

METEOR M150

1. Weekly report (27.08.–02.09.2018)

The research cruise M150 BIODIAZ of RV METEOR aims an intensive sampling of biological and sedimentological material from three islands of the Azores Archipelago – Flores in the west, Terceira in the centre, and Santa Maria in the east – as well as from one or two seamounts (Princess Alice Bank, Formigas Bank) (Fig. 1).

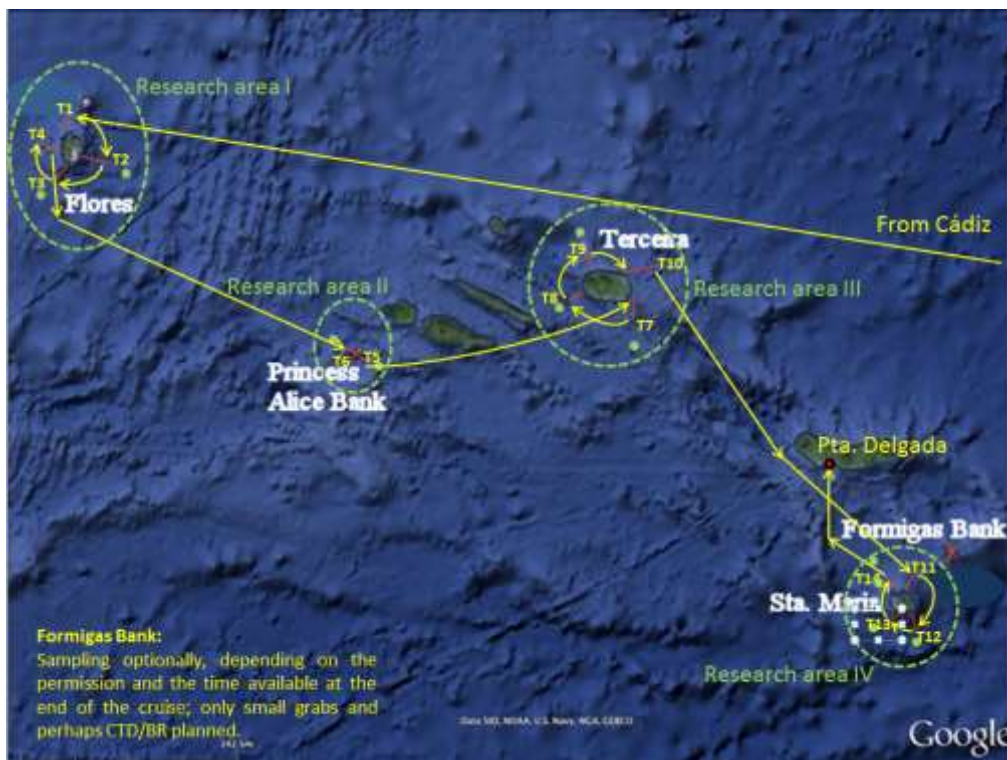


Fig. 1: Itinerary of FS METEOR cruise M150 BIODIAZ. Beside the steaming route (yellow arrows), the map shows the four research areas around the islands Flores, Terceira, and Santa Maria as well as the two seamounts Princess Alice and Formigas Banks.

The research program encloses six major topics, (a) to achieve the biodiversity around the islands and seamounts, (b) to detect whether the Azores may be characterized by a unique fauna, or if any exchange with other oceanic regions takes place, (c), to clear if there exist faunistic differences between the islands ins seamounts, or if an intra-Azorean faunistic exchange exists at least for certain taxa, (d) to record if there are differences regarding phytoplanktonic productivity around and between the islands and seamounts and (e) if the seamounts do influence the benthic and planktonic productivity, and (f) to study the influence of terrestrial erosion for the formation of the marine substrates surrounding the islands, in particular to detect the conditions in which such terrestrial influence is more and more replaced by an exclusive marine, biological formation of sediments.

For that purpose we will take samples along 14 transects in selected water depths a series of different sampling gears, i.e. different grabs and corers as well as dredges and sledges for bottom sampling, plankton nets and water samplers, and several devices for the measurement of temperature, salinity, oxygen and other important parameters of respective water depths.

