Prof. Dr. Sebastian Krastel
Christian-Albrechts-Universität zu Kiel
Institute of Geosciences
Otto-Hahn-Platz 1
D24118 Kiel, Germany

Tel.: +49-431-880 3914
Fax: +49-431-880 4432
email: sebastian.krastel@ifg.uni-kiele.de

Short Cruise Report RV Meteor-Cruise M155

Pointe-à-Pitre - Mindelo

26.05.2019 - 30.06.2019

Chief Scientist: Prof. Dr. Sebastian Krastel

Captain: Rainer Hammacher

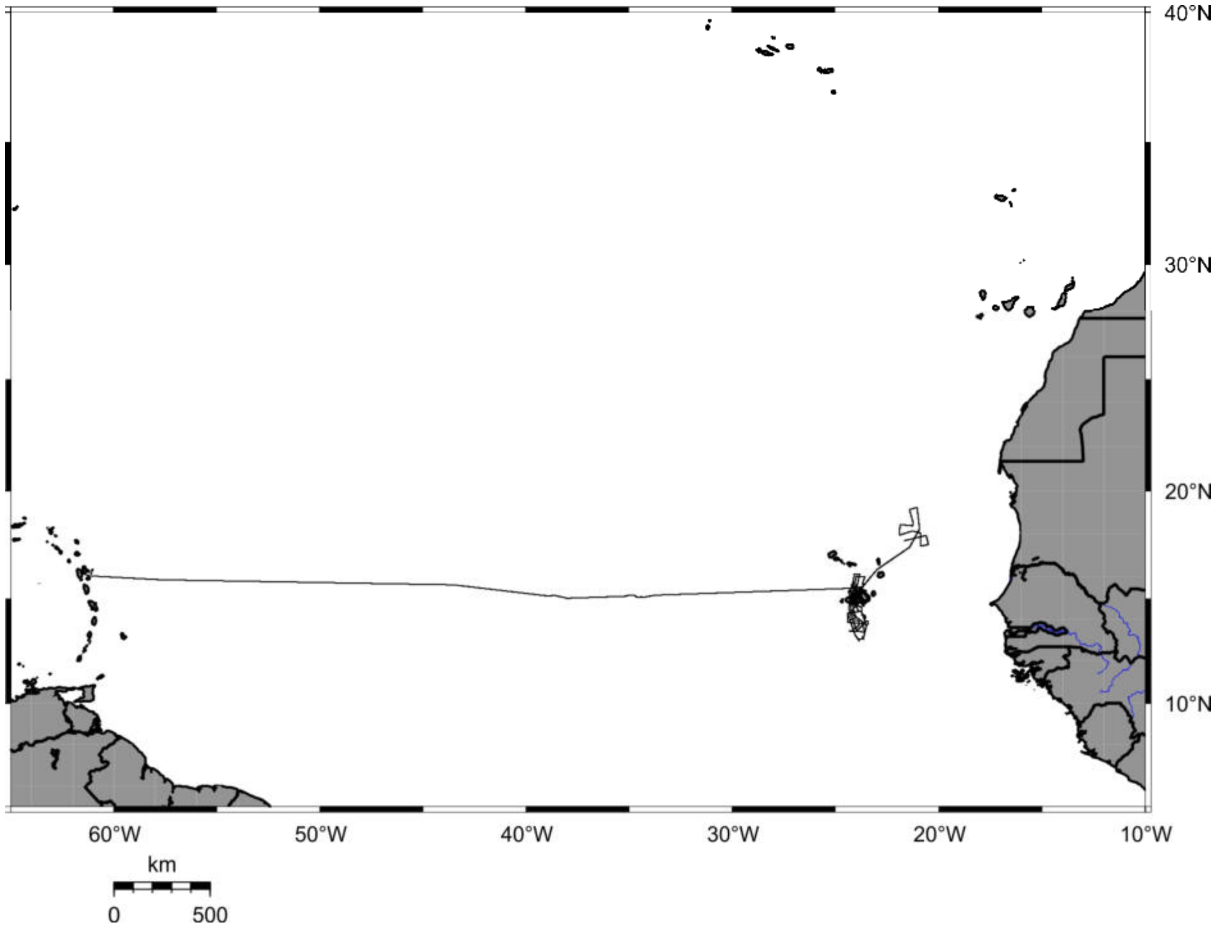

Fig 1: Track chart of Cruise M155 (Pointe-à-Pitre – Mindelo).

