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Short Cruise Report RV SONNE SO270

Hong Kong – Port Louis 06.09. – 23.10.2019

Chief Scientist: Dr. Sebastian Lindhorst Captain: Lutz Mallon



Fig. 1: Track of RV SONNE cruise SO270 MASCARA (map by WTD RV SONNE)



 Fig. 2:
 Working areas of cruise SO270 at the Saya de Malha Bank with CTD transect at 65° E, and borders of Exclusive Economic Zones (EEZ) and the Joint Management Area (JMA).

 60°0.00'E
 61°0.00'E
 62°0.00'E
 63°0.00'E



Fig. 3: Detailed track chart and station plan of RV SONNE cruise SO270 MASCARA. Please note that the stations of the CTD/MCN transect at 65°E are outside the map section.

Objectives

The superordinate objective of the cruise was to test the hypothesis that the Saya de Malha Bank is a carbonate platform controlled by water mass boundaries and currents which exert a strong control on sedimentation, ecosystems and biogeochemistry. Particular aims of the expedition are therefore to acquire data to (1) amend models of carbonate sequence stratigraphy, (2) develop a sedimentological model for a carbonate platform under the influence of internal waves, and (3) establish a model of carbonate sedimentation in an area with varying biogeochemical nature. Based on this, the project aims on unlocking the record of paleoceanographical changes and of sea-level fluctuations recorded in the deposits of the Saya the Malha Bank.

Narrative

The expedition SO270 MASCARA started on September 4 in Hong Kong with the arrival of the scientific advance party to RV SONNE to unload six containers with scientific equipment. Thanks to the great support by the Crew, this task was fulfilled within a few hours and the scientists returned to their hotel. The next morning, September 5, the scientific party of SO270 comprising 37 scientists from eight institutions in six nations boarded the ship and immediately started to set up the labs and to install the gears.

RV SONNE left her pier in the harbor of Hong Kong on the morning of September 6. The official start of the sea voyage was set to 02:48 UTC. After disembarkment of the pilot, the SONNE set course SSE towards the Sunda Strait; 16 days of transit to the working area in the western Indian Ocean ahead. The comparable long transit was used by the scientists for the final preparation of the labs and refinement of working procedures. The variety of scientific disciplines on board provided the basis for interdisciplinary discussions and evening science meetings gave further opportunity to learn more about the methods and approaches used by the other groups.

The SONNE crossed the equator west of Borneo in the early morning of September 11. The Sunda Strait, separating the Indonesian islands of Sumatra and Java, was reached in the evening of September 12. The impressive silhouette of the Krakatau volcano in the moonlight was a sight to behold. After this passage, the SONNE turned WSW and sailed towards the open Indian Ocean.

Acquisition of scientific data started on the early morning of September 14 after leaving the exclusive economic zone (EEZ) of Indonesia. Underway measurements included oceanographic data like salinity, conductivity, and chlorophyll, but also geochemical investigations (e.g. nutrients) and current profiling in the water column (ADCP). In addition, the microplastic-filtration was set into action. A first station to test the CTD (conductivity temperature depth, a probe for oceanographic water column measurements) and the multi-closing net (MCN) was scheduled on September 16; followed by a test of the digital streamer for reflection seismics on September 17.

The first station of the north-south trending transect along 65° E was reached at 7° S on September 21, and CTD and MCN were deployed. Work along this profile continued until the early morning of September 23 when the last station at 11° S was finished. After 10 hours more of transit, in the afternoon, the SONNE arrived at the Saya de Malha Bank. Approaching the carbonate platform, the digital streamer was deployed to perform a first seismic survey consisting of two lines crossing the bank in E-W direction. Aim of these lines was to gain insight into the large

scale platform architecture, but also to provide a first overview on platform slope geometry. Seismics ended on September 26, and after recovering of the seismic gear, the SONNE moved to the first sedimentological station, located at the foot of the eastern slope of Saya de Malha at a water depth of 2000 m. Here CTD, MCN as well as sea floor sampling were performed and the first, 4.5 m long, sediment core was recovered. Station work terminated in the early morning of September 27, followed by 24 hours of hydroacoustic surveying along the eastern slope.

From September 28 to the morning of September 29, sediment samples were taken along the W-E transect. The material turned out to be very coarse, which prevented the recovery of sediment cores. The box corer, however, turned out to be efficient in this type of sediment. In the course of the sampling program, the ROV Subatlantic MOHAWK of the University of Hamburg was deployed at one station to image the variety of carbonate producing organisms at the sea floor. However, at 15 m of water depth, the system had a short circuit in one of the thrusters. The dive was terminated and after recovery of the ROV the sampling resumed.