After leaving Cádiz on Monday past, we steamed with 10–11 knots towards Flores Island, our first research area. From a faunistic, ecologic, and biogeographic point of view Flores is of particular interest due to its remarkable isolation within the Archipelago.

The five steaming days were used by the scientific participants to install their laboratories and to configure and check the sampling gears. In the early evening of August 31st we reached our destination and started immediately with the sampling program at Transect T1 in the north of Flores, covering water depths from 50 m to 1,000 m. The work at T1 finished on September 1st, and in the meantime we begun to sample at eastern Transect T2.

On board all are in good health; waves between 1 and 2 metres height as well as convenient weather conditions with 21–24°C and mostly blue sky (only interrupted by rare warm rain showers are best prerequisites for a successful expedition!

On behalf of all participants I remain with kind regards



Kai Horst George

Chief scientist

METEOR M150

2. Weekly report (03.–09.09.2018)

During the second week of the cruise we were able to realise intensive sampling at transects T1– T3 (Flores Island), and in the meantime also the work at the seamount “Princess Alice Bank” (T5 and T6) is nearly finished. All in all, the sampling is quite successful – the CTD at the last location of T6, just returning on deck, constitutes the 230st deployment, after just one week of work at sea!

The sampling material looks quite promising; beside different sediments we got organisms of many different major groups, like e.g. sponges, echinoderms, molluscs (Fig. 1), crustaceans, fish, corals and brachiopods. After the cruise they will be studied and determined in the labs of the participating institutions and provide information regarding the major topics listed in WR 1.



Figure 1: a wonderful bivalve (*Pecten jacobaeus*) collected with the Henning-grab from station M150-#54 (50m depth). Foto: A. Ostmann.

The sampling stations of the transects are always located at the same water depth: 50m, 150m, 300m, and 500m. The three shallower stations are exclusively sampled with grabs to get sediment and the inhabiting benthos. As due to the few time available, an intensive mapping of the seafloor cannot be realised, we deploy the underwater video camera at 50m and 150m to check the composition and structure of the seafloor and to decide if the deployment of the grabs is possible. Beside the Shipek- and the Henning-grab (Fig. 2), two

small but quite efficient grabs for getting sediment and tiny organisms (meiofauna, protists), also the box corer (BC) is deployed at 150m and 300m, aiming to obtain larger amounts of undisturbed sediment. Moreover, it is also applied in depths >500m, for instance in 1,000m (T1), 1,500m (T3), 2,000m (T3, T5). Last but not least, also the multicorer is used in depths of 2,000m and 3,000m (if achievable) for obtaining undisturbed sediment, protists, and meiofauna.



Figure 2: The Henning-grab is deployed. Foto: A. Ostmann.

Beside the grabs, also the deployment of two dredges and one sledge was scheduled, namely the epibenthic sledge (EBS; macro-epifauna), the Agassiz trawl (AGT; megabenthos), and the rock dredge (RD; megabenthos). The latter was planned to replace the AGT at stony and rocky grounds. However, unfortunately both the EBS and the RD were badly damaged during the second and first deployment, respectively, and they cannot be used during our cruise anymore. At least the EBS sampling can be partially replaced by additional box-coring, but sampling of megabenthos has to be restricted to depths >500m, in order to avoid its damage at stony/rocky grounds.

Also the water column was sampled intensively at almost all depths except 50m. CTD casts were made from 150m down to the deepest location on every transect, and 1–2 plankton

hauls were realised at selected locations; one horizontal haul at the water surface, and/or one vertical haul down to 200m depth.

As we got the research permission for the Formigas Bank, we decided to cancel one transect at each island. Although that means getting less sampling material from the islands, on the other hand it allows us to cover the whole study area.

On board all are in good health. Weather and sea are very cooperative, and the collaboration of the ship's crew and scientists is absolutely excellent!

On behalf of all participants I remain with kind regards



Kai Horst George
Wiss. Fahrtleiter

METEOR M150 Weeklyreport No. 3 (10.–16.09.2018)

During the third week we did quite successful sampling at transects T8 and T9 at the island of Terceira. But then, the tropical storm “Helene” got in our way. Against the common direction of such storms, “Helene” did not move north-westerly towards the U.S. coast, passing south of the Azores but turned into north-eastern direction. The storm reached Flores Island last midnight, with wind velocities of about 50 knots, and rainfalls reaching 60 litres/m². The relatively short distance to Terceira Island prompted us to postpone the sampling at transect T10 and, instead, to steam to the south-east, to Sta. Maria Island, where the impact of “Helena” is much lower. At Sta. Maria, we will be able to work at all originally scheduled transects T11–T14, and subsequently we will return to Terceira to sample at T10. Then, we will go to the Formigas Bank to undertake the last sampling of the cruise in the Azorean Archipelago.