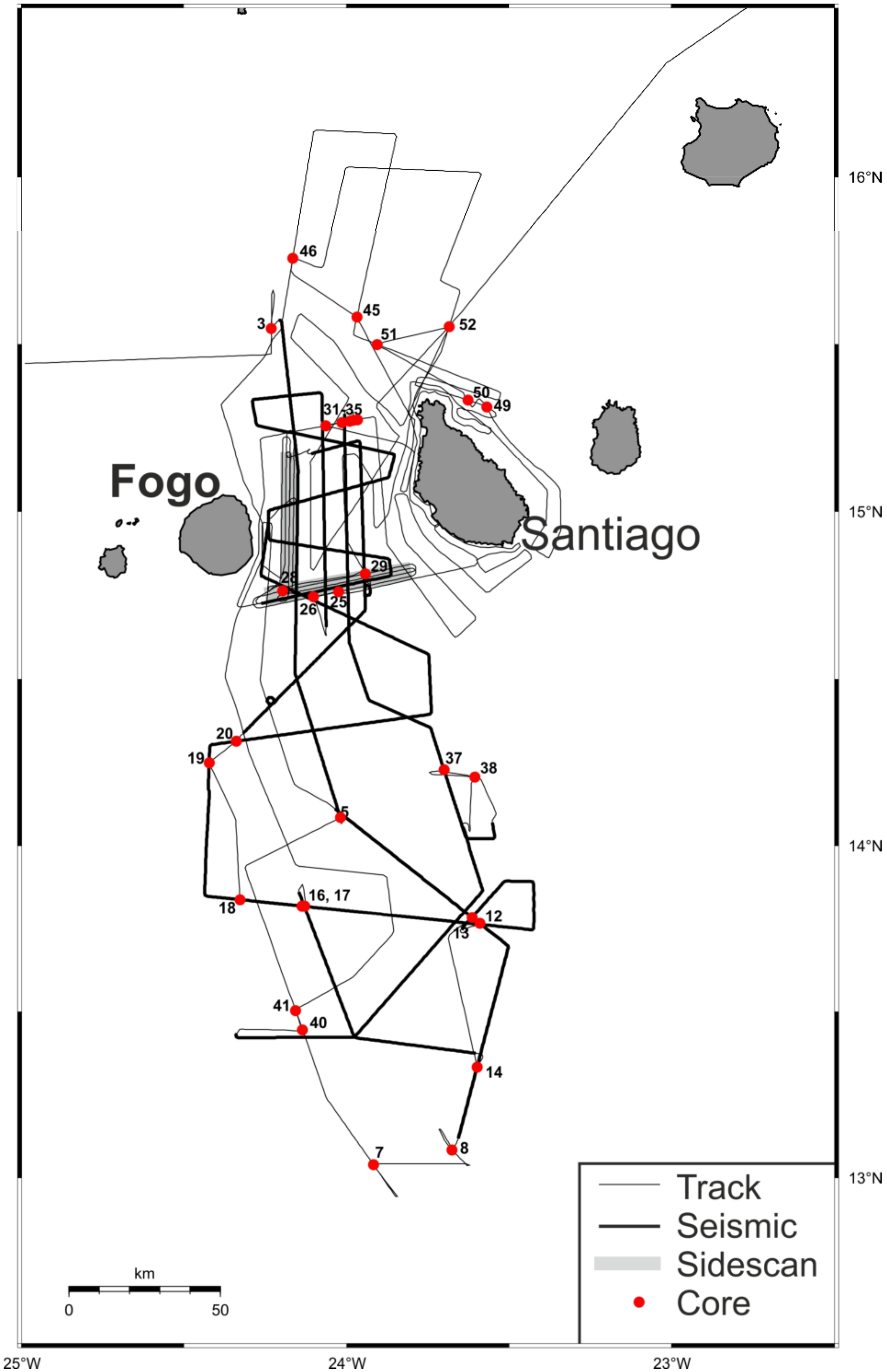

Fig. 2: Track chart of main working area between Fogo and Santiago

Objectives

RV Meteor-Cruise M155 realized two proposals with different objectives. The main part of the cruise was assigned to the proposal ‘The tsunamigenic gravitational flank collapse of Fogo volcano, Cape Verde Islands’. The cruise contributes to the assessment of poorly constrained and heavily debated tsunamigenic potential of large volcanic island flank collapses. The recent discovery of tsunamigenic deposits in the Cape Verdes shows that Fogo collapsed catastrophically at ~73 ka, resulting in a mega-tsunami. This provides a unique opportunity to reconstruct the generation and impact of a mega-tsunami, directly linked to a study of its trigger mechanism. Accordingly, offshore collapse deposits were investigated by means of (1) high-resolution mapping with multibeam and side-scan sonar to accurately determine the run-out distance, and the number of collapse events; (2) seismic profiling to image the deposits’ thicknesses and internal structure; and (3) coring to establish a stratigraphy of collapse events. This study will put us at a critical juncture where the latest developments in tsunami modelling can be integrated with physical evidence from both the offshore and onshore. A smaller part of the cruise was assigned to the proposal ‘Seismic pre-site survey for an IODP site on the Cape Verde Plateau’. The IODP full-proposal ‘Cenozoic climate, productivity, and sediment transport at the NW African continental margin’ (IODP proposal 933-full) addresses Neogene climate, sedimentation and ocean productivity along the continental margin of NW Africa. A central site is proposed on the Cape Verde Plateau close to ODP Site 659 but no modern high-resolution seismic data are available for this area. A seismic survey around Site 659 would have aimed in identifying a location where the Plio-Pleistocene is thinner and the Miocene is thicker than at Site 659. This would allow to APC-XCB deeper into the Miocene. This part of the proposal, however, could not be realized due to a failure of the ship’s compressor.

Narrative

The scientific crew of METEOR-Cruise M155 embarked the vessel in Pointe-á-Pitre on May 25 at 10:00h at very pleasant weather conditions. The scientific crew consisted of 11 scientists from Kiel University, 3 scientists from GEOMAR, 3 scientists from Bremen University, 2 scientists from the University of Lisbon, and 1 scientist each from the Max Planck Institute for Meteorology and the German Weather Service.

We left port on May 26 at 10:00h local time. The long transit was used to set up the labs and test the equipment. Hydroacoustic surveying started when leaving the EEZ of Guadeloupe on May 27 at 14:40h UTC. Data on the transit were mainly collected for the Seabed 2030 project of the Nippon Foundation and GEBCO in order to create improved maps of the sea floor. A first expandable sound velocity probe for acquiring a sound velocity profile needed for the multibeam system was collected in the afternoon of May 27. We crossed the