The next seismic survey started on September 29, in the morning. This 410 nm long survey aimed on deciphering the internal architecture of the southern part of Saya de Malha and the connection to the Nazareth bank towards the south. Seismics ended on the morning of October 3. Subsequently, two sedimentological stations were sampled, at water depths of 1400 and 1800 m, respectively. On the first station a 4.5 m long core was recovered. On the second station, however, the core tube remained empty, probably due to the slightly coarser sediment in the vicinity of the platform slope. Only a few sediment grains were recovered from the next station, located on top of the southern part of the Saya de Malha platform and it seems that the southern part of the platform mainly consists of bare rock with only thin sediment veneers at certain localities.

On October 4, the SONNE reached a station in the south of the Saya de Malha Bank, intended for the observation of the internal waves over the time period of a complete tidal cycle. Parallel to shipboard Yo-Yo CTD, ADCP, and water column recording by means of Multibeam, the acquisition of satellite based synthetic aperture radar (SAR) imagery was scheduled to directly image the internal waves. The SONNE remained on station until midnight and a complete cycle of internal waves was measured during this period. Station work continued on October 5 with one station located in deeper waters off the southeastern tip of Saya de Malha Bank. Water column sampling using CTD and MCN went well, but the gravity corer remained empty. It was therefore decided to use the box corer instead of the scheduled MUC. The box corer recovered a coarse-grained carbonate sand with very little fine fraction.

The next seismic and hydroacoustic survey started on October 6. Acquisition of seismic lines southeast of the platform aimed on linking our survey data to the stratigraphy of ODP sites 705 and 706. On the course to the ODP sites, the digital streamer had a short circuit and measurements were interrupted. The module and the first active section were removed from the streamer, however, the system remained down and it was therefore decided to terminate the survey and to continue with hydroacoustic mapping and station work. This multibeam survey on the southwestern slope of Saya de Malha Bank revealed a complex system of submarine channels cutting into thick drift sediments. Based on this survey information, a gravity core of 4.8 m and two box cores were successfully retrieved from drift sediments and two localities along one channel course on October 7 and 8. Sampling was interrupted by a short multibeam survey to close data gaps and to refine the bathymetric information.

Sediment sampling and CTD continued until October 9 with several stations along a NE-SW trending transect towards the center of the Saya de Malha Bank. Due to the coarseness of the sediment, sampling with the MUC and the gravity corer was not very successful; the box corer, however, continuously delivered undisturbed samples, often with a preserved sea-floor surface. On October 9, the OFOS (Ocean Floor Observation System) was deployed at three localities to visually inspect the sea floor. Videos and still photographs were of superb quality. A first comparison of sediment samples and OFOS results showed that lateral facies changes are more important than previously expected. It was therefore decided to allocate more time to sea floor observation and further OFOS surveys were planned for the next day. In the late afternoon station work was resumed and sediment sampling continued through the night. Three OFOS transects were recorded during daytime of October 10 along the E-W trending transect, before station work continued with nightfall. Station work ended in the morning of October 11 and with a hydroacoustic survey along the western slope of the Saya de Malha Bank, the SONNE started research in working area WA-4.

Hydroacoustic mapping ended in the evening of October 11 and based on the acquired data, one station was selected at a water depth of 2516 m, in a sediment fan in front of one of the deep channels that characterize the slope of the platform. Station work included CTD, MCN, and two MUC runs. In the morning of October 12, a 5.4 m long gravity core was recovered. After quitting the station the analog streamer was deployed (in replacement of the damaged digital streamer) and the SONNE started a seismic survey to image the internal architecture of the western platform margin. After recovery of the seismic gear in the evening of October 14, the next sampling block started with a station on the platform margin at about 100 m of water depth. Sampling continued through the night with stations at intermediate water depths, 700 to 1400 m, where two gravity cores were retrieved successfully.

On October 15, a MBES survey was performed to map a segment of the platform margin a depths between 300 and 100 m. The aim of this survey was to image the connection between the large canyons of the lower slope and the shallow water platform. Subsequently, sediment sampling was continued until the morning of October 16, when a ROV site was scheduled to study a sequence of drowned reefs at 90 m of water depth. However, again there was a problem with the high-voltage power supply and the deployment procedure was stopped. As a backup, the OFOS was deployed after adapting the observational transect to inspect the reefs. The working scheme with sampling blocks interrupted by OFOS transects continued through October 17 until the morning of October 18 when the last station was performed at the eastern slope of Sava de Malha Bank. Subsequently, the seismic gear was deployed and a short seismic survey was started to investigate the internal architecture of the slope on the eastern side. The survey ended in the early morning of October 19 and after recovery of the seismic equipment, the SONNE started her transit to the transect of CTD/MCN stations along 65° E, where 4 stations still needed to be visited. The first of these stations (12° S / 65° E) was reached in the late evening. Work along the CTD-transect ended on October 21 around 04:00 UTC with the last station at 15° S. This last station marks also the end of the scientific work of the cruise and RV SONNE headed towards Port Louis, Mauritius. The two days of transit were used to finish sample preparation and description as well as to pack the equipment. Research cruise SO270 MASCARA ended with port call in Port Louis in the morning of October 23 (04:00 UTC).



