TFS SONNE Expedition SO247 SlamZ

– Slide activity along the Hikurangi Margin, NZ

3. Weekly report: 04.04. – 10.04.2016

And here we are approaching the end of the second week. After having reached a sub-seafloor depth of 50 metres at our second MeBo station last Sunday, we reached a maximum borehole depth of 82.3 metres on the following Monday. We were quite surprised as we removed the liner from the core barrel: very good core recovery of more than 60% up to a depth of ~23 metres, but unfortunately followed by a large gap to ~65 metres sub-seafloor depth. Deeper than 65 metres the liners were again filled with sediments. After splitting the cores it was apparent that the bounding core segments were characterized by interbedded sandy material and repeating layers of clayey-silty ash layers. Our initial suspicion is that the missing depth segments in the core might have been caused by thick turbidite sequences with high sand content that are likely difficult to recover during drilling.

On the bright side however, our borehole has provided the first insight into the nature of material at sub-seafloor depths of more than 80 metres on the Hikurangi slope margin. The sedimentology group led by Alan Orpin (NIWA) described the material as greenish-grey, very stiff, clayey silt. These deep core segments also show repeating regions of massive, disturbed sand material. The colleagues estimate that the clay contents in these regions are up to 20-40%. The disturbed regions in the core are highly likely to have formed during the dissolution of gas – an interpretation that is supported by both the methane analyses and pore water anomalies. These methods confirm the presence of methane in the core, but in such low concentrations that the formation of massive gas hydrate at these depths is very unlikely. It is more likely that if hydrate formed at these depths it would be dispersed and finely disseminated, and any hydrates that might have existed in the core would have dissociated into free gas during recovery.

Fig.1: A scan of the sediment core GeoB20803-2 from a depth of 79 metres shows clear zones of disturbance caused by the gas dissolution.

After MeBo was recovered on deck, we used the following night to continue our heat flow mapping of the Tuaheni landslide. The survey went off without a hitch and was completed relatively quickly in the shallow water depths of up to 750 metres. The geophysicists in charge were able to complete two long profiles with a total of 23 stations and are already evaluating and modelling the acquired data.

On Tuesday morning we then left the northern working area and made our way south to our second working area, Rock Garden. The general work programme at Rock Garden is very similar to that of Tuaheni. First up, on Tuesday evening, we ran a CTD profile to calibrate the echo-sounder systems. We followed this with a high-resolution mapping survey of Rock

Garden. Based on the multibeam and Parasound datasets acquired during this survey we then chose gravity core sites to test for the best locations for a MeBo deployment. The periods of time between MeBo deployments during the week were, as previously during the voyage, used for mapping and heat flow measurements. The data are being processed and we will give more information about the results in the next weekly report.

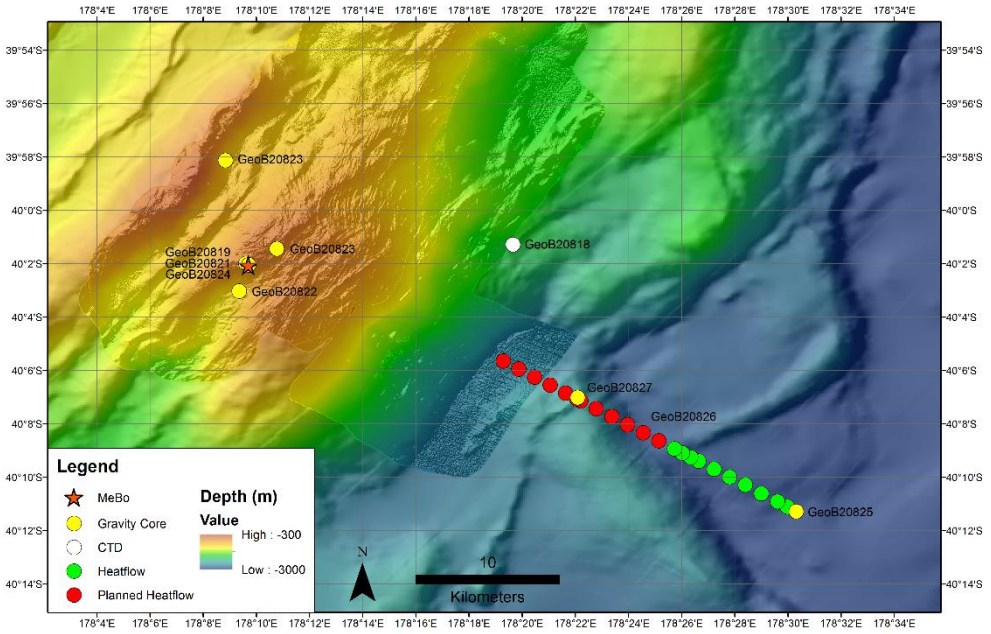

Fig. 2: The Rock Garden working area showing the locations of cores and heat flow measurements.

Two gravity cores GeoB20819 and GeoB20823 taken at the top of Rock Garden exhibited only a thin sediment cover of approximately 1 meter. In contrast, we reached coring depths of approximately 1.6 meters at the stations GeoB20821 and GeoB20824. The cored sediments consisted of mainly stiff clayey silts with frequently embedded tephra layers. Although we had some initial concerns about whether MeBo would be able to land on the presumably very hard material of the accretionary ridge, the location we chose turned out to be an ideal landing spot. After 14 meters of the first drilling attempt we had not intercepted the expected hard rock. What was drilled, were clayey silts with interbedded ash-rich sediments. A second rotary-drilled borehole at the same location, 35 meters long this time, painted the same picture. Since we were expecting hard rocks at ~20 meters beneath the seafloor, and had based our drilling strategy on that assumption, the core liners were only ~25% filled with sediment. Based on this result, we made the decision yesterday afternoon to go for a third attempt at this hole, but this time using a "push-core" drilling strategy to recover core. For both of these last two attempts the hole was (or will be, in the case of the current hole) logged with gamma ray and dual induction. These logging data will enable us to correlate both cores with each other to produce an image of the sub-surface that is as continuous as possible. The correlation will be made easier by the fact that the two drill holes are only 14 meters apart. The positioning system of the SONNE and the navigating skills of those on the bridge are truly impressive!

Greetings from all cruise participants on board SO247 on behalf of

Katrin Huhn & Nina Kukowski