Mid-Atlantic Ridge on May 29. A first test of the seismic equipment was performed in the morning of May 31. The test was successful except for a failure of one of the air guns. The cause for the failure was quickly detected after the test and could easily be fixed. A second expandable sound velocity probe was taken in the afternoon of the same day. The air guns were tested again on June 2 and this test was successful. We arrived in the working area around Fogo on June 3 in the evening. We took a first gravity core (M155_3) about 30 nm north of Fogo based on a short hydroacoustic survey. Selecting the coring location was difficult because the entire area is characterized by a very strong double reflector at the sea floor above a hummocky surface. Core recovery was only one meter; we found very coarse volcaniclastic material in the core catcher. The night was used for acquiring a first seismic profile heading south between Fogo and Santiago. We passed east of Fogo at a distance of about 10 nm in the morning of June 4 and had the first spectacular view of the island. Seismic surveying was continued until the evening at 19:00h UTC. The hydroacoustic data still showed a hummocky topography and clear landslide deposits despite being already 50 nm south of the island. The same strong double reflector as north of Fogo was visible in the Parasound data. We took a gravity core (Station M155_5) but recovery was again only one meter. Hence, we decided to collect hydroacoustic data further to the south. We imaged thick landslide deposits even 100 nm south of the island showing that the areal extent of landslide deposits is much larger than expected but we also managed to locate a location with almost undisturbed deposits, which we selected for the next core in order to sample a long sequence of volcaniclastic turbidites and tephra. A 5m-long core over-penetrated and the following 10m-long core had a recovery of 676 cm (M155_7-2). Further to the east of this location, we found areas with even thicker undisturbed deposits and the Core M155_8 brought a recovery of 987 cm. This core is spectacular with six volcaniclastic layers being thicker than 10 cm; the thickness of on of the volcaniclastic layers is ~ 80 cm pointing to a very large event. We collected a long seismic profile back to the North in direction to Fogo in the night and retrieved the seismic gear at 11:00h UTC on June 6. A short hydroacoustic survey brought us to the deployment point of the first sidescan sonar box ~ 8 nm east of Fogo in order to image the deposits of the 73 ka failure. Deployment was smooth but a failure of the system was realized when being in water. A broken cable was quickly identified as fault and the sonar was deployed again at 21:30h UTC after replacement of the broken cable. This time the system worked well until June 8 in the late morning, when we lost connection to the instrument while heaving very fast due to an underwater obstacle. The instrument was back on deck around noon and water intrusion to one of the connectors was quickly identified as cause for the malfunction.

