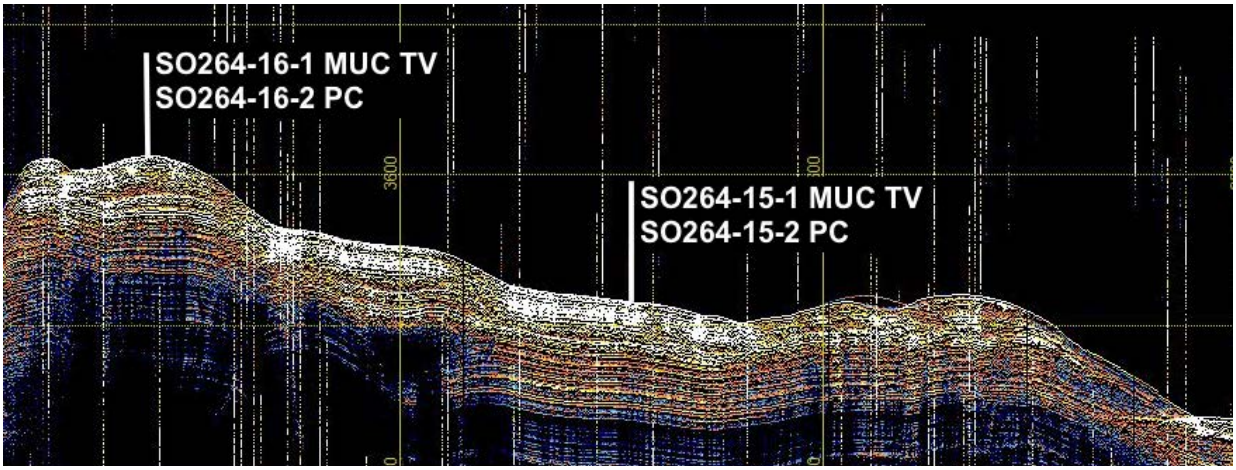
SO264 SONNE-EMPEROR

Weekly Report No. 4
(15.7.-22.7.2018)

Over the past week RV SONNE has left the influence of the Kuroshio Current system and has come into the influence of the counterclockwise rotating Subarctic Gyre. Together with the Subtropical Gyre they represent the two largest vortex systems at mid latitudes of the North Pacific. Both gyres, which are separated by the Kuroshio Current at ~37 °N are circulation patterns driven by trade winds and the west wind drift. When entering the sub-polar climate zone, the water and air temperatures decreased significantly and made cruise participants used to more tropical conditions increasingly feel chilly. Today, on Sunday, 22.7.2018, the air temperatures are at only 13 °C and the water temperatures are at 11 °C. Shorts and T-shirts were meanwhile replaced by long pants and sweaters. Since two days, the North Pacific became foggy and hazy all day, in rather weak winds.

Last week was marked by an intense geology program, several Emperor Seamount Chain volcanoes were mapped and sampled between 37 °N and 44 °N. These volcanoes are youngest in the south with ages of ~55 million years and age towards ~65 million years at 44 °N. With increasing age, they sink below sea level and are increasingly covered by sediments.

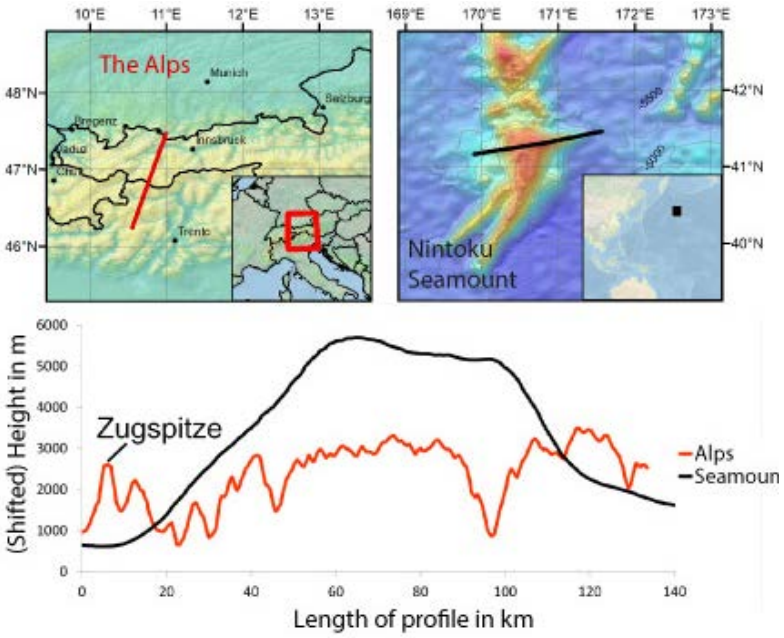
These oceanic deposits have been the focus of this journey: Comparable to the leaves of a book, these individual sediment layers store information about the past evolution of the ocean currents and the associated climate. They can be read out and interpreted by applying most sophisticated measuring techniques and following various scientific approaches. The primary intention of our research field is to understand the natural variability of the ocean-climate system in the context of future climate change.



