



## SO264 SONNE-EMPEROR

Weekly Report No. 3

(July 9.-15., 2018)

In the course of the past week, FS SONNE has made huge strides in crossing the subtropical vortex of the North Pacific and reaching the actual SO264 study area in time. On Monday, Wednesday and Friday we completed our "Trans-Pacific water sampling program", which already had begun at 7 °S, at 18 °N, 27 °N and 33 °N. The last station was also the beginning of the marine geological work in the area east of the Kimmei volcano in the southernmost area of the north-south oriented Emperor seamount chain.

The sampling of the water column is a small, although exciting program. After crossing the equatorial currents, plankton assemblages have increasingly changed to species communities that can tolerate nutrient-poor conditions. Upon reaching the northern margin of the subtropical gyre, we see a further adaptation of the species to new environmental conditions.



*Deployment of the geological core device from FS SONNE*

This subtle vortex-like circulation pattern, turning in a clockwise direction and occupying almost the entire North Pacific, became subject of wide discussions: Due to its high amount of floating garbage, it is referred to as the "Great Pacific Garbage Patch". Unfortunately, we also realized that the subtropical gyre is indeed characterized by high proportions of floating trash, and in this respect is different from ocean regions to the south and north. Although being thousands of miles away from human settlements, we observed floating garbage that came along every few minutes on our route between 10 °N and 30 °N, be it plastic bags, light bulbs, fishing net balls, styrofoam, or plastic pieces.

At ~32 °N we leave the influence of the subtropic gyre and slowly enter the realm of the Kuroshio Current, one of the largest current system in the world with a transport volume of ~45 million cubic meters of water per second. The Kuroshio transports tropical heat northward, converges with the southward flowing Oyashio Current off Japan and is deflected



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eastwards into the North Pacific. There, it acts as an oceanographic and climatic barrier - further north, the air and water temperatures will drop significantly.

The focus of our paleoceanographic studies is sampling of sediments on top of submarine volcanoes of the Emperor Seamount Chain, the youngest of which is Hawaii. These volcanoes rise several 1000 m above the deep sea plain, which is at 5-6 km water depth. Interesting for paleoceanographers is that the preservation of tiny calcitic microfossils in these relatively shallow water depths is very good compared to the corrosive regions of the deep North Pacific. The isotope-geochemical signature stored in these calcitic shells provides important insights on how the ocean circulation has changed in the past.

In the first three days of the geological program, various sediment cores from different water depths and areas have already been obtained and processed. Samples from these cores have been collected and archived for a wide variety of analytical approaches. The time-consuming measurements, however, will be made in the home laboratories after the samples have been shipped back home by container from Yokohama (Japan).



*Deck work onboard RV SONNE during SO264*

Surprisingly, on the summit of the volcano Koko in ~1000 m water depth our coring device got stuck in a sediment deposit, which due to its composition does not belong to a deep sea environment. Visual inspection identified it as a shallow-marine lagoonal deposit enriched with biogenic debris. The initially enigmatic geological finding of such a lagoonal sediment at such great depths was quickly explained. The reef atoll, which formed ~50 million years ago around a volcano towering above sea level, sank to great depth on an aging and cooling lithospheric plate after volcanism declined. It remains questionable in this respect whether these sunken lagoon sediments have never been covered by other deposits since then, or whether erosive ocean currents have incessantly prevented any sedimentation since millions of years until today.

According to our preliminary station planning, we will hit the next volcanic cone, Ojin Seamount, already tomorrow. In good spirits and best support by the SONNE crew, we send cordial greetings from the 36 °N 171 °E to those left at home.

On behalf of the cruise participants  
Dirk Nürnberg