Another set of seismic profiles were collected south of Fogo to continue mapping of the landslide deposits. Landslide deposits are more widespread to the west, while they thin out significantly or pinch out further to the east. The seismic equipment was retrieved on June 11 at 08:00h UTC, and was followed by coring at three stations along the eastern edge of the landslide deposits. The first core (M155_12) targeted undisturbed deposits but the recovery was only 250 cm. The second core (M155_13) in very close proximity targeted stacked slide deposits, and surprisingly, recovery was much better (ca. 650 cm). The core show a debrite at the base, which is directly covered by a volcaniclastic layer. Such settings will help to reconstruct the relationship between volcanic activity and mass flows. The last core of the day (M155_14) was further south and recovered another interesting ca. 700 cm long succession of volcaniclastic and background sediments. Additional seismic profiles were collected during the night when moving to the western side of the landslide area, which was the target for coring on June 11. The first two cores (M155_16 and 17) targeted relatively undisturbed deposits but recovery was very low (< 100 cm) probably due to a near surface volcaniclastic layer causing the corer to bounce. The third core (M155_18) was taken in a landslide channel and recovery was 166 cm. The last two cores of the day were very successful. Core M155_19 was almost 400 cm long and full of thin volcaniclastic layers. Core M155_20 recovered 745 cm of sediments. This core contains less volcaniclastic layers because it was located on a morphological high and only large flows reached this location. The night and the following morning was used for additional seismic surveying. Acquisition of a second sidescan sonar box started on June 12 at 15:30h. First, we filled the missing track of the fist sidescan survey. Afterwards, we collected four parallel E-W lines perpendicular to the assumed flow direction slightly south of Fogo. The sidescan data do not show many indications for very young flows but several major hummocks of older flows were clearly imaged. The sidescan was back on deck on June 15 at 09:00h UTC. We deployed a 2000-m deep CTD afterwards because different sound velocity probes (SVP) resulted in slightly different vertical sound velocity profiles and we used the CTD to check, which SVP worked correct. The next 24 hours were used to fill gaps in existing bathymetry, especially close to Santiago. Tsunami deposits were identified on Santiago and a good bathymetric map is essential for realistic modelling of tsunami run-ups. Coring was continued in the afternoon of June 16. The aim was to core the proximal deposits of Fogo, which was a challenging task. Core M155_25 and 26 only had very short or no recovery. The seismic system was deployed in the evening of June 16. The next 36 hours were used to map the proximal landslide deposits by one long south-north line and five E-W lines. This grid will lead to a significantly improvement of the volume estimates of major flank collapses. Penetration is not always good but boundaries between landslide deposits are clearly visible. June 18 was used for another attempt to core the proximal deposits southeast of Fogo. We started with a Giant Box Core (M155_28) on a canyon flank ~ 200 m higher than a main sediment transport pathway. The box corer was filled to the top and included two volcaniclastic layers. A second box corer was taken at the gravity core station M155_26 (there was no recovery two days before) and the box corer sampled ~ 20 cm of volcanic sand. We also tried to take a gravity corer at the Giant Box Corer Station 28 but penetration was only slightly deeper and included one additional volcaniclastic layer. A last gravity corer (M155_29) on that day was taken further to the west. Core recovery was ~ 130 cm. Due to strong winds, we decided not to deploy the seismic gear for the night but collected additional hydroacoustic data. Coring was continued on June 19 northeast of Fogo. The locations were located on the island flank of Santiago. One motivation was to core potential backwash deposits. In total, we took five gravity cores (Stations M155_31 – 35) but core recovery was relatively low. A promising ~150 cm long core was taken in a channel on the flank of Santiago. This core contains three distinct gravity flow deposits, which are separated by undisturbed sediments. There are many possible explanations for the gravity flows and backwash is one of them but more investigations in the labs are needed to verify of falsify this hypothesis. The night was used for collecting a long seismic line to the south. We realized a few gaps in our coring grid south of Fogo and June 20 was used to fill these gaps at the eastern edge of the survey area. The first coring attempt (M155_37) was empty but the second core (M155_38) only six nm to the east recovered a 649 cm-long very nice succession of background sediments and volcaniclastic layers. Seismic surveying in the night to June 21 brought us to the western edge of the landslide area. Similar to the previous day, the first core (M155_40) was empty but the following core (M155_41) recovered 933 cm of sediments. This core was located at a morphological high, which may have prevented this location from very coarse sediment input. The core includes a debrite in about 3 m depth; undisturbed sediments including volcaniclastic layers are found above and below. The night was used to fill gaps in the bathymetric coverage on our way to the north. In order to locate potential coring locations of the distal northern deposits, we planned to collect a combined seismic and hydroacoustic profile north of Fogo. Deployment of the seismic gear was smooth as always but a major malfunction occurred when starting the compressor. It quickly became clear that the damage could not be repaired with on-board resources. Hence, we retrieved the seismic gear and continued the hydroacoustic mapping. We checked all possibilities for a replacement of the compressor but there was no chance to get any other compressor in time.