The mapping of the marine deposits is carried out with the ATLAS PARASOUND sediment echosounder. Here shown, as an example, the seabed region in ~3200 m water depth east of the Nintoku volcanic area.

Before sampling the marine sediments, the seabed is mapped with echosounding systems which, on one hand, can display the seafloor three-dimensionally and, on the other hand, penetrate the upper 10s to 100s meters of the sedimentary deposits. These high-tech tools give us the opportunity to select good sampling locations. They also allow us to improve and

to correct existing bathymetric records. Hours and days are spent for intensive and systematic mapping. Using a cruising speed of 6 kn, 60 nautical miles or nearly 120 kilometers can be recorded in 10 hours – which is a time-consuming approach in view of the huge dimensions of the submarine mountains.



The comparative presentation of height profiles across the Nintoku Seamount and the Alps illustrates the gigantic dimensions of the submarine volcanic structures of the Emperor Seamount Chain. The Nintoku volcano overtops the Alps by more than 2000 meters in altitude.

As expected, the search for good sediment deposits turns out to be quite difficult. Our ambition is to recover sediments rich in biogenic calcite that is preserved only rarely in the relatively flat regions of the North Pacific: that's why we focus our work on the "volcanic peaks". During the last few days we worked on the flattest regions of the Ojin, Nintoku, Yomei and Suiko volcanic regions, but also sampled the volcanic flanks down to water depths of ~5700 m.

For the recovery of sediment cores, we use wire-guided, up to 20 m long gravity pipes, which are lowered and retrieved via the ship´s lowering gear. Meanwhile, we have gained a large number of high-quality, carbonate-rich sediment cores from various water depths, from which we will produce paleoceanographic and paleoclimatic data series. We must realize, however, that the summit regions often consist of bare basalt rocks, since sediments down to depths of ~1800 m are eroded or transported away by strong bottom currents. The search for sediment pockets is tedious, but not impossible.

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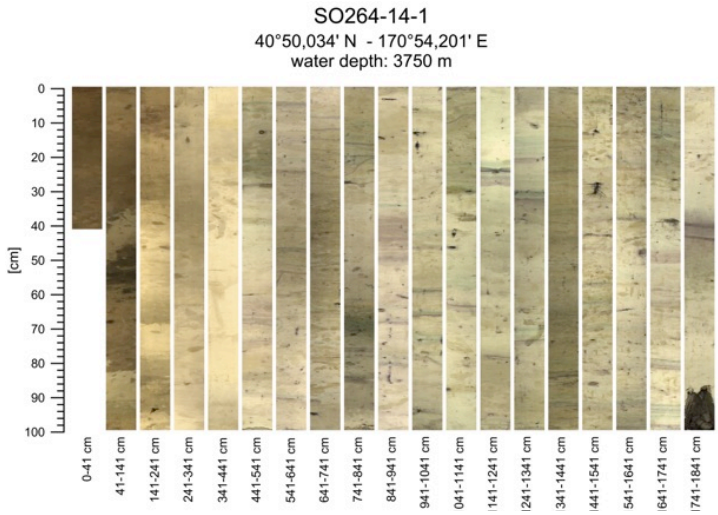
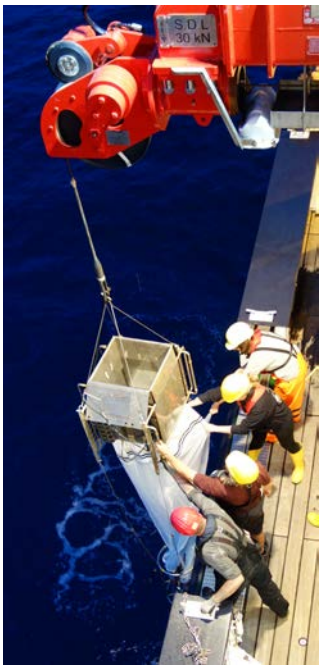


Bright carbonate-rich sediments can be found in large water depths of up to 4200 m. They contain abundant planktonic and benthic unicellular microfossils (foraminifera) - the most important (isotopic) geochemical signal carrier in paleoceanography. Cooler climatic periods are clearly recognizable by darker colors. Also typical are basaltic pebbles and sand layers, which suggest intensive downhill transport. Prominent volcanic ash layers can contribute important information to the age of the deposits.

Our intensive sampling program of the water column will continue at Suiko Seamount, which will serve to calibrate and further underpin the proxy parameters used in paleoceanography. The oceanic mixed layer is commonly sampled by multinets in order to describe calcitic and siliceous plankton communities.

Multinet in continuous use in order to study plankton communities.



The scientific work is in full swing and the various disciplines work hand in hand to quickly process the numerous sediment cores. Even if the busy days become sometimes long, the preparation and analysis of the samples is fun for all of us. Tomorrow, we will “climb” the next summit, in the best mood and greatly supported by the RV SONNE crew. All send cordial greetings from 44 °N 170 °E to those who stayed at home.

On behalf of all cruise participants

Dirk Nürnberg