From the sedimentary point of view the M150 BIODIAZ cruise will give answer to the question how the sedimentary signal changes in the evolutionary trend from volcanic islands to seamounts (Fig. 1).



Figure 1: Fine gravel of basaltic material (northern shelf of Terceira Island, 50m water depth). Photo: A. Wehrmann

Our investigations around the Azores will contribute to previous studies in the Northern Atlantic as the oceanography of this region differs significantly from others. We are focusing on the onset of biogenic sedimentation (Fig. 2), its principle processes and controls. This finally will lead to defined regional carbonate factories. Additionally, the volcanoclastic and bioclastic sediments are an important habitat for (meio-) benthic organisms. As a standard routine we analyze grain size distribution, mineral composition and the amount of total organic carbon. For the reconstruction of the geological history the marine sediments function as palaeoenvironmental archives.



Figure 2: Bioclastic sand composed of fragments from Bryozoa, Mollusca and Foraminifera (northern slope of Terceira Island, 300m water depth). Photo: A. Wehrmann

Apart of the slight disturbance caused by “Helene”, we enjoy excellent weather conditions, even allowing a nice interruption of the scientific work some days ago, when in the frame of the training of some METEOR crew members with the rubber dinghy also excited scientists were allowed to participate on short dinghy tours surrounding METEOR, in the middle of the Atlantic Ocean – marvellous!

On board all are in good health. Past Thursday we enjoyed a nice “Bergfest”, i.e. the traditional party celebrating the achievement of the midway of the cruise, and now, we all are ready to use the remaining two weeks for intensive sampling!

On behalf of all participants we remain with kind regards



Kai Horst George
Chief Scientist



Achim Wehrmann
Head research group “sediments”

4. Weekly report (17.–23.09.2018)

Our fourth week was quite successful! As planned we were able to sample all four transects at Santa Maria Island, and then we returned to Terceira to catch up transect T10; you may remember that we had to skip that transect due to the tropical storm “Helene”. However, the sampling was so efficient that we decided even to sample transect T7; we had cancelled that transect (among others) at the beginning of the cruise (cf. WR 2), but in the meantime we are working at the penultimate depth position (400m), where the CTD and the box corer will be deployed. Afterwards we will steam to the last T7 depth position (1,500m). There, again the CTD and the box corer will be launched, but also the multicorer and the Agassiz trawl. For the three last-mentioned gears it will be the last deployment on our cruise; at Formigas Bank, only the CTD and the small grabs will be used.

The success of catching up T10 and T7 at Terceira and even to include the Formigas Bank actually is, however, not only because of the fantastic cooperation of all participants. So, at some stations we were unable to deploy all aimed gears, mainly because of the given sediment and/or the topography. That saving of time contributes to the circumstance that we will get all originally scheduled transects (except T4 at Flores Island) plus Formigas Bank.

To measure hydrographic data in the water column and to collect water samples from different depths, a CTD probe attached to a 24-bottle rosette is used (Fig. 1). The CTD probe continuously measures the pressure, conductivity and temperature of the water column as it descends towards the seabed on a wire, which displays and records the measurement data in real time on a PC in the laboratory. Attached to the probe are additional sensors measuring the oxygen content, the fluorescence and the light radiation relevant for photosynthesis (Fig. 2).

Based on the fluorescence and the oxygen profile, the appropriate depths for sampling of seawater are determined. These water samples are filtered on board and frozen, later analysed in the laboratories of the participating institutions. These samples are then used to detect phytopigments, and to study certain groups of the phytoplankton, as well as the content of microplastic particles and DNA.

To date, 60 CTD profiles have been recorded and more than 2,000 litres of seawater have been filtered from different depths of down to 150 meters.



Figure 1: Rosette with mounted CTD probe. Photo: B. Springer.