Fig. 4: Science party of RV SONNE cruise SO270

Acknowledgements

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The expedition was conceived and applied for by Christian Betzler, who unfortunately could not participate in person.

Participants

Name	Discipline	Institution
Appoo, Jennifer	Biogeochemistry	DBES
Artschwager, Maike	Hydroacoustics	UHH
Bialik, Or, Dr.	Sedimentology	UHH
Birkicht, Matthias	Carbonate Chemistry	ZMT
Bissessur, Dass, Dr.	Hydroacoustics	MoDRM
Braga, Juan-Carlos, Prof. Dr.	Sedimentology	UGr
Budke, Linus	Hydroacoustics	UHH
Bunzel, Dorothea	Micropaleontology	UHH
Coopen, Priscilla	Seismics, ADCP	MoDRM
Eberhardt, Benjamin	Hydroacoustics	UHH
Eggers, Dirk	Sedimentology, ROV	UHH
Eisermann, Jan Oliver	OFOS, Hydroacoustics, Sedim., Planning	UHH
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Taphorn, Björn	Plankton	MPIC
Vosen, Stephan	Micropaleontology, Sedimentology	UHH
Wasilewski, Thomas	Sedimentology, ADCP	UHH
Welsch, Andreas	СТD	UHH

Participating Institutions

Abbreviation	Institute
UHH	University of Hamburg, Institute for Geology,Hamburg, Germany
HZG	Helmholtz-Zentrum Geesthacht Centre for Materials and Coastal Research, Geesthacht, Germany
ZMT	Leibniz Centre for Tropical Marine Research, Bremen, Germany
UGr	Universidad de Granada; Departamento de Estratigrafía y Paleontología, Granada, Spain
KFUPM	King Fahd University of Petroleum & Minerals, Dhahran, Saudi Arabia
MPIC	Max Planck Institute for Chemistry, Mainz, Germany
MoDRM	Department for Continental Shelf, Maritime Zones Administration and Exploration, Ministry of Defence and Rodrigues, Port Louis, Republic of Mauritius
DBES	Department of Blue Economy, Mahe Victoria, Seychelles

Stationlist

Explanation of device abbreviations:

CTD:	Conductivity temperature depth
MSN:	Multi-closing net
MCS:	Seismic streamer recording (multi-channel reflection seismics)
SVP (XSV):	Sound velocity probe (SIPPICAN Underway)
BC:	Box corer
MUC:	Multi corer
GC:	Gravity corer
ROV:	Remote operated vehicle
VGRAB:	Van-Veen grab sampler
OFOS:Ocean	floor observation system
EM400.	Multibeens sweth ashees under (Kenneberg EM122) & DARAGOUN

EM122: Multibeam swath echosounder (Kongsberg EM122) & PARASOUND PS70

Date & Time [UTC]	Lat. S	Lon. E	Device	Depth [m]
16.09.2019 03:00	08° 58.480'	086° 21.570'	CTD	5023
16.09.2019 04:31	08° 58.496'	086° 21.569'	MSN	5026
21.09.2019 02:43	06° 59.993'	065° 00.003'	CTD	4190
21.09.2019 03:55	07° 00.001'	064° 59.999'	MSN	4190
21.09.2019 04:36	07° 00.002'	065° 00.002'	MSN	4192
21.09.2019 05:07	07° 00.001'	065° 00.002'	MSN	4174
21.09.2019 05:15	07° 00.001'	065° 00.010'	MSN	4171
21.09.2019 17:18	09° 00.064'	064° 59.999'	CTD	4161
21.09.2019 18:18	09° 00.069'	064° 59.997'	MSN	4161
21.09.2019 19:00	09° 00.069'	065° 00.000'	MSN	4161
21.09.2019 23:15	09° 29.996'	065° 00.004'	CTD	4062
	Date & Time [UTC] 16.09.2019 03:00 16.09.2019 04:31 21.09.2019 02:43 21.09.2019 03:55 21.09.2019 03:55 21.09.2019 03:55 21.09.2019 05:07 21.09.2019 05:07 21.09.2019 05:15 21.09.2019 17:18 21.09.2019 17:18 21.09.2019 18:18 21.09.2019 19:00 21.09.2019 19:00	Date & Time [UTC]Lat. S16.09.2019 03:0008° 58.480'16.09.2019 04:3108° 58.496'21.09.2019 02:4306° 59.993'21.09.2019 03:5507° 00.001'21.09.2019 04:3607° 00.002'21.09.2019 05:0707° 00.001'21.09.2019 17:1809° 00.064'21.09.2019 18:1809° 00.069'21.09.2019 19:0009° 00.069'	Date & Time [UTC]Lat. SLon. E16.09.2019 03:0008° 58.480'086° 21.570'16.09.2019 04:3108° 58.496'086° 21.569'21.09.2019 02:4306° 59.993'065° 00.003'21.09.2019 03:5507° 00.001'064° 59.999'21.09.2019 04:3607° 00.002'065° 00.002'21.09.2019 05:0707° 00.001'065° 00.002'21.09.2019 05:1507° 00.001'065° 00.002'21.09.2019 17:1809° 00.064'064° 59.999'21.09.2019 18:1809° 00.069'064° 59.997'21.09.2019 19:0009° 00.069'065° 00.000'21.09.2019 23:1509° 29.996'065° 00.004'	Date & Time [UTC]Lat. SLon. EDevice16.09.2019 03:0008° 58.480'086° 21.570'CTD16.09.2019 04:3108° 58.496'086° 21.569'MSN21.09.2019 02:4306° 59.993'065° 00.003'CTD21.09.2019 03:5507° 00.001'064° 59.999'MSN21.09.2019 04:3607° 00.002'065° 00.002'MSN21.09.2019 05:0707° 00.001'065° 00.002'MSN21.09.2019 05:1507° 00.001'065° 00.010'MSN21.09.2019 17:1809° 00.064'064° 59.999'CTD21.09.2019 18:1809° 00.069'064° 59.997'MSN21.09.2019 19:0009° 00.069'065° 00.000'MSN21.09.2019 23:1509° 29.996'065° 00.004'CTD

