to April 17, April 18, April 19 etc. On Easter Sunday, April 20, at 8.00 hrs a.m. we saw container vessel “NICOLAS DELMAS” arriving in the port of Dakar and we could even see our hot-longed container on board, but again it turned out to be impossible to transfer the container on board of RV METEOR the very same day.

A scientist from Morocco was our guest on board, whereas an officer from Senegal, who was supposed to accompany us as well, declined shortly before we left Dakar. His superior did no longer insist on his participation, since we only made use of the port of Dakar and did not have any intentions to do research within the territorial waters of Senegal. The observers also created some problems, since none of them had a valid visa for Spain. It was Easter and there was no chance to receive a visa or at least a transfer-visa at short term via the Spanish embassy in Dakar, and finally the ship agency in Las Palmas promised to arrange for a transfer-visa from ship to airport before the arrival of METEOR in Las Palmas.

On Easter Monday finally the compressor container arrived on board and we left Dakar around 14.00 hours with more than 5 days delay. About 24 hours we moved north parallel to the foot of the continental slope until we arrived in our first working area along the continental slope between 18°N and 22°N. At the southern edge of this area we first passed – according to the recordings of hydrosweep and parasound – a big

area with many slides, avalanches and debris flows and later at the latitude of Cap Timiris a very big and deep canyon, which was not registered on any map so far. We found a new name for it which is “Cap Timiris Canyon”. Along the foot of this continental slope at a water depth of 3000 meters the canyon has a depth of 300 m and a total width of more than 2 km. On half depth we clearly recognized mainly in the transverse profile a terrace. Especially the narrow deep cut shows distinctively meanders, which are partly even more concise slope upwards. All these details in the shape of the canyon resemble very much the picture of a river on the land, and we had always to remind ourselves, that these are pictures from thousands of meters under the water surface.

Next step was the measurement of the big areas between 19°N and 22°N, registered in the map of the working group from Southampton as areas with vast “debris flows” and “slides”. Our measurements with hydrosweep, parasound and multichannel seismic however showed us, that this area of the continental slope shows a rather regular sedimentation with only sporadic and small slides and debris flows. In one of the sediment cores we discovered such a small debris flow showing very characteristic sediment structures. We arranged for a more or less “online production of an age model” with measurements of susceptibility and fluorescent X-ray analysis, which continued to work reliably and we therefore know for sure, that this debris flow event took place approximately 200.000 years ago.

In consideration of our expectations regarding registration of transportation along this continental slope between 19°N and 22°N, the slope turned out to be somewhat “boring”. For detailed exploration we therefore decided to concentrate on the area around Cap Timiris Canyon as well as on the big slide complex in the south, mentioned above, which we already had crossed on our way.

Cap Timiris Canyon kept us busy until Thursday, May 1st with seismic- and hydrosweep/parasound profiles as well as taking cores with multicorer, gravity corer and on the shelf even with the giant box corer. Seismology permitted deep views into the sediments at multiple profiles, crossing the course of the canyon. From such profiles it could be derived that this canyon and its inflows had been more or less stationary in their position since long (~tertiary) time, and along with the results of other working groups it became evident, that they are still active and represent a characteristic for the mass transportation in this section of the continental slope.

This part of the canyon provided us with a range of interesting sediment cores, and at two places we managed to compare a core from up the Levee (beach barrier) and from the deepest parts of the canyon. First we planned to use a 3 m long (short) core barrel at the canyon, but some interesting layers in the parasound encouraged us to use a 6 m long gravity corer. While the ships position was kept precisely, we managed to get the core from the deepest part of the canyon – and it turned out to be shot through up to the top of the weight. Finally the repetition with a 12 m long gravity corer provided us another core of 9 m length, where the sedimentologists counted a sequence of totally 33 turbidity events. The analysis of the pore water showed, that the uppermost layers were still young, perhaps some decades old. Whereas cores from the Levee (beach barrier) showed a more or less undisturbed sedimentation at high sedimentation rates, rarely interrupted by small turbidity layers.