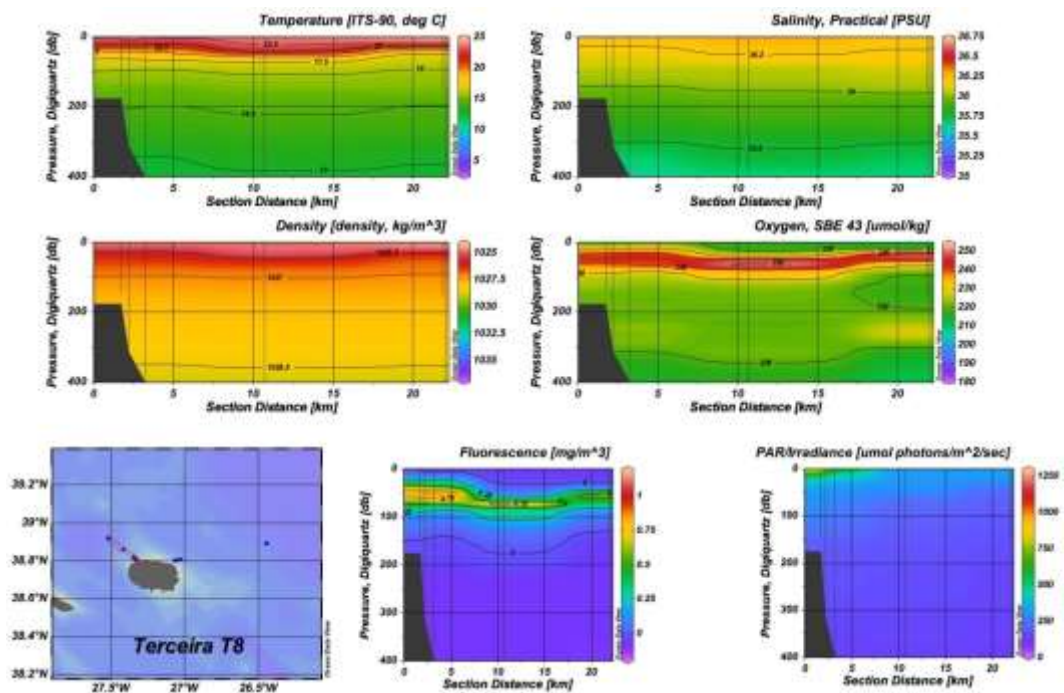


Figure 2: Profile along transect T8 in the NW of the island Terceira with distribution of temperature, salinity, density, oxygen, fluorescence and light radiation down to 400 m depth.

The phytoplankton forms the basis of the food chain in the sea and is therefore of great importance for species richness in the ocean. It can be divided into 3 size classes, namely pico-, nano- and microphytoplankton with different species composition. In the oligotrophic areas (low nutrient areas), e.g. the zone around the Azores, small-sized phytoplankton groups up to about 20 μm (pico- and nanophytoplankton) dominates, which are particularly adapted to these conditions. Islands and seamounts can cause higher nutrient concentrations due to local/regional flow conditions, leading to a shift in the species spectrum towards larger phytoplankton organisms (microphytoplankton).

The following questions will be answered on this cruise:

1. Are there differences in the species composition and abundance of phytoplankton between the different Azorean islands?
2. Is there a gradual difference in species composition and abundance in relation to water depth?

From the water samples of the rosette two further aspects are treated: bacterioplankton and microplastics. Bacterioplankton (bacteria and archaea), although microscopic in size, is one of the most important marine organisms as it plays a crucial role in the regulation of global element cycles due to its unique ability to decompose and re-mineralise dissolved organic matter. The term microplastic refers to plastic waste that is smaller than 5 mm. They are originated, among other things, by the degradation of large plastic waste.

For analysis, water samples are filtered through specific membranes to isolate cells for genomic DNA extraction and further sequencing for bacterioplankton ID and potential plastic particles. Those are characterized by size, shape and colour and undergo further chemical analyses for polymer identification.

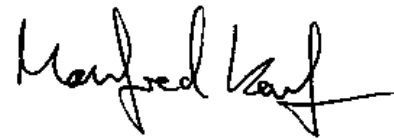
Beside these scientific aspects, also personal circumstances do impact our cruise. At Santa Maria Island, one crew member had to leave the vessel because of urgent familiar conditions, and tomorrow, on our way to the Formigas Bank, we will stop in Ponta Delgada (Sao Miguel), to disembark one scientist – again because urgent familiar circumstances. At least we are close to the islands instead of somewhere in the vast Atlantic Ocean.

