

3rd Cruise report (May 9 to 16, 2016)

SO-248 „BacGeoPac“ 01.05.2016 (Auckland, Neuseeland) – 03.06.2016 (Dutch Harbor, Alaska, USA)

In the late evening of May 11th we arrived at the most prominent station of our long transect: the equator at the date line (0° N/S, 180° W/E), our station 6. Before we had sampled successfully station 5 at 5° S, 178° 19,0' W. At the equator we had a 24 hour station and two nautical miles before we had the accompanying MUC station. By several indications we noticed that we met the nutrient-rich upwelling region of the equatorial current. The current velocity from east to west was up to 2 kn and showed impressively how strongly pronounced this current is. In addition, the deep chlorophyll maximum, the depth in which the phytoplankton, in this case blue green cyanobacteria, are mainly concentrated, was at 60 m in contrast to 90-110 m further south in the tropical south Pacific. Further, in sediment samples diatom frustules could be seen under the microscope.

The work of the microbiologists in the upper 1000 m of the water column and of the geochemists is part of projects in the frame work of the Collaborative Research Center (CRC) "Ecology, Physiology and Molecular Biology of the Roseobacter group: towards a system biology understanding of a globally important group of marine bacteria" (www.roseobacter.de). The overarching goal of this CRC is to understand the evolutionary, genetic and physiological principles of this important group of marine bacteria. During this cruise this group of bacteria is in the special focus of the microbiological investigations.

The main goal of the station at the equator was to study the day-night cycle of the bacterial communities and the dissolved organic nutrients available to them. Therefore a CTD was run down to at least 300 m every three hours from 6 am on May 12th until 6 am on May 13th and several depths down to at least 100 m were sampled. The microbiologists on board filtered out of these samples bacteria and froze them at -80°C to later analyze in the home labs how the phylogenetic composition of the bacterial communities, their metabolic activities and gene expression pattern change during day and night. In addition, these samples served to assess directly on board the bacterial abundance, biomass production, growth rate and turnover rate of dissolved amino acids and glucose and the hydrolysis rate of polysaccharides. When these samples will have been analyzed in several days we will have right on board first results on the day night rhythm of the cycling of matter of the bacterial communities. These results will help to even better plan and carry out a similar 24 hour time series in the northern Pacific. The geochemists and bioopticians took samples during the 24 hour time series to assess them later on with respect to the dissolved organic nutrients.

The mentioned parameters are analyzed at every station down to a depth of 300 m and at selected stations down to 1000 m. In addition samples are collected to analyze inorganic nutrients, dissolved amino acids and carbohydrates, dissolved organic matter (DOM), chlorophyll and particulate organic carbon, as biogeochemical background information. Therefore, the main activity of the microbiologists on board is to filter water which takes at least several hours after each station. One group on board needs very much water to investigate population genomics of specific subgroups of the Roseobacter group and therefore uses a so-called in situ pump. This pump is used usually at every other station and lowered to the desired depth, usually 60 m, on a wire and pumps seawater computer-controlled usually for three hours. Thereafter, the pump is brought on board again, the filters with the concentrated bacteria removed and frozen at -80°C.

To examine how the bacterial communities respond to changing nutrient conditions so-called mesocosm experiments are conducted. Therefore, 20 liter-carboys are filled with seawater. One series is supplemented with secretion products of diatoms, another with distinct polysaccharides and a third one with vitamin B12. The mesocosms are subsampled for six days, the samples processed in the same way as those of the profiles at the stations so that we later can analyze how the bacterial communities responded to these different nutrient conditions. This enables us to infer how the bacterial community composition is controlled by the different conditions and to better understand the data of our station profiles. The mesocosm experiments are conducted at three stations. The experiment at station 2 is finished, a second experimental series started yesterday at station 5 at 3° 30' N and the third series will

be conducted at appr. 40° N where we expect to meet the phytoplankton spring bloom of the north Pacific. At the station at the equator and during the intense work over the 24 hours we still found enough time to document our visit at this very special location appropriately by photos. On Whitsunday we steamed all day to arrive at our next station at 11° N on Monday at 2 am. Therefore we had enough time to celebrate this holiday appropriately by a barbecue in the hangar and on the working deck. The dinner was excellent. On behalf of the scientists I would like to thank the cook Andreas Spindler and his crew for this exquisite barbecue but also for the delicious daily meals.

With best regards on behalf of the scientists,

Meinhard Simon

