

RV METEOR Expedition M154-2 SEKT

Sector collapse kinematics and tsunami implications



1. Weekly report: 29.04. – 05.05.2019

As the first 12 scientists of the voyage M154-2 arrived at the ship on the morning of 25th April, 8 containers were on the pier with scientific equipment ready to be loaded on board the Meteor. Among the equipment was the Bremen seafloor drilling rig, „MeBo70“. With support from the crew and crane operator, all of the scientific equipment was lifted on board and stored within three days; nearly 100 tons of scientific material and equipment has found its place on and under the ship's deck. Equipping the MeBo70 took 4.5 days and was successfully completed with the harbour basin test on the morning of Monday 29th April.

The previous day, an additional 11 scientists had arrived, giving a total of 23 scientists who met at the METEOR, with participants from MARUM, University Bremen, the GEOMAR, the University of Birmingham and the Southern Methodist University Dallas. By lunchtime on Monday the 29th April, all labs were set up, boxes were stowed away, and we left the Port of Pointe-à-Pitre, Guadeloupe.



Fig. 1: View over the working deck of RV METEOR towards our target area southeast of Montserrat.

At this point, we would like to take the opportunity to thank the entire crew of RV METEOR for their warm welcome on board and for their excellent support with setting up equipment.

After a short transit of 7h, we arrived in our research area offshore Montserrat and immediately continued with the hydroacoustic mapping of the target area, SE of the island, that our colleagues of the 1st leg M154-1 had started. As already mentioned in their weekly reports, the major aim of these cruises is to investigate distinct deposits of large-scale volcano collapses, of which there are several examples in this region, and to shed light on their timing and dynamics. To meet this aim, our colleagues on M154-1 collected high-resolution 2D and 3D seismic data which reveal new information about the internal structure and dimension of the deposits. On

the basis of these data, we will determine suitable locations to drill through the slide deposits, aiming to recover core material from the collapse itself as well as the underlying sediment, utilizing gravity coring and MeBo70 drill technology. Sedimentological and especially geotechnical analyses will serve as input parameters to simulate slide kinematics and thus gain a deeper insight into their tsunamogenic potential.

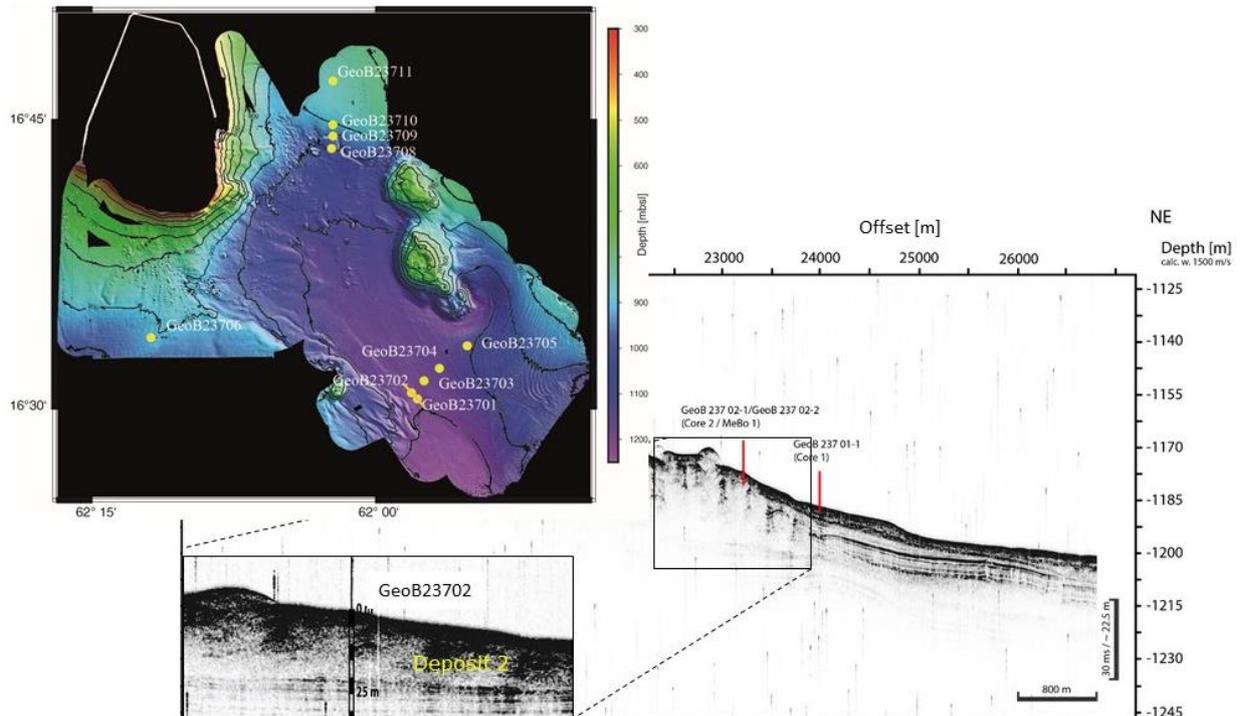


Fig. 2: shows the location of the first gravity core and MeBo locations.

On the 30th of April, we collected 5 gravity cores in a transect across the distal part of the largest near-surface landslide deposit offshore Montserrat, named Deposit 2 (GeoB23701-GeoB23705; Fig.2). Gravity core recovery reached a maximum of 2.98 mbsf, at the site also selected for the first MeBo drilling (GeoB23702), a very good recovery in this sandy sediment. During the subsequent MeBo deployment, a CPT (cone penetration test) profile was acquired to a depth of 12.8 mbsf, where the CPT hit a very stiff, sandy layer and measurements were stopped. The final borehole depth reached 30.46 mbsf, and an acoustic probe measured v_p velocities to 27.7 mbsf. Based on these data, drilling parameters were adjusted for a second MeBo deployment at the same location, which aimed to collect sediment cores through to the base of Deposit 2, which was successfully penetrated at approx. 21 mbsf. Here, a very prominent gravel layer was identified, coinciding with a significant magnetic susceptibility signal measured subsequently by the borehole logging tool. The final drill depth was 30.46 mbsf. Detailed core descriptions and further analyses and measurements will follow, but drilling at this first MeBo site has already achieved the aim of drilling the slide mass, glide plane and underlying stratigraphy, enabling improved age constraints and information on the emplacement dynamics of Deposit 2.

Initial core observations show that Deposit 2 is overlain by greenish-gray to brownish-beige, moderately bioturbated hemipelagic muds interbedded with normally-graded silts and sands, with cm to dm thicknesses, deposited by mass flows and density currents. These beds range from relatively pure volcanoclastic (lithic and crystal fragments) to bioclastic compositions, with some mixed deposits.. Parts of the MeBo core recovered mixed hemipelagic and volcanic lithologies, above the coarse gravel, while lower stratigraphy included volcanic beds with pumice clasts. Drilling disturbance in the recovered cores is nearly absent.

After the first MeBo location we used the next day to continue mapping and gravity coring in the area of the 2nd MeBo location, GeoB23711. The aim here is to drill undisturbed sediments incl. the potential glide plane of deposit 2, and thus to have a continuous sediment core for high resolution stratigraphy of this area. Based on this data we expect to obtain detailed information about long-term volcanic activity at Montserrat as well as timing of the major flank collapses.

At the moment, MeBo is drilling and we enjoy the short break to process data and to discuss our first results.

After an initial seasickness, everyone has now 'sea legs'. The weather god is with us - despite stiff breeze the waves are still moderate with max 2m of height.

On behalf of all on board M154-2, greetings from

Katrin Huhn