On Friday, May 2, we started with seismic-profiles in various directions in the area of the great debris flow between 17° and 18°N (we now call it “Mauritania Debris Flow”). And on Sunday 04.05.03 we started the core program at positions following the results of seismology and sediment acoustics. At three border areas, where the debris flow already showed minor thickness, we managed to get cores which penetrated the debris flow and found pelagic sediments above und below which will allow a precise dating. In all three cases we dated the age of the debris flow (preliminarily) at around 10.000 years. However we had to learn that getting sediment cores from rather inhomogeneous depositions can be problematical. The price we had to pay for our good cores was a relatively high number of twisted core barrels (bananas).

Our fourth week started with core stations at the “Mauritania Slide Complex” and the “Mauritania Debris Flow”, that follows down the continental slope at a latitude between 17°N and 18°N. Beforehand we took parasound/hydrosweep- and seismic-profiles in various directions along this area and we could clearly recognize the internal structure of these sediment slides and debris flows. We also observed that this debris flow, dominating the shape of the continental slope, is not the first one, but there were distinct signs of more than one predecessor, and this seems to be the dominating form of sediment transportation along this part of the continental slope.

Along the edges of the debris flow mainly the parasound-profiles documented those parts, where it lays thinly over well bedded sediments. At these places we were hopeful to pervade the sedimentation of the debris flow with the gravity corer. And thanks to the good parasound-quality and the following interpretation we managed to do so at three places. An extremely good example is gravity core GeoB 8523-1. The lower parts of this core until 2,80 m under sediment surface contains pelagic sediments, easy to date, followed by the last depositions of the Mauretania Debris Flow between 2,80 and 1,15 m depth with flow structures and big clasts. Then between 1,15 m and ~ 0,55 m a turbidite followed, carrying coarse sediments at its base from the shelf. Probably this turbidite was triggered by the debris flow. Between 0,55 m and the sediment surface we again found normal pelagic sedimentation, representing again the last 10.000 years, according to preliminary dating. Thus we can now date this debris flow event into the early holocene. Thanks to seismic and sediment-acoustic preparatory work we found two more cores at other places of the debris flow, which confirmed this estimation of age.