Station	Date & Time [UTC]	Lat. S	Lon. E	Device	Depth [m]
SO270_05-1	22.09.2019 04:04	10° 00.005'	065° 00.000'	CTD	3131
SO270_05-2	22.09.2019 05:09	10° 00.000'	065° 00.003'	MSN	3131
SO270_05-3	22.09.2019 05:50	10° 00.000'	065° 00.003'	MSN	3131
SO270_06-1	22.09.2019 10:34	10° 30.003'	065° 00.004'	CTD	4000
SO270_07-1	22.09.2019 16:33	11° 00.003'	065° 00.002'	CTD	4098
SO270_07-2	22.09.2019 18:27	10° 59.999'	065° 00.001'	MSN	4101
SO270_07-3	22.09.2019 19:05	10° 59.997'	064° 59.998'	MSN	4099
SO270_07-4	22.09.2019 19:46	10° 59.995'	064° 59.996'	CTD	4097
SO270_08-1	23.09.2019 04:17	11° 06.661'	063° 05.960'	MCS	2689
SO270_09-1	23.09.2019 09:51	11° 06.103'	062° 35.843'	SVP (XSV)	2042
SO270_10-1	24.09.2019 09:53	11° 03.237'	060° 09.939'	SVP (XSV)	2390
SO270_11-1	26.09.2019 15:51	10° 43.116'	062° 37.082'	CTD	2092
SO270_11-2	26.09.2019 17:07	10° 43.121'	062° 37.077'	MSN	2083
SO270_11-3	26.09.2019 17:50	10° 43.115'	062° 37.077'	MSN	2085
SO270_11-4	26.09.2019 19:08	10° 43.118'	062° 37.088'	BC	2085
SO270_11-5	26.09.2019 21:13	10° 43.119'	062° 37.093'	MUC	2081
SO270_11-6	26.09.2019 23:02	10° 43.118'	062° 37.094'	MUC	2080
SO270_11-7	27.09.2019 00:39	10° 43.124'	062° 37.092'	GC	2081
SO270_12-1	28.09.2019 00:47	11° 05.688'	062° 14.644'	CTD	263
SO270_12-2	28.09.2019 01:29	11° 05.687'	062° 14.643'	BC	263
SO270_12-3	28.09.2019 02:11	11° 05.690'	062° 14.648'	MUC	259
SO270_12-4	28.09.2019 02:41	11° 05.687'	062° 14.644'	GC	255
SO270_13-1	28.09.2019 03:56	11° 05.564'	062° 07.907'	CTD	136
SO270_13-2	28.09.2019 04:28	11° 05.564'	062° 07.905'	BC	141
SO270_13-3	28.09.2019 04:57	11° 05.562'	062° 07.903'	MUC	141
SO270_13-4	28.09.2019 05:17	11° 05.563'	062° 07.904'	GC	140
SO270_14-1	28.09.2019 06:10	11° 05.537'	062° 06.190'	CTD	93
SO270_14-2	28.09.2019 06:53	11° 05.531'	062° 06.185'	MUC	96
SO270_14-3	28.09.2019 07:09	11° 05.537'	062° 06.188'	BC	97
SO270_14-4	28.09.2019 07:29	11° 05.540'	062° 06.190'	GC	97
SO270_15-1	28.09.2019 09:22	11° 05.338'	061° 56.411'	ROV	47
SO270_15-2	28.09.2019 11:59	11° 05.338'	061° 56.410'	BC	47
SO270_16-1	28.09.2019 13:09	11° 05.944'	062° 03.041'	CTD	57
SO270_16-2	28.09.2019 13:31	11° 05.944'	062° 03.041'	BC	60
SO270_16-3	28.09.2019 13:58	11° 05.944'	062° 03.042'	MUC	60
SO270_17-1	28.09.2019 16:27	11° 05.029'	061° 39.904'	BC	95
SO270_17-2	28.09.2019 16:57	11° 05.019'	061° 39.916'	GC	92
SO270_17-2	28.09.2019 17:21	11° 05.018'	061° 39.916'	GC	91
SO270_18-1	28.09.2019 18:17	11° 04.944'	061° 36.929'	BC	103
SO270_18-2	28.09.2019 18:42	11° 04.943'	061° 36.929'	GC	101

