

Expedition SO287 – CONNECT

11.12.2021 - 11.01.2022

Las Palmas - Guayaquil

1st Weekly report

10.12. - 12.12.2021



A good start to the big measurement cruise across the Atlantic

It's two o'clock in the morning and I've just come from the bow of RV SONNE, where I collected one of our first air samples in a stainless steel container that looks a bit like a rugby ball. As the sample pump was warming up, I once again had a few minutes to look up into the dark sky over the ocean, which compensates for the many efforts of the intense preparation time of this expedition with the intense twinkling of the millions of stars that are so visible out here.

Now we have finally arrived here after our research proposal for the four-week expedition across the Atlantic was approved in July of this year. Several proposals, thousands of emails, phone calls, forms, video conferences, contracts, signatures, acquisitions, certificates and questionnaires later we made it to the large current, which transports seawater from Africa across the Atlantic to the Sargasso Sea and all the way to the Caribbean. The biogeochemical processes that occur during this journey have been poorly understood. Therefore, we, an international team of 39 scientists together with the 30 crew of the research vessel SONNE will cross the Atlantic over Christmas on the expedition SO287-CONNECT, taking thousands of measurements - also to clarify how these processes are linked to climate change.



Fig. 1: Scientists of SO287 arriving at the vessel

Although the Atlantic is several thousand kilometers wide, the water masses in the west and east of this large ocean are closely interconnected. Off West Africa, nutrient-rich water rises from the deep and promotes the growth of plant and animal microorganisms and fish at the

ocean surface. Some of the water is carried by a large current - the North Equatorial Current - as far as the Gulf of Mexico and the Caribbean. This water mass transport is so important because it carries large amounts of organic material to the open ocean. For microorganisms such as bacteria, they act there like an elixir of life. But how these nutritious remnants of algae and other substances are processed by microorganisms on their long journey, biochemically transformed, decomposed into nutrients and respired to carbon dioxide, has so far only been incompletely researched. Therefore, on December 11, 2021, we set out west from Las Palmas de Gran Canaria to take water samples at many locations all the way into the Pacific Ocean and to measure trace substances in the atmosphere. After passing the Panama Canal, RV SONNE will reach its destination port in the Ecuadorian city of Guayaquil on January 11, 2022.

On our route, we will follow the water masses to the Sargasso Sea where we will celebrate Christmas with twelve nations. Also Christmas we will sample air and sea water to provide new details about the large cycles of carbon and nitrogen, but also of many other elements, such as oxygen, iodine, bromine, sulphur and phosphate. How are biogeochemical and ecological processes linked over large distances, and how large are the amounts of substances exchanged between the ocean and the atmosphere?



Fig. 2: The equipment in the boxes must be transformed into a laboratory in the shortest possible time (Photo: Folkard Wittrock)

We are studying iodine compounds and other trace gases from the ocean that can promote cloud formation and affect climate. How much will Sargasso kelp, which we hope to sample during the expedition, release iodine and halogenated hydrocarbons into the atmosphere? In addition, bromine and iodine compounds are generally emitted naturally from the ocean into the atmosphere, and some reach the stratosphere where they contribute to ozone depletion. We will therefore measure exactly how much of these compounds are released and at what locations, and how they are transformed in the ocean and in the atmosphere. To do this, we will measure the trace compounds on board in the seawater samples and the air using state-of-the-art technology. We are also investigating the influence of various natural parameters such as temperature and solar radiation on the biogeochemical transformation processes in incubation experiments in order to understand the influence of climate change on the processes.

We are also interested in how the busy shipping traffic on the Atlantic influences the material cycles in the ocean. For example, large quantities of nitrogen oxides are introduced into the water via ship exhaust. It is unclear to what extent these affect the natural nitrogen cycle.

Today, many ships are equipped with exhaust gas purification systems that remove sulfur compounds from the exhaust gases. We are also investigating the impact of the resulting sulfurous, acidic and dirty water on organisms and biochemical processes in the ocean. We are taking the opportunity to capture plastic debris in the ocean with a fishing skid and investigate its contribution to global biogeochemical transformation processes.

With this voyage, the research vessel SONNE has finally set sail again for one of its most important areas of operation - the Pacific Ocean - after a long forced break due to the Corona pandemic, during which cruises just on the Atlantic Ocean were possible. All of us on the cruise have been double and triple vaccinated and have had to submit PCR tests in order to be allowed to embark on the voyage, and we are still wearing masks until we can be absolutely sure that no virus will ruin our research and mood. We are overjoyed to be able to undertake this unusual expedition, which will give us the opportunity to explore very fundamental questions in detail. Throughout the cruise, we will be taking water samples regularly at noon at the highest position of the sun and in the middle of the night. It will be particularly interesting to compare the readings from midday and from the night, because solar radiation influences many biogeochemical processes. The fact that we will be traveling over Christmas does not bother us, given the unique opportunity for this expedition. However, because it is a special period, some colleagues were not be able to join. However, many students have taken the opportunity for their master's theses and are looking forward to Christmas in the Sargasso Sea and New Year's Eve in the Caribbean, which promises a short relaxation to the round-the-clock work on the expedition.



Fig. 3: Leaving Las Palmas (Photo: Henning Burmester)

But for now, many eyes are red and many tired faces are seen today, as a day and a half of setting up complete labs, from the arrival of the equipment to the start of the expedition the day before yesterday and the start of measurements four hours later, requires a lot of strength, energy, organization and stamina. Some students are on a research vessel for the first time and underestimated the effort, which is required to make experiments and sampling go well. Also, the ship movements and all the work involved and things that need to be learned to make sampling happen take their toll. Not to mention the masses of samples that are suddenly available after the 288 litres of seawater from various depths have reached the surface in the 24 bottles of the bottle-rosette, and twenty people in hundreds of different containers have carried the water to the labs where it must now be processed. But I'll tell you about that next week. It only remains to mention that despite the current exhaustion, everyone is in a good mood and there is a very pleasant and cheerful atmosphere on board. Let's hope that it stays like this and that we can continue our successful start.

With best regards, the team of SO287-Connect will see you next week.

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