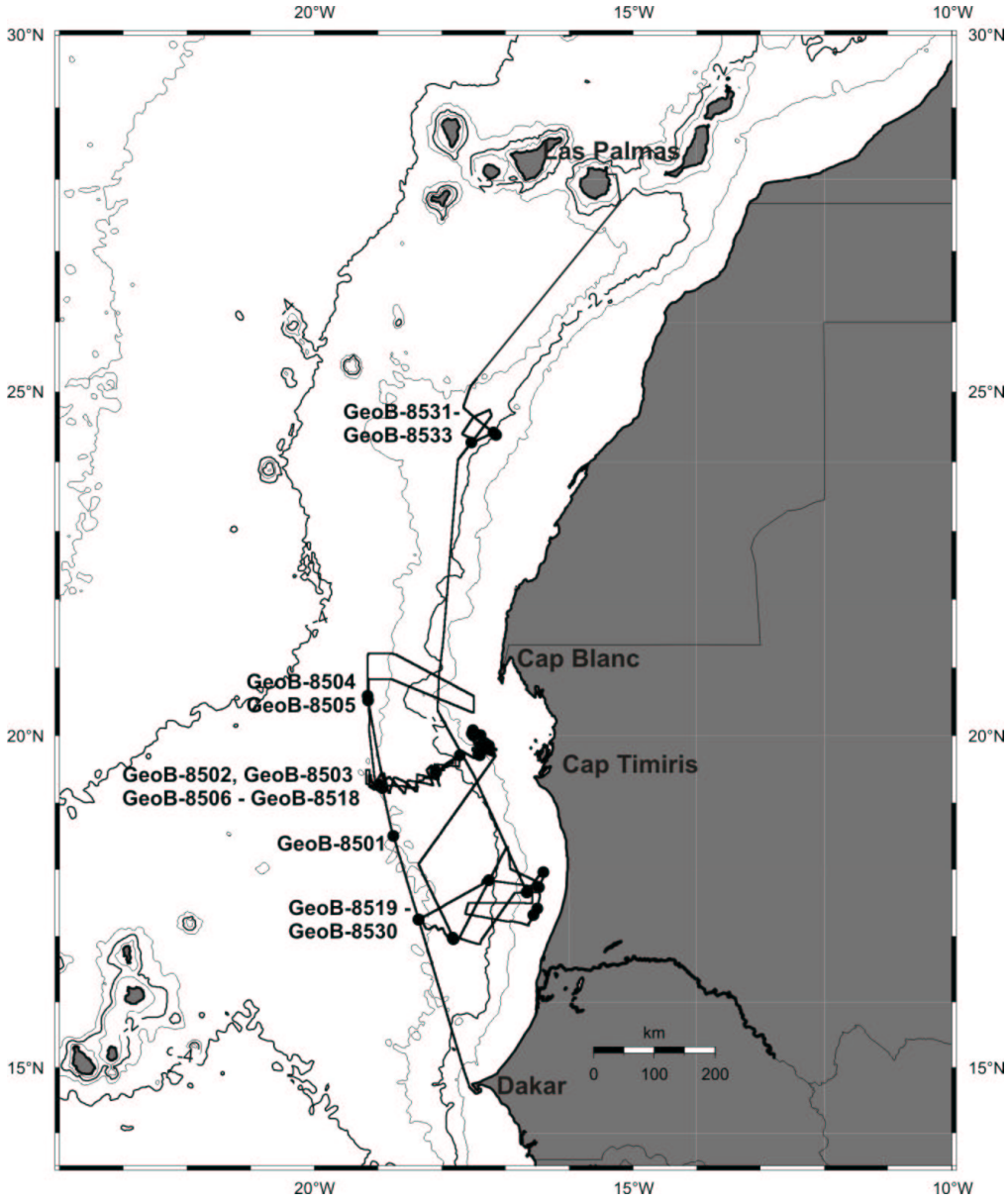
Following our coring activities we took further profiles with seismic and sediment-acoustics, in order to improve our knowledge about the extension and the interior structure of the Mauritania Slide Complex and the Mauritania Debris Flow. We finished our activities in this area with using the box corer at several stations along the shelf margin. The sedimentologists wanted to explore the origin of the material, which we found further down the slope in the turbidites and in the debris flow. This presented us another little highlight, i.e., structures in the seismic-profiles, found in a water depth of around 500 m along the continental slope, turned out to be what was already suspected, i.e., reefs of coldwater corals. The box corer is not quite the right tool for sampling such structures, but we managed to scratch some pieces from the reefs.

On Thursday, 08.05., and Friday 09.05., we made headway towards the north to the Sahara Debris Flow at 24° to 25°N. During the night of Friday to Saturday, 10.05., we started working on seismic- and parasound/hydrosweep profiles. This resulted in

choosing three core stations on Saturday along the area at the upper headwall of the slide. We again managed at two places to penetrate the depositions of the debris flow with the gravity corer down to the sliding plane respectively to undisturbed sediments. The young pelagic sedimentation on top of these two debris flow positions is only 10 to 20 cm, and we therefore expect the age to be holocene, perhaps even late-holocene. As it was envisaged to enter Las Palmas on Monday, May 12 – time and place of our debarkation - there was only time to label and open these cores, sampling and treatment had to be postponed until we are back in Bremen. The working group of Russel Wynn will be also engaged in this sampling and investigating these cores. Russel Wynn and his PhD-student Aggeliki Georgiopoulou, being experts in slides and debris flows, were a big support during this METEOR expedition, and we are very much looking forward to our joint treatment of core material from Sahara Debris Flow in Bremen.

From our scientific point of view the cruise turned out to be an exciting one and we almost forgot about the long time of waiting and the delayed beginning of our journey. We learnt a lot about the mass transportation along this high productive continental slope, and our knowledge about canyons, debris flows and sediment slides has become far more intense. The function of all apparatus brought along by the different groups of scientists and their individually used methods turned out to work without any problems, and as a result we come home with loads of samples and data.

Last but not least Kapitän Henning Papenhagen and his crew contributed a great deal to the success of this cruise and we – the group of scientists – take this opportunity to express our gratitude for the excellent support throughout the journey. All of us are looking forward to the next cruise.



METEOR Cruise M 58/1, cruise tracks and core locations.