Station	Date & Time [UTC]	Lat. S	Lon. E	Device	Depth [m]
SO270_18-3	28.09.2019 19:08	11° 04.944'	061° 36.928'	GC	108
SO270_19-1	28.09.2019 20:58	11° 04.666'	061° 23.318'	CTD	123
SO270_19-2	28.09.2019 21:37	11° 04.681'	061° 23.321'	BC	118
SO270_19-3	28.09.2019 22:02	11° 04.682'	061° 23.320'	MUC	117
SO270_19-4	28.09.2019 22:31	11° 04.682'	061° 23.320'	MUC	117
SO270_20-1	28.09.2019 23:58	11° 04.467'	061° 12.681'	BC	79
SO270_21-1	29.09.2019 04:00	10° 57.931'	061° 45.534'	MCS	56
SO270_22-1	30.09.2019 16:59	12° 08.405'	060° 30.372'	SVP (XSV)	2377
SO270_22-2	30.09.2019 17:09	12° 07.934'	060° 31.223'	SVP (XSV)	2372
SO270_23-1	03.10.2019 06:43	11° 58.731'	060° 45.573'	CTD	1377
SO270_23-2	03.10.2019 07:44	11° 58.730'	060° 45.570'	MSN	1380
SO270_23-3	03.10.2019 08:34	11° 58.733'	060° 45.574'	BC	1381
SO270_23-4	03.10.2019 09:18	11° 58.730'	060° 45.573'	MSN	1382
SO270_23-5	03.10.2019 09:57	11° 58.729'	060° 45.571'	MSN	1383
SO270_23-6	03.10.2019 10:41	11° 58.735'	060° 45.570'	MUC	1377
SO270_23-7	03.10.2019 12:32	11° 58.728'	060° 45.575'	GC	1380
SO270_23-8	03.10.2019 13:53	11° 58.727'	060° 45.574'	MUC	1381
SO270_24-1	03.10.2019 15:59	11° 55.894'	060° 52.697'	CTD	886
SO270_24-2	03.10.2019 16:52	11° 55.893'	060° 52.700'	MSN	883
SO270_24-3	03.10.2019 17:36	11° 55.892'	060° 52.697'	BC	882
SO270_24-4	03.10.2019 18:11	11° 55.895'	060° 52.699'	MSN	881
SO270_24-5	03.10.2019 18:53	11° 55.886'	060° 52.697'	MUC	884
SO270_24-6	03.10.2019 19:39	11° 55.896'	060° 52.700'	GC	883
SO270_25-1	04.10.2019 00:03	12° 08.107'	061° 23.055'	CTD	270
SO270_25-2	04.10.2019 01:26	12° 08.100'	061° 23.054'	CTD	270
SO270_26-1	04.10.2019 23:20	12° 21.206'	061° 03.009'	VGRAB	271
SO270_27-1	05.10.2019 06:14	12° 37.453'	061° 18.507'	CTD	2061
SO270_27-2	05.10.2019 07:35	12° 37.451'	061° 18.514'	MSN	2061
SO270_27-3	05.10.2019 08:11	12° 37.447'	061° 18.506'	MSN	2065
SO270_27-4	05.10.2019 09:34	12° 37.454'	061° 18.507'	GC	2064
SO270_27-5	05.10.2019 11:14	12° 37.451'	061° 18.506'	BC	2063
SO270_28-1	06.10.2019 03:49	12° 17.562'	061° 11.400'	MCS	254
SO270_29-1	06.10.2019 21:15	12° 43.529'	061° 10.753'	EM122	2008
SO270_30-1	07.10.2019 11:08	12° 15.686'	060° 36.236'	GC	2137
SO270_31-1	07.10.2019 14:32	12° 02.008'	060° 41.343'	BC	2227
SO270_31-2	07.10.2019 15:47	12° 02.003'	060° 41.349'	SVP (XSV)	2225
SO270_31-3	07.10.2019 16:51	12° 02.009'	060° 41.347'	MUC	2227
SO270_33-1	07.10.2019 17:55	12° 01.671'	060° 41.549'	EM122	2017
SO270_34-1	08.10.2019 08:36	11° 52.502'	060° 52.525'	BC	1163
SO270_35-1	08.10.2019 12:58	11° 47.306'	061° 07.961'	BC	282

