TFS SONNE Expedition SO247 SlamZ

– Slide activity along the Hikurangi Margin, NZ

4. Weekly report: 11.04. – 17.04.2016

The fourth week began with the successful completion of the first MeBo drill hole at Rock Garden (GeoB20824-4). The total depth of approximately 35 m was at a position above the bottom-simulating reflection (BSR), which marks the base of gas hydrate stability. As soon as MeBo was back on board, the liners were removed from the core barrels and samples were taken for gas analyses. After cutting out whole round segments from the core for porewater geochemistry, the cores were halved so that we could gain the first understanding into the nature of material at depth beneath Rock Garden. We were pleased with the very good total core recovery of well over 90% in eight of the eleven core liners, and recovery of about 50% in the remaining three liners (Fig. 1). In addition, we recovered two pressure cores deployed in this hole and measured gamma ray and dual induction properties with the core logging tool.

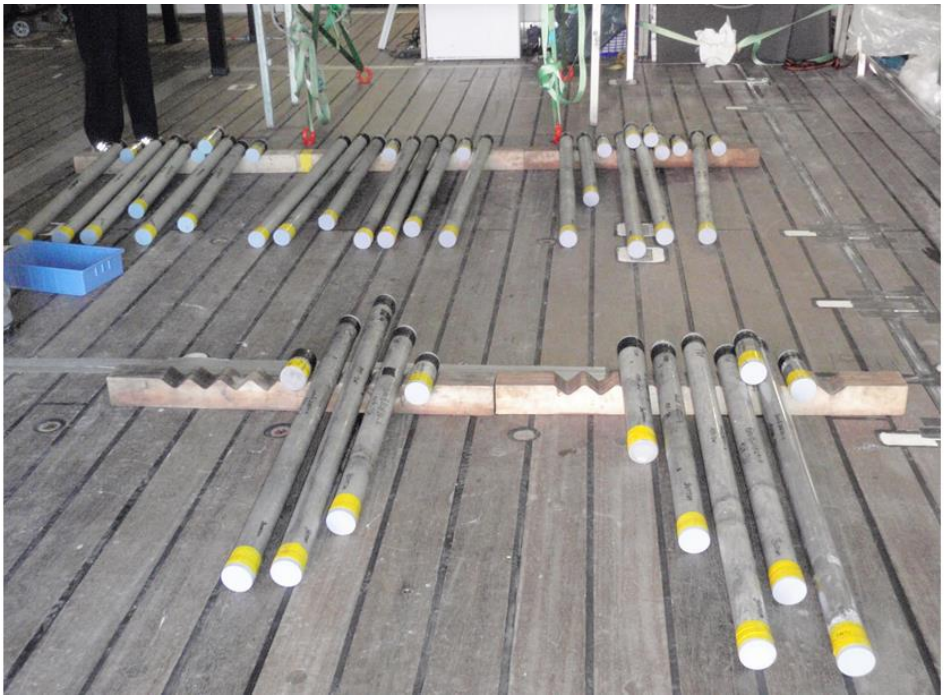

Fig. 1: Cores from MeBo Hole GeoB20824-4 laid out in the Hanger for geochemical sampling and division into working and archive halves.

Up to a drilling depth of ~20 m the sediments consisted of hard, greenish-grey, clayey silt with sections of turbidite material as well as embedded tephra layers. Below ~20 m the facies changed significantly; from here on we encountered laminated and very hard clayey silts. The material drilled will help us to understand the behavior of the sediments during uplift and erosion and thereby test a hypothesized mechanical weakening process on the ridge top that has been likened to the terrestrial frost heave process. Understanding the methane profile through the drill hole might prove to be a hard nut to crack, given that we observed practically

no methane in the upper 20 m of the core and then unusual concentration gradients deeper than 20 m.

Over the night from Monday to Tuesday, we continued with the heat flow profile along the lower slope of Rock Garden. In total 22 heat flow measurements were successfully recorded. These data reveal stable background values typical for subducting oceanic crust. The measured heat flow of 50 mW/m² indicates a crustal age of approximately 100Ma. Along the same transect several gravity cores were taken and the hydro-acoustic mapping was finalized before we left this region to return to Tuaheni. Two gravity cores taken from an active as well as inactive former gas flare structure which exhibits typical features indicating the presence of gas hydrates, eg carbonate facies and gas-induced fractures (Fig. 2).

Fig. 2: Typical seep-carbonate facies in gravity core GeoB20830-1

The Tuesday evening on the transit to Tuaheni, we have used the short break to celebrate the „Bergfest“ – halftime – with delicious pizza in the Hangar.

After arrival in Tuaheni, additional gravity cores were taken at the outer edge of the slide masses of southern Tuaheni as well as further down in the deeper canyon seaward of the landslide. Here, we could recover material from the potential glide plane on top of which the sediments were transported downslope. Cores showed a typical sequence of interbedded fine sand and coarse silt layers. Significant changes in dip angles of stratified lithologies as well as thin frequently occurring cavities with sandy fillings are remarkable and were observed here for first time. These sands are also present in most of the MeBo cores from the Tuaheni landslide and are assumed to cause the loss of MeBo core recovery when drilling the slid mass. So, the core recovery rate was again good with 42% when we drilled another leg at the Tuaheni landslide down to 77 mbsl on Thursday and Friday. Unfortunately, a few liners had very little recovery (<5%) between 37 and 60 mbsl. However, we have recovered with this core the first direct observations of the glide plane composition and can test a couple of hypotheses regarding slide mobility. In addition, gas sampling was intensified for the MeBo core to analyse the gas composition and gain a deeper insight into the gas hydrate system.

In the meantime, was also made heat flow measurements north of the Tuaheni landslide. The major aim of this profile was to gain a better understanding of a recently mapped double BSR. These structures are observed in previously acquired seismic data. A dense heat flow profile along the outcropping BSRs should enable us to test conceptual models for their origin.

After this very busy and core-rich week, MeBo has just been deployed again at the undeformed reference site in Tuaheni. With this, hopefully, successful core recovery to look forward to in the upcoming days we send greetings on behalf of all cruise participants on board SO247

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