Based on the hydroacoustic mapping, we selected two gravity corer stations north of Fogo in order to extend our record to this area. Parasound data showed very promising locations but the first core (M155_45) was empty, while the second core (M155_46) recovered a ~3m-long sequence of interlayered background sediments and volcaniclastics. The night to June 24 was used to collect bathymetric data north of Santiago. The data show a complex pattern of channels and volcanic cones, which most likely have a significant impact on tsunami propagation. Activities were stopped for the afternoon due to required maintenance of the lifeboats. We collected some hydroacoustic data east of Santiago in the following night. This area was not mapped before; it is relatively smooth compared to the western slopes of Santiago. On June 25, we had two attempts to core backwash sediments north of Santiago. A ~350 cm long core (M155_50) at a morphological high recovered a very interesting ~1m thick coarse sand layer, which is a potential candidate for backwash sediments. A second core at the thalweg of a gully was empty. Two additional cores were taken further to the northwest. Core M155_51 on a morphological high brought a recovery of 778 cm. It contains background sediments and volcaniclastic layers. To our big surprise, we had significant over penetration with a 10m core at station M155_52. We repeated this core on the next day after filling remaining gaps in the bathymetry. A 15m-core barrel resulted in a recovery of 1250 cm. The core contains mainly background sediments but several thin turbidites document significant sediment input from the islands.

Despite the fact, that the seismic system was not working any more, we headed to the second working area (the Cape Verde Rise). The transit was slower than expected due to strong winds from the front. We arrived at the Cape Verde Rise on June 27 in the morning and started a hydroacoustic survey. The first profile crossed DSDP-Site 368 and ODP-Site 659. In the evening, we took a core (M155_55) at a proposed IODP site, which brought a recovery of 882 cm. Afterwards we surveyed

the top and the flanks of the Cape Verde Rise until we started our short transit to Mindelo on June 29 in the morning. We arrived in Mindelo at 09:00h local time on June 30.
RV METEOR-Cruise M155 was a great success, except for the planned seismic pre-site survey of the Cape Verde Rise, which could not be conducted due to the compressor failure. In the working area between Fogo and Santiago, we collected about 1500 km of seismic 2D-lines in exceptional quality. A very detailed hydroacoustic data set was collected around Fogo and on the entire transit (total of ~10.000 km). An area of about 400 km^2 was imaged with a lateral resolution of 1 m by means of the sidescan sonar. Geological sampling was done at 32 stations (29 with recovery) with a total core length of 140 m. Coring was not always easy especially in the proximal landslide areas but the detailed hydroacoustic survey allowed to select successful coring stations. The new data will contribute to the assessment of poorly constrained and heavily debated tsunamigenic potential of large volcanic island flank collapses and puts us at a critical juncture where the latest developments in tsunami modelling can be integrated with an in-depth analysis of the flank collapse deposits, which triggered the tsunami.