The remaining people on board are in good health. We look forward to a busy week, before our sampling program ends, and packing begins!

On behalf of all participants we remain with kind regards



Kai Horst George
Chief scientist



Manfred Kaufmann
Head research group „water samples“

5. Wochenbericht (24.–30.09.2018)

Our last expedition week was dedicated to research at Formigas Bank. We managed to deal with four transects with the CTD, the underwater camera and the two small grabs – a yield that we had not dared to hope for when we started our journey. The Formigas Bank is a seamount located northeast of Santa Maria, whose westernmost tip in the form of a small rock reef stands out even a few meters above the water surface. Today, a lighthouse sends its warning light across the ocean, but in earlier times, many a sailor fell victim to this reef, especially at night, when the rocks are not visible at all.

A special concern was to use the underwater camera on two crossing transects to haul them over the ridge (about 50m depth) at a speed of 0.5 knots from a depth of about 150m. On the one hand, we wanted to see what sediment awaits us and whether we could use the grabs at all. On the other hand, we wanted to document the changes that would show uphill.

While fine to medium-fine sand with high biogenic proportions could always be found at a depth of approx. 150m (Fig. 1), where our grabs brought out very good sediment samples, we were able to detect extensive tang forests at a depth of about 50m on our journey (Fig. 2). We had assumed to find large, macroalgae-covered areas also at appropriate depths on the islands studied, or at least the Princess Alice Bank, but to our surprise, we had never found anything! The entire sublittoral area in the study area is remarkably poor in large, bottom-living organisms and large algae. The fact that the Formigas Bank has extensive algae areas may well be due to the fact that it has been strictly protected for many years and, for example, any fishery is absolutely prohibited; that was also the reason for our initial fear that we would not be allowed to work there.

In addition to the two crossing transects, we were able to sample two more sections. So, we received a fair amount of sediment (and algae) samples from Formigas Bank.

The last sediment-laden grab came back to deck yesterday afternoon with station number M150_676. We drove more equipment deployments during this five-week journey than all previous METEOR expeditions this year!



Figure 1: Transect T16, Formigas Bank, about 150m water depth. The bright, fine sediment is easily recognizable.
Photo: M. Wilsenack.



Figure 2: Transect T16, Formigas Bank, about 50m water depth. Extensive seaweeds provide a picture of lush growth that offers food and shelter to a variety of animal organisms. Photo: M. Wilsenack.

Until our departure to Ponta Delgada on Tuesday morning, two additional transects are alternately traversed to make flow measurements over the seamount using the ADCP - the "Acoustic Doppler Current Profiler". These measurements, which last for several days and

are always run over a period of 12 hours on each of the two sections, are intended to shed light on possible influences and effects of tidal currents on the Formigas Bank.



Figure 3: The travel team of scientists M150 BIODIAZ. Photo: S. Seidel.

In the meantime, everyone is packing the boxes, and also cleaning the laboratories has already begun. Tomorrow, Monday, the containers will be packed, so that we have done all the work at midday on Tuesday before our arrival in Ponta Delgada.

In the name of Science (Fig. 3), I would like to sincerely thank Captain Korte and the entire crew of METEOR for their energetic help and support on this successful and beautiful journey. We could not have done much without the competent help from the machine, the crew and the ship's command! Devices had to be repaired, nets patched and course and speed kept accurate (camera profiles!), and we could always rely on everything being provided and undertaken purposeful and to our satisfaction! In addition there was a consistently excellent food, which we enjoyed three times a day to the fullest, and the always warm service by the stewards – also you and the caboose is our sincerest thanks!

Last but not least, we would also like to express our heartfelt thanks to Mr. Andreas Raeke; his comprehensive weather reports have been instrumental in planning and executing the

work in advance. Once again it was an extremely successful and unforgettable research cruise with RV METEOR!

We say goodbye to our readers and wish them all the best! But we wish both METEOR and its crew good and successful rides, and: See you next time!

In the name of all participants of the cruise I send you very warm greetings



Kai Horst George
Chief scientist