Station	Date & Time [UTC]	Lat. S	Lon. E	Device	Depth [m]
SO270_35-2	08.10.2019 13:30	11° 47.307'	061° 07.961'	GC	282
SO270_36-1	08.10.2019 16:40	11° 36.690'	061° 28.117'	BC	210
SO270_37-1	08.10.2019 17:24	11° 40.440'	061° 26.318'	EM122	242
SO270_38-1	08.10.2019 18:17	11° 41.616'	061° 25.548'	BC	243
SO270_39-1	08.10.2019 19:01	11° 41.474'	061° 25.676'	CTD	402
SO270_39-2	08.10.2019 19:32	11° 41.481'	061° 25.673'	MSN	401
SO270_39-3	08.10.2019 20:02	11° 41.479'	061° 25.675'	GC	402
SO270_40-1	08.10.2019 21:16	11° 44.240'	061° 23.862'	CTD	259
SO270_40-2	08.10.2019 21:55	11° 44.236'	061° 23.869'	MSN	258
SO270_40-3	08.10.2019 22:30	11° 44.233'	061° 23.870'	BC	257
SO270_40-4	08.10.2019 23:01	11° 44.248'	061° 23.870'	MUC	256
SO270_41-1	09.10.2019 00:53	11° 54.264'	061° 18.037'	CTD	0
SO270_41-2	09.10.2019 01:33	11° 54.264'	061° 18.043'	BC	302
SO270_41-3	09.10.2019 01:58	11° 54.266'	061° 18.040'	BC	299
SO270_41-4	09.10.2019 02:29	11° 54.267'	061° 18.038'	BC	292
SO270_41-5	09.10.2019 03:14	11° 52.987'	061° 17.593'	EM122	301
SO270_42-1	09.10.2019 06:22	11° 54.253'	061° 17.820'	OFOS	299
SO270_43-1	09.10.2019 10:04	11° 41.447'	061° 25.527'	OFOS	240
SO270_44-1	09.10.2019 14:29	11° 31.392'	061° 30.882'	OFOS	173
SO270_45-1	09.10.2019 16:21	11° 31.384'	061° 31.091'	CTD	172
SO270_45-2	09.10.2019 16:50	11° 31.384'	061° 31.089'	BC	172
SO270_45-3	09.10.2019 17:14	11° 31.383'	061° 31.086'	MUC	172
SO270_46-1	09.10.2019 18:14	11° 28.515'	061° 32.715'	BC	144
SO270_46-2	09.10.2019 18:40	11° 28.519'	061° 32.716'	GC	134
SO270_46-3	09.10.2019 19:03	11° 28.512'	061° 32.718'	MUC	134
SO270_47-1	09.10.2019 20:08	11° 24.884'	061° 34.743'	BC	125
SO270_47-2	09.10.2019 20:30	11° 24.872'	061° 34.743'	GC	117
SO270_47-3	09.10.2019 20:53	11° 24.883'	061° 34.740'	MUC	126
SO270_48-1	09.10.2019 21:43	11° 23.255'	061° 35.669'	BC	117
SO270_48-2	09.10.2019 22:03	11° 23.255'	061° 35.667'	MUC	116
SO270_49-1	10.10.2019 00:27	11° 08.380'	061° 44.010'	CTD	93
SO270_49-2	10.10.2019 00:49	11° 08.394'	061° 44.010'	BC	97
SO270_49-3	10.10.2019 01:11	11° 08.398'	061° 44.006'	GC	96
SO270_49-4	10.10.2019 01:35	11° 08.389'	061° 44.010'	MUC	96
SO270_50-1	10.10.2019 03:56	11° 05.347'	061° 57.607'	OFOS	60
SO270_51-1	10.10.2019 09:43	11° 04.604'	061° 24.351'	OFOS	128
SO270_52-1	10.10.2019 13:26	11° 04.469'	061° 12.600'	OFOS	81
SO270_53-1	10.10.2019 17:05	11° 04.306'	061° 04.343'	BC	125
SO270_53-2	10.10.2019 17:25	11° 04.304'	061° 04.339'	MUC	126
SO270_54-1	10.10.2019 19:28	11° 04.063'	060° 52.021'	CTD	139