Acknowledgements

The scientific party of RV METEOR Cruise M155 gratefully acknowledges the very friendly and most effective cooperation with Captain Hammacher and his crew. Their great flexibility and their perfect technical assistance substantially contributed to make this cruise a scientific success. We also appreciate the valuable support by the Leitstelle Deutsche Forschungsschiffe (German Research Fleet Coordination Centre) at the University of Hamburg. The expedition was funded by the Deutsche Forschungsgemeinschaft.
.

Teilnehmerliste

Name	Discipline	Institution
Krastel, Sebastian, Prof.	Marine Geophysics / Chief Scientist	CAU
Barrett, Rachel	Seismics	CAU
Hauser, Robert	Seismics	GeoB
Hinz, Anina-Kaja	Seismics	CAU
Klein, Elisa	Seismics	CAU
Köck, Danny	Seismics	CAU
Lebas, Elodie, Dr.	Seismics / Coring	CAU
Lindhorst, Katja, Dr.	Seismics	CAU
Tang, Qinqin	Seismics	CAU
Villinger, Heiner, Prof. Dr.	Seismics	GeoB
Klaucke, Ingo, Dr.	Sidescan Sonar	GEOMAR
Andrade, Mariana	Coring	FCUL
Klügel, Andreas, Dr.	Coring	GeoB
Kutterolf, Steffen, Dr.	Coring	GEOMAR
Pank, Katharina	Coring	CAU
Ramalho, Ricardo, Dr.	Coring	FCUL
Scheffler, Janne	Coring	GEOMAR
Jähmlich, Heiko	Technician	CAU
Heinrich, Sven	Technician	CAU
Donoval, Dominique	Atmospheric Observations	MPI-M
Rohleder, Christian	Weather Technician	DWD

CAU	Christian-Albrechts-Universität zu Kiel
DWD	Deutscher Wetter Dienst
FCUL	Faculdade de Ciências da Universidade de Lisboa
GeoB	Fachbereich Geowissenschaften, Universität BREMEN
GEOMAR	GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel
MPI-M	Max-Planck Institut für Meteorologie, Hamburg

