

4th Cruise report (May 16 to 23, 2016)

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

After cruising through the tropical and subtropical regions of the Pacific we reached the temperate zone at 37°N on May 23rd. The water temperature is only 16°C and the air temperature even only 12°C. From a European perspective one would not expect such low temperatures in these latitudes, but in the Pacific the influence of the temperate and subarctic zone without any barrier to the Arctic is effective much further south. We investigated a station at every 6th degree latitude, always alternating between a shallow one down to 1000 m and a deep one down to the bottom. On May 22nd the shallow station 12 was visited. The water color already indicated that the water is less transparent than in the tropics. The transparency measured by the Secchi disc was only 14 m and no deep chlorophyll maximum existed. The towed Bongo net contained for the first time radiolarians and many crustacean zooplankton, a clear indication of the higher productivity in these latitudes. Further, quite a few plastic particles were trapped as well, a clear sign of civilization and presumably a hint to the large amounts of plastic in the north Pacific central gyre. Indications of this much more productive area were discernable since the day before yesterday, as more pelagic birds occurred, mainly petrels and albatrosses and on May 21st also the first whales were spotted, mainly minke whales.

The occurrence of plastic particles at the surface and their colonization by animals and microorganisms is one of the topics of the group on board from the University of Vienna. Its leader, Prof. Gerhard Herndl, is not on board but well represented by his senior research associate Thomas Reinthaler, who, together with five colleagues, carries out the work on board. The main question of this group is to investigate the carbon cycle in the deep ocean and the identification of the prokaryotes involved, mainly Archaea. Because quite a few of them are able to fix CO₂, i.e. live autotrophically, they measure in water samples from below the illuminated near surface layer how much CO₂ is fixed. Further, they study how fast, or more precisely how slow the prokaryotes grow in the deep ocean, how much biomass they produce and which significance these processes have for the carbon cycle in the oceans. The processes in the deep ocean are much slower than in the near surface layer due to the low temperature, the scarcity of nutrients and the fact that much fewer microorganisms dwell in these depths. However, one should not underestimate the significance of these processes simply because of the enormous range of the deep oceans. In a related project they investigate whether the Archaea can use urea to meet their carbon demand at least partially. In a pilot project dissolved proteins are isolated from the deep sea for a later identification. Therefore the proteins are concentrated from 480 liters of sea water, which takes two days. As the abundance of microorganisms in the deep ocean is lower than in the near surface ocean by at least a factor of 10, in depths below 3000 m up to a factor of 100, the Vienna group requires large amounts of water, for the mentioned analyses 1000 L and for several experiments between 240 and 480 L, equivalent to half or all bottles of one CTD cast. Thanks to the large volume bottles this demand of water is no problem and so far all water wishes were fulfilled. Below 2000 m the prokaryotes obviously are adapted to the high pressure which, however, may inhibit their growth at atmospheric pressure at the surface, causing technical problems for measurements at atmospheric pressure. Therefore, at one station the growth of the prokaryotes was measured in a special incubator in 2000 m depth by deploying it fixed at a steel wire for eight hours at this depth. The data of this experiment are still being processed.

Meanwhile every scientist is well acquainted with all rooms and spots on board. The last missing areas of the ship to become acquainted with were the facilities in the lower decks where the engine and power unit, the winch room, the drinking water processing facilities and the sewage treatment system are located. The chief engineer, Achim Schüller, gave a very interesting and competent guided tour through these catacombs of the ship which remain unnoticed when the ship is steaming and the scientists are working. It became clear to everybody that for the smooth operations and the most complex requirements of this research vessel a technical team is on duty which is very well familiar with all facilities on the lower decks. Smaller or larger technical problems, which occur again and again, are solved and fixed such that the scientific work on board is affected not at all. On behalf of the scientists I would like to thank Achim Schüller and his team very much for his unnoticed but most valuable commitment.

With best regards on behalf of the scientists,

Meinhard Simon



Foto: M. Simon



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