Station	Date & Time [UTC]	Lat. S	Lon. E	Device	Depth [m]
SO270_54-2	10.10.2019 19:56	11° 04.060'	060° 52.016'	MSN	140
SO270_54-3	10.10.2019 20:24	11° 04.056'	060° 52.019'	BC	139
SO270_54-4	10.10.2019 20:47	11° 04.061'	060° 52.017'	MUC	148
SO270_55-1	10.10.2019 22:00	11° 03.947'	060° 45.310'	CTD	58
SO270_55-2	10.10.2019 22:20	11° 03.933'	060° 45.329'	BC	61
SO270_55-3	10.10.2019 22:38	11° 03.942'	060° 45.328'	MUC	59
SO270_56-1	10.10.2019 23:30	11° 03.888'	060° 40.953'	CTD	60
SO270_56-2	10.10.2019 23:50	11° 03.839'	060° 41.001'	BC	74
SO270_56-3	11.10.2019 00:09	11° 03.844'	060° 40.993'	MUC	75
SO270_57-1	11.10.2019 01:05	11° 03.712'	060° 35.353'	CTD	46
SO270_57-2	11.10.2019 01:21	11° 03.728'	060° 35.347'	BC	35
SO270_58-1	11.10.2019 02:15	11° 03.945'	060° 27.984'	EM122	57
SO270_58-2	11.10.2019 12:57	10° 59.729'	060° 06.275'	SVP (XSV)	2314
SO270_59-1	12.10.2019 19:25	10° 55.534'	060° 02.484'	CTD	2505
SO270_59-2	12.10.2019 20:59	10° 55.538'	060° 02.488'	MSN	2504
SO270_59-3	12.10.2019 21:36	10° 55.532'	060° 02.486'	MSN	2504
SO270_59-4	12.10.2019 23:12	10° 55.535'	060° 02.491'	BC	2506
SO270_59-5	13.10.2019 01:01	10° 55.539'	060° 02.481'	GC	2506
SO270_59-6	13.10.2019 03:26	10° 55.533'	060° 02.488'	MUC	2507
SO270_59-7	13.10.2019 05:26	10° 55.534'	060° 02.486'	MUC	2504
SO270_61-1	13.10.2019 06:19	10° 55.533'	060° 02.483'	MCS	2506
SO270_62-1	14.10.2019 16:18	10° 46.255'	060° 09.016'	CTD	99
SO270_62-2	14.10.2019 16:38	10° 46.261'	060° 09.016'	BC	99
SO270_63-1	14.10.2019 18:35	10° 49.967'	060° 09.981'	BC	697
SO270_63-2	14.10.2019 19:21	10° 49.973'	060° 09.979'	MUC	699
SO270_63-3	14.10.2019 20:01	10° 49.973'	060° 09.974'	GC	697
SO270_64-1	14.10.2019 21:34	10° 50.950'	060° 10.213'	CTD	1278
SO270_64-2	14.10.2019 22:34	10° 50.940'	060° 10.214'	MSN	1248
SO270_64-3	14.10.2019 23:11	10° 50.941'	060° 10.212'	MSN	1273
SO270_64-4	15.10.2019 00:21	10° 50.949'	060° 10.216'	BC	1266
SO270_64-5	15.10.2019 01:39	10° 50.947'	060° 10.218'	GC	1275
SO270_64-6	15.10.2019 02:49	10° 50.944'	060° 10.218'	MUC	1253
SO270_64-7	15.10.2019 03:56	10° 50.943'	060° 10.212'	MUC	1267
SO270_65-1	15.10.2019 04:26	10° 50.952'	060° 10.213'	EM122	1267
SO270_66-1	15.10.2019 13:22	10° 52.385'	060° 14.146'	OFOS	93
SO270_67-1	15.10.2019 16:00	10° 46.127'	060° 14.793'	OFOS	40
SO270_68-1	15.10.2019 18:15	10° 46.129'	060° 15.203'	CTD	40
SO270_68-2	15.10.2019 18:30	10° 46.125'	060° 15.205'	BC	40
SO270_68-3	15.10.2019 18:43	10° 46.125'	060° 15.202'	MUC	41
SO270_68-4	15.10.2019 18:51	10° 46.125'	060° 15.209'	MUC	41