Stationslist

Station	Date / Time UTC	Device	Latitude	Longitude	Depth (m)	Comment
M155_1-1	27.05.19 17:14	XBT	15° 50,925' N	056° 41,281' W	f5318	
M155_2-1	31.05.19 16:20	XBT	15° 00,401' N	038° 04,551' W	5606	
M155_3-1	03.06.19 20:58	Gravity Corer	15° 32,846' N	024° 13,900' W	3825	5m with SVP, recovery: 100 cm
M155_4-1	03.06.19 23:27	Seismic Towed	15° 34,316' N	024° 12,568' W	3818	
M155_4-1	04.06.19 18:44	Seismic Towed	14° 05,432' N	024° 01,309' W	4319	
M155_5-1	04.06.19 19:40	Gravity Corer	14° 04,988' N	024° 01,156' W	4320	3m, recovery 96 cm
M155_6-1	04.06.19 21:52	MB and Para	14° 04,901' N	024° 01,200' W	4321	
M155_6-1	05.06.19 07:20	MB and Para	12° 56,346' N	023° 50,774' W	4765	
M155_7-1	05.06.19 08:12	Gravity Corer	13° 02,364' N	023° 55,100' W	4712	5m, overpenetration
M155_7-2	05.06.19 10:54	Gravity Corer	13° 02,361' N	023° 55,098' W	4711	10 m with SVP, recovery: 676 cm
M155_8-1	05.06.19 16:57	Gravity Corer	13° 04,997' N	023° 40,604' W	4664	10m with SVP, recovery: 987 cm
M155_9-1	05.06.19 19:48	Seismic Towed	13° 07,153' N	023° 39,426' W	4646	
M155_9-1	06.06.19 11:19	Seismic Towed	14° 06,667' N	024° 02,282' W	4299	
M155_10-1	06.06.19 23:01	Side Scan Sonar	14° 50,408' N	024° 11,433' W	2963	
M155_10-1	08.06.19 10:17	Side Scan Sonar	15° 05,483' N	024° 10,490' W	2653	communication to sidescan lost
M155_11-1	08.06.19 14:04	Seismic Towed	14° 58,363' N	024° 14,408' W	1527	
M155_11-1	10.06.19 07:45	Seismic Towed	13° 44,837' N	023° 38,935' W	4402	
M155_12-1	10.06.19 09:06	Gravity Corer	13° 45,916' N	023° 35,431' W	4391	10m with SVP, recovery: 247 cm
M155_13-1	10.06.19 11:37	Gravity Corer	13° 47,019' N	023° 36,896' W	4388	10m, recovery: 655 cm
M155_14-1	10.06.19 17:09	Gravity Corer	13° 20,023' N	023° 35,951' W	4551	10m with SVP, recovery: 690 cm
M155_15-1	10.06.19 20:23	Seismic Towed	13° 22,489' N	023° 36,118' W	4540	
M155_15-1	11.06.19 06:44	Seismic Towed	13° 51,629' N	024° 08,838' W	4392	
M155_16-1	11.06.19 07:58	Gravity Corer	13° 49,037' N	024° 07,743' W	4406	10m, recovery: 102 cm
M155_17-1	11.06.19 10:26	Gravity Corer	13° 49,083' N	024° 08,331' W	4403	10m, no recovery
M155_18-1	11.06.19 13:25	Gravity Corer	13° 50,267' N	024° 19,709' W	4496	5m, recovery: 166 cm
M155_19-1	11.06.19 17:39	Gravity Corer	14° 14,867' N	024° 25,400' W	4277	5m with SVP, recoevery: 385 cm
M155_20-1	11.06.19 20:20	Gravity Corer	14° 18,743' N	024° 20,376' W	4163	10 m, recovery. 745 cm
M155_21-1	11.06.19 22:49	Seismic Towed	14° 20,192' N	024° 19,101' W	4147	
M155_21-1	12.06.19 15:30	Seismic Towed	15° 10,402' N	024° 06,581' W	3088	
M155_22-1	12.06.19 20:01	Side Scan Sonar	15° 06,409' N	024° 10,476' W	2695	
M155_22-1	15.06.19 06:41	Side Scan Sonar	14° 43,794' N	024° 14,726' W	3209	
M155_23-1	15.06.19 09:45	CTD	14° 43,908' N	024° 20,034' W	2731	with 2 SVPs
M155_24-1	15.06.19 11:35	MP and Para	14° 44,013' N	024° 19,987' W	2685	
M155_24-1	16.06.19 13:20	MP and Para	14° 50,988' N	023° 35,821' W	1941	
M155_25-1	16.06.19 15:45	Gravity Corer	14° 45,627' N	024° 01,506' W	3600	5m, no recovery
M155_26-1	16.06.19 18:06	Gravity Corer	14° 44,727' N	024° 06,192' W	3545	5m, no recovery
M155_27-1	16.06.19 21:13	Seismic Towed	14° 39,066' N	024° 03,819' W	3806	
M155_27-1	18.06.19 07:50	Seismic Towed	14° 43,468' N	024° 16,123' W	3157	
M155_28-1	18.06.19 09:17	Box Corer	14° 45,794' N	024° 11,841' W	3187	
M155_26-2	18.06.19 12:08	Box Corer	14° 44,723' N	024° 06,154' W	3546	
M155_28-2	18.06.19 15:22	Gravity Corer	14° 45,775' N	024° 11,828' W	3190	5m, recovery:: 79 cm
M155_29-1	18.06.19 19:05	Gravity Corer	14° 48,822' N	023° 56,584' W	3455	5m, recoevery: 131 cm
M155_30-1	18.06.19 20:00	MP and Para	14° 48,845' N	023° 56,584' W	3454	
M155_30-1	19.06.19 09:00	MP and Para	15° 15,432' N	024° 03,910' W	2871	
M155_31-1	19.06.19 09:02	Gravity Corer	15° 15,441' N	024° 03,904' W	2870	5m, recovery: 107 cm
M155_32-1	19.06.19 10:51	Gravity Corer	15° 15,982' N	024° 00,901' W	2819	5m, recovery: 100 cm
M155_33-1	19.06.19 12:47	Gravity Corer	15° 16,393' N	023° 58,774' W	2926	5m, recovery: 126 cm
M155_34-1	19.06.19 14:27	Gravity Corer	15° 16,519' N	023° 58,067' W	2827	5m, recovery: 124 cm
M155_35-1	19.06.19 16:14	Gravity Corer	15° 16,265' N	023° 59,426' W	2902	5m, recovery: 160 cm
M155_36-1	19.06.19 18:39	Seismic Towed	15° 17,487' N	024° 00,418' W	2937	

