

# Research Vessel SONNE

SO266:

Kaohsiung – Kaohsiung

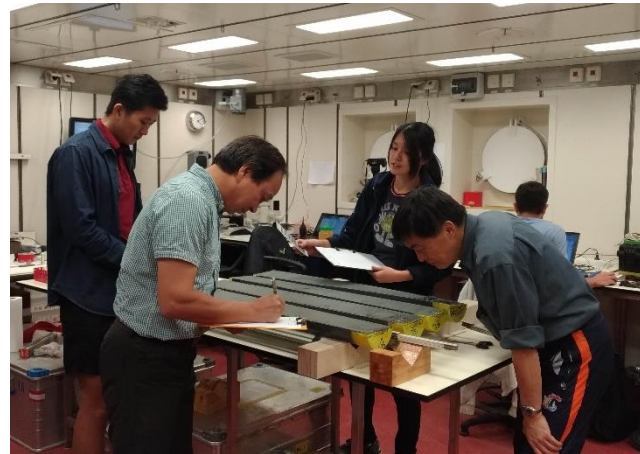
Fifths and last weekly report: 12 – 18 November 2018



Last week, with the 10th and 11th MeBo drilling of this cruise, two important holes were drilled in the eastern working area in the accretionary wedge. On Monday and Tuesday, 12 and 13 November, we drilled 77.4 m deep on South Yungan East Ridge, recovering older sediments of the accretionary ridge below a geological unconformity. Unfortunately, the hope of drilling gas hydrates in the fracture zones that are visible in the seismic data was not fulfilled. While indications of large gas volumes were ubiquitous, there were no indicators of gas hydrates, such as chemical anomalies, or soupy layers in the sedimentary sequence. The well-trained work force in all laboratories (Figures 1 and 2) ensured that we were able to present all data from this drilling as early as Wednesday, November 14, as part of the daily science meeting at 15:30. The MeBo team started on this day with our last hole on Four Way Closure Ridge, which was aimed at drilling a deep sediment sequence between 115 and 140 meters, which is represented by high amplitudes in seismic data. An earlier hole that we drilled at the same site previously only reached depths of 126 meters, but showed signs of sand deposits, which have a high potential for gas hydrate presence. A second earlier hole at the location that used a different drilling technique, i.e. it did not core sediments but merely logged physical data of the rock formations at depths of up to 144 m. Based on the results we proposed numerous layers of sand at depth. In the new core drilling, which unfortunately did not quite reach the depth of 144 m, numerous sand layers were actually present, whose gas hydrate saturation could be determined with a high degree of confidence on the basis of the chloride and IR temperature anomalies. Thus, a very important goal to prove gas hydrate occurrences in coarse-grained accretionary wedge sediments was reached in the last week of the expedition.



**Figure 1:** View of the dry laboratory 1 of FS SONNE, where the chloride, sulfate, ammonium and hydrogen sulfide contents of the pore water are analyzed after each drilling (© Tzu-Ting Chen).



**Figure 2:** The geological processing of the sediment cores in wet laboratory 2. In addition to a detailed description of the cores, the first micro-paleontological investigations are also carried out (© Tzu-Ting Chen).

On Thursday and Friday, 15 and 16 November, we sampled the water column above the Formosa Seep with the ship's CTD at many sampling points around the seep area which has a diameter of approx. 140 m. Significantly higher methane concentrations up to 2000 nM were measured in the sampled water, whose distribution pattern also clearly indicated the source at Formosa Seep. On Thursday morning, 15 November, we were visited by the new Taiwanese research vessel LEGEND, which TORI is currently commissioning (Fig. 3).

After nearly 5 weeks of intensive research on FS SONNE, we look back on eleven MeBo boreholes that we have successfully completed at 6 different locations. No other exploration could previously drill 8,300 feet with the MARUM seabed drill, with over 420 meters of drilling and over 350 sediment cores collected. This corresponds to a core recovery of more than 83% in predominantly difficult-to-recover gas-rich deposits, which expand during retrieval from their rock formation, so that it often comes to loss of sediments. Two pressure cores successfully recovered sediments with gas hydrates. Never before has MeBo completed over 480 meters of borehole logging. In addition, 15 CTD stations were carried out during the cruise, 9 gravity cores were taken and 26 heat flow measurements in surface sediments and 6 observation profiles on the seabed were carried out with the new OFOS. Between station work, the swath bathymetry and sediment echosounders measured over a distance of 4,180 km along the seabed, so that a bathymetric map of about 8,000 km<sup>2</sup> with the highest resolution ever in Taiwanese waters could be created.

The success of the scientific work is also due to the excellent and friendly support of the ship's crew in all areas (nautic crew, WTD, deck crew, machine and service area, etc.) and the shipping company. For that, we thank master Lutz Mallon and his entire team, who supported us in all matters. Many thanks also go to the MeBo drilling team, which continuously advanced the drilling process during their shifts. R/V SONNE is ideally suited for research cruises with MeBo200 due to its ample deck space, cranes, laboratories and accommodation capacity (40 science berths). One of the highlights is the large space on the working deck, the large hangar and the cold rooms at working deck level, which greatly facilitate the handling long sediment cores. The joint cruise of GEOMAR in Kiel and MARUM Bremen is a scientific cooperation with Taiwanese institutes, whereby the National Taiwan University (NTU) in Taipei with Prof. Saulwood Lin is the coordinator on the Taiwanese side. The scientific post-processing of the valuable data collected during the SO266 expedition will be jointly performed during the upcoming months and presented at a first meeting in Taipei in October 2019 during the 9th TaiGer meeting.



**Figure 3:** On Thursday morning the Taiwanese research vessel LEGEND visited us. The ship was built in Vietnam, was recently acquired by the Taiwan Ocean Research Institute TORI and is still in the testing phase (© Berthold Schütte).



**Figure 4:** Group picture on the bridge deck. It's done; On Friday, November 16 at 08:00 the last station work of SO266 was completed with a CTD. The last two expedition days were used for seafloor mapping (© Berthold Schütte).

Today, 18 November, we reached the port of Kaohsiung and immediately began to clear the expedition equipment and the containers. While our Taiwanese scientists are already at home, most of us will return home by plane tomorrow.

Everyone is healthy; It greets one last time from this trip on behalf of all cruise participants (Fig. 4)  
Gerhard Bohrmann

R/V SONNE, Sunday 18 November 2018