Station	Date & Time [UTC]	Lat. S	Lon. E	Device	Depth [m]
SO270_68-5	15.10.2019 19:18	10° 46.220'	060° 15.571'	MUC	40
SO270_69-1	15.10.2019 20:30	10° 52.405'	060° 14.486'	BC	81
SO270_70-1	15.10.2019 21:00	10° 52.399'	060° 14.353'	BC	87
SO270_71-1	15.10.2019 21:27	10° 52.091'	060° 13.826'	EM122	106
SO270_72-1	16.10.2019 04:25	10° 45.520'	060° 45.053'	ROV	101
SO270_72-2	16.10.2019 05:03	10° 45.506'	060° 45.678'	OFOS	98
SO270_73-1	16.10.2019 08:38	10° 45.516'	060° 45.673'	BC	99
SO270_74-1	16.10.2019 09:24	10° 45.481'	060° 47.653'	BC	118
SO270_74-2	16.10.2019 09:45	10° 45.474'	060° 47.658'	GC	119
SO270_75-1	16.10.2019 12:40	10° 45.000'	061° 11.788'	BC	126
SO270_75-2	16.10.2019 13:01	10° 44.999'	061° 11.790'	GC	123
SO270_75-3	16.10.2019 13:25	10° 45.002'	061° 11.784'	MUC	122
SO270_75-4	16.10.2019 13:45	10° 45.003'	061° 11.788'	GC	122
SO270_76-1	16.10.2019 16:44	10° 44.479'	061° 36.649'	OFOS	75
SO270_77-1	16.10.2019 18:22	10° 44.378'	061° 42.175'	OFOS	61
SO270_78-1	16.10.2019 20:14	10° 44.244'	061° 48.802'	OFOS	36
SO270_78-2	16.10.2019 21:55	10° 44.247'	061° 48.813'	BC	37
SO270_79-1	16.10.2019 22:39	10° 44.195'	061° 51.416'	BC	65
SO270_79-2	16.10.2019 22:56	10° 44.191'	061° 51.423'	GC	63
SO270_80-1	17.10.2019 00:14	10° 44.029'	061° 59.670'	CTD	34
SO270_80-2	17.10.2019 00:29	10° 44.031'	061° 59.673'	BC	22
SO270_81-1	17.10.2019 02:14	10° 43.740'	062° 13.761'	BC	24
SO270_82-1	17.10.2019 03:08	10° 43.699'	062° 16.032'	CTD	172
SO270_82-2	17.10.2019 03:36	10° 43.692'	062° 16.041'	MSN	173
SO270_82-3	17.10.2019 03:53	10° 43.694'	062° 16.040'	BC	174
SO270_82-4	17.10.2019 04:16	10° 43.695'	062° 16.040'	GC	177
SO270_82-5	17.10.2019 04:35	10° 43.691'	062° 16.034'	MUC	171
SO270_83-1	17.10.2019 05:24	10° 43.752'	062° 13.770'	OFOS	1336
SO270_84-1	17.10.2019 07:47	10° 43.690'	062° 15.016'	EM122	61
SO270_84-2	17.10.2019 11:38	10° 47.576'	062° 21.871'	SVP (XSV)	1897
SO270_85-1	17.10.2019 14:44	11° 05.703'	062° 15.744'	OFOS	294
SO270_86-1	17.10.2019 19:13	11° 06.575'	062° 17.347'	BC	1011
SO270_86-2	17.10.2019 20:16	11° 06.574'	062° 17.346'	GC	1010
SO270_87-1	17.10.2019 21:34	11° 05.923'	062° 16.301'	BC	638
SO270_87-2	17.10.2019 22:27	11° 05.922'	062° 16.299'	MUC	634
SO270_88-1	17.10.2019 23:47	11° 05.240'	062° 17.689'	CTD	1174
SO270_88-2	18.10.2019 00:42	11° 05.245'	062° 17.684'	MSN	1172
SO270_88-3	18.10.2019 01:24	11° 05.237'	062° 17.684'	MSN	1176
SO270_88-4	18.10.2019 02:32	11° 05.237'	062° 17.685'	BC	1178
SO270_88-5	18.10.2019 03:38	11° 05.243'	062° 17.683'	BC	1170

Station	Date & Time [UTC]	Lat. S	Lon. E	Device	Depth [m]
SO270_88-6	18.10.2019 05:02	11° 05.236'	062° 17.685'	GC	1181
SO270_88-7	18.10.2019 06:03	11° 05.245'	062° 17.687'	MUC	1179
SO270_89-1	18.10.2019 06:36	11° 05.266'	062° 17.712'	MCS	1166
SO270_90-1	19.10.2019 19:03	11° 59.992'	065° 00.001'	CTD	3276
SO270_90-2	19.10.2019 20:01	12° 00.001'	065° 00.004'	MSN	3270
SO270_90-3	19.10.2019 20:38	11° 59.993'	065° 00.004'	MSN	3278
SO270_91-1	20.10.2019 03:43	12° 59.999'	065° 00.001'	CTD	3463
SO270_91-2	20.10.2019 04:41	12° 59.997'	064° 59.995'	MSN	3465
SO270_91-3	20.10.2019 05:16	12° 59.997'	065° 00.002'	MSN	3453
SO270_92-1	20.10.2019 12:31	13° 59.994'	065° 00.000'	CTD	3425
SO270_92-2	20.10.2019 13:30	14° 00.000'	064° 59.997'	MSN	3431
SO270_92-3	20.10.2019 14:09	13° 59.990'	065° 00.003'	MSN	3423
SO270_93-1	20.10.2019 22:14	14° 59.995'	065° 00.001'	CTD	3462
SO270_93-2	21.10.2019 00:18	14° 59.996'	065° 00.007'	MSN	3464
SO270_93-3	21.10.2019 00:58	14° 59.993'	065° 00.001'	MSN	3461
SO270_93-4	21.10.2019 01:38	15° 00.005'	064° 59.999'	CTD	3468