Station	Date / Time UTC	Device	Latitude	Longitude	Depth (m)	Comment
M155_37-1	20.06.19 17:00	Gravity Corer	14° 13,599' N	023° 42,063' W	4176	10m, no recovery
M155_38-1	20.06.19 19:47	Gravity Corer	14° 12,264' N	023° 36,358' W	4187	10m, recovery: 649 cm
M155_39-1	20.06.19 23:44	Seismic Towed	14° 03,450' N	023° 38,656' W	4282	
M155_39-1	21.06.19 13:50	Seismic Towed	13° 25,327' N	024° 20,019' W	4553	
M155_40-1	21.06.19 15:34	Gravity Corer	13° 26,670' N	024° 08,159' W	4603	5m, recovery: no recovery
M155_41-1	21.06.19 18:09	Gravity Corer	13° 30,205' N	024° 09,452' W	4539	5m, overpenetration
M155_41-2	21.06.19 20:36	Gravity Corer	13° 30,211' N	024° 09,452' W	4537	10m, recovery: 933 cm
M155_42-1	21.06.19 22:32	MP and Para	13° 30,316' N	024° 09,365' W	4536	
M155_42-1	22.06.19 13:45	MP and Para	15° 31,126' N	024° 13,472' W	3798	
M155_43-1	22.06.19 13:48	Seismic Towed	15° 31,259' N	024° 13,360' W	3800	compressor failure, no profiles
M155_44-1	22.06.19 14:42	MP and Para	15° 33,616' N	024° 12,026' W	3804	
M155_44-1	23.06.19 14:07	MP and Para	15° 16,980' N	023° 47,987' W	802	
M155_45-1	23.06.19 16:06	Gravity Corer	15° 34,842' N	023° 58,141' W	3670	10m, recovery: 88 cm
M155_46-1	23.06.19 19:18	Gravity Corer	15° 45,379' N	024° 09,978' W	3873	5m, recovery: 249 cm
M155_47-1	23.06.19 22:00	MP and Para	15° 43,722' N	024° 04,647' W	3805	
M155_47-1	24.06.19 11:05	MP and Para	15° 02,278' N	023° 46,633' W	922	
M155_48-1	24.06.19 21:07	MP and Para	15° 18,414' N	023° 48,602' W	1072	
M155_48-1	25.06.19 09:00	MP and Para	15° 18,800' N	023° 34,153' W	1091	
M155_49-1	25.06.19 09:14	Gravity Corer	15° 18,800' N	023° 34,153' W	1091	5m, recovery: 376 cm
M155_50-1	25.06.19 10:57	Gravity Corer	15° 19,989' N	023° 37,631' W	1309	5m, no recovery
M155_51-1	25.06.19 13:25	Gravity Corer	15° 29,985' N	023° 54,382' W	3492	5m, overpenetration
M155_51-2	25.06.19 15:21	Gravity Corer	15° 29,987' N	023° 54,380' W	3493	10m, recovery: 778 cm
M155_52-1	25.06.19 18:46	Gravity Corer	15° 33,148' N	023° 41,127' W	3310	5m, overpenetration
M155_52-2	25.06.19 20:30	Gravity Corer	15° 33,152' N	023° 41,123' W	3288	10m, overpenetration
M155_53-1	25.06.19 22:01	MP and Para	15° 32,888' N	023° 41,138' W	3262	
M155_53-1	26.06.19 13:23	MP and Para	15° 33,193' N	023° 41,142' W	3287	
M155_52-3	26.06.19 13:28	Gravity Corer	15° 33,196' N	023° 41,132' W	3290	15m, recovery: 1250 cm
M155_54-1	27.06.19 09:31	MP and Para	17° 23,401' N	021° 25,310' W	3452	
M155_54-1	27.06.19 20:30	MP and Para	18° 45,004' N	021° 00,000' W	3181	
M155_55-1	27.06.19 20:41	Gravity Corer	18° 45,001' N	020° 59,998' W	3181	10m, 882 cm
M155_56-1	27.06.19 22:37	MP and Para	18° 45,004' N	021° 00,010' W	3180	
M155_56-1	29.06.19 08:43	MP and Para	17° 55,640' N	020° 37,119' W	3081	