



Expedition SO251

3. Weekly report



RV Sonne was in Yokohama port from 15.-18. October in order to load and mobilise the Heat flow probe as well as the remotely operated vehicle PHOCA of our colleagues from GEMAR Kiel. Despite the delivery of ROV PHOCA on very short notice because of the stranded expedition equipment on HANJIN vessels, the harbour test was successful. In Yokohama we also had visits from several groups from JAMSTEC and CDEX to see RV Sonne and discuss scientific strategies. We also had a visit from GOOGLE Culture videographers, footage of which will soon be available as a virtual ship's tour on RV Sonne via the internet.

The SO251 science party was partly exchanged to meet the requirements in the second study area and expedition leadership went to Achim Kopf, Professor of Marine Geotechnics at MARUM Bremen. The international scientific team now consists of 34 persons from 10 countries (20 Germans, 4 Japanese, 2 Taiwanese, 1 Italian, 1 Brazilian, 1 American, 1 Dutch, 1 Austrian, 1 Belgian and 2 Swiss). The team had partly worked together on leg SO251-1 already and harmonises extremely well.

On 18.10. at 8 o'clock, RV Sonne left Yokohama and reached the research area of leg SO251-2, the Nankai Trough, in perfect weather conditions. In contrast to the Japan Trench margin with subduction erosion in the North, the Nankai Trough region is characterised by a huge accretionary complex. In Nankai we have fairly regular earthquake activity with magnitudes exceeding M8, which are often accompanied by mass wasting and tsunamis. Regardless of the earlier campaigns by IODP (expeditions 332/333/338/348) there is still a severe lack of understanding which factors control the onset and recurrence of large earthquakes. During the recent MARUM expedition SO222 we completed several MeBo seafloor drill holes in Nankai, some of which host observatory instruments since 2012. One major objective of the second leg of the *EAGER-Japan* project is thus the recovery of these instruments using ROV PHOCA. Additional piston and push cores in both the Kumano Basin and the slope of the accretionary prism are aimed to shed light on both fault slip activity and fluid seepage as a result of seismicity. Heat flow measurements and hydro-acoustic surveys will further allow us to identify fluid originating from depth and reaching the seafloor.

The scientific work on leg SO251-2 started with heat flow measurements across a mud volcano and along a N-S profile across the Kumano Basin, which complements data from cruise SO222 in 2012. Elevated heat flow values on mud volcano MV13 indicate fluid mobilisation from depth. Equally, the first dive of ROV PHOCA on mud volcano MV2 found several younger mud extrusions. Measurements by the ROV with a short temperature lance (T stick) attested that the most active zone is the crater area in the southwestern summit. At the crest we also observed living clams, bacterial mats, and occasional large clasts of several decimeters in diameter.

Indications for fluid seepage were also found on mud volcano MV1, MV11 as well as on a topographic high termed „Joseph“ given its vicinity to „Maria“ mud volcano. In a piston core

from that area we suspect elevated methane concentrations (which will be measured at University Bremen later), but primarily hemipelagic background sediments. Mud breccia was probably absent, however, some intervals may be interpreted as mud flow deposits. Detailed interpretations will be gained from post-cruise research in the laboratory.

Piston cores at the flank of mud volcanoes „Maria“ and MV1 show homogeneous mud breccia with light grey matrix and occasional small clasts. Pore waters show subtle freshening (i.e. 80-90% SW salinity), indicating deep-seated fluid origin.

Dives 2 und 3 with ROV PHOCA served to localise and recover the MeBo-borehole observatories. In the summit area of MV3 we had problems with the positioning system but still discovered one of the two instruments. On mud volcano MV4 we found one observatory quickly and worked on it. Given that the hotstab connection was too tight to be loosened, the skillful approach by the ROV pilots allowed us to unscrew the entire upper MeBo drill rod. As a consequence of the longer item, the so-called MeBoCORK-A currently resides on the seafloor and an attempt for recovery is planned in an upcoming dive.

We are currently in transit to the pilot station where we drop the JAMSTEC coring technician, who is needed on another mission. We want to thank our Japanese colleagues again for their willingness to collaborate and help out with equipment without which this cruise would have been impossible to run.

Achim Kopf (Chief Scientist SO251-2) on behalf of the entire SO251-Team

Right: Flares in the water column indicate seepage activity of mud volcanoes MV1, MV11 and „Joseph“ topographic high.

Below: Photos of ROV PHOCA operated by GEOMAR Kiel with observatory recovery device (left) and underwater pictures of the MeBoCORK-A (middle) and –B (right) instruments.

