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# Short Cruise Report RV SONNE cruise SO301

Port Louis – Port Louis (Mauritius) 22.11.2023 – 04.01.2024 Chief Scientist: Martin Engels Captain: Tilo Birnbaum



Fig. 1: Cruise track of RV SONNE cruise SO301

## Objectives

The main target of survey SO301 within the SCIROCCO project is a seismic image of the Central Indian Ridge near 25° S / 70° E in order to better understand structures and processes of magmatism and crustal extension. At slow spreading ridges, phases of magmatic accretion alternate with phases of tectonic stretching and consequently faulting on different scales. The long-living large detachment faults lead to the formation of Oceanic Core Complexes (OCC), which represent exhumed lower crustal or upper mantle material raised along these detachment faults to the seafloor. Seismic imaging will allow validating competing conceptual OCC models by resolving crustal structure and fault systems at depth. Faults are potential pathways for fluids, which might develop to hydrothermal systems in combination with magmatic heat sources. Hence, we study the link between OCCs, fault systems and hydrothermal vents by seismic imaging.

The study area north of the Rodriguez Triple Junction represents an exciting key section of the Central Indian Ridge including the huge 25 °S OCC and the active Kairei hydrothermal vent system. We investigate these targets by geophysical imaging with

- i) a dense grid of multichannel seismic lines with 8 km hydrophone cable length,
- ii) two refraction lines with ocean bottom seismometers (OBS),
- iii) two OBS arrays around the OCC and the Kairei hydrothermal field, and
- iv) magnetic, gravity and bathymetric mapping.

By joint interpretation of these geophysical imaging methods, we aim to progress our understanding of the interactions between magmatism, faulting, OCC formation and hydrothermal activity at slow spreading ridges.

In the KABA secondary user project, we study the hydrothermal plume of the Kairei hydrothermal field. The high heat flux and seawater-rock interaction lead to the dissolution of reduced metals, sulfur compounds and energy-rich gases, which rise far into the water column. These components make a yet unquantified contribution to the biogeochemistry of the deep water. The plumes are also a source of important trace elements for life in the ocean. In the KABA project, we investigate the impact of these vents on the oceans using physicochemical, geochemical, and molecular biological methods.

#### Narrative

The scientific expedition SO301 departed from Port Louis at 19:30 hours on November 22 after mobilisation of 12 containers. At the EEZ on November 25, we conducted an OBS releaser test of 51 devices. At noon on November 26, we reached the westernmost OBS site in our survey area. This location served as a reference station for the vessel's CTD rosette and the titanium trace metal rosette (TMR) from Bremen, before we deployed 25 OBS at the western part of an SW-NE refraction profile and a 3D array around the OCC.

From November 27 to 29, a first CTD program followed at the Kairei hydrothermal vent site for the KABA project. It consisted of a stationary Yo-Yo CTD over 12 hours (tidal cycle) followed by a TMR hydrocast, a Tow-Yo CTD, a TMR hydrocast, and another Tow-Yo CTD in order to map the plume in space and time.

Meanwhile, we prepared the remaining 20 OBS and deployed them on November 30 along the second half of the SW-NE refraction profile. This refraction profile was sailed for 24 hours after deployment of magnetometer, passive acoustic monitoring system (PAM) for whale detection, airguns, and magnetometer. After recovery of the outboard systems, we recovered 19 OBS along the refraction line, saved the data and redeployed 15 OBS to complement the 3D array around the OCC.

From December 2nd to 3<sup>rd</sup>, we conducted a second CTD program at the Kairei site consisting of two CTD Tow-Yo profiles, each followed by a TMR hydrocast station.

On December 4, the MCS program started with the deployment of the 8 km long hydrophone cable with 756 channels, magnetometers, PAM and 16 airguns. After a first reference profile in the south, we recovered the first 1.5 km of the streamer in order to replace a malfunctioning bird (depth control unit). Since then, we sailed a total of 29 profiles without interruptions applying a shotpoint spacing of 50 m until recovery of the outboard equipment on December 18. Airgun failures occurred in the second MCS week and could be maintenanced during profile turns. Profile turns were shot in a one-minute interval to serve for large off-set observations on the OBS.

From December 18 to 19, a third CTD program over 36 h at the Kairei site consisted of three CTD Tow-Yo profiles and two TMR hydrocast station in-between. On December 20, we recovered five broadband OBS, which had already been deployed camera-controlled in September during SO300/1 at Kairei on a passive sulphide mound.

For about 24 h, we shot a second refraction line along a polygon around and across the OCC with a one-minute shotpoint spacing for the OCC OBS 3D-array. Afterwards in the evening of December 21, we recovered 19 OBS from the OCC and prepared them again for the next deployment.

Meanwhile, on December 22 to 23, a fourth CTD program started at the Kairei site with a stationary 12 h Yo-Yo CTD hydrocast around the tidal minimum, followed by a TMR hydrocast. After a transit to the northernmost OBS location, we conducted a second reference station measurement with the CTD and titanium TMR.

On December 24, we deployed 21 OBS along the NS refraction profile. After one day with bathymetry profiling (EM122), we shot the third refraction profile from the December 25 to 26. The recovery of all remaining 42 OBS lasted 36 h until late December 27.

After 10 hours of bathymetry profiling in order to fill gaps, two CTD Tow-Yo profiles followed on December 28 on an OBS site, where the previously recovered OBS smelled intensively after sulphide on deck. However, no active plume signals could be recorded.

After another day of bathymetry profiling in the western part of the survey area, a fifth and last 36 h CTD program at the Kairei site lasted from December 30 to 31. It contained three CTD Tow-Yo profiles and two TMR hydrocast sites. In the afternoon of December 31, the transit back to Port Louis started with bathymetry, gravity and shipborne magnetic underway recording until the EEZ border. We reached Port Louis on January 4 for demobilisation, and all scientists left RV SONNE on January 5.



*Fig. 2: Survey area at 25° S 70° E with MCS profiles (red lines), refraction profiles (yellow lines) and OBS locations (yellow and blue dots). Black lines show the one-minute shot interval during MCS shooting.* 



Fig. 3: Scientific crew of SO-301, photo: Willi Rieger

### Acknowledgements

The SCIROCCO project has been funded by BMBF (Federal Ministry of Education and Research) under Grant Nb. 03G0301A (BGR) and 03G0301B (GEOMAR), the secondary user project KABA under Grant Nb. GPF22-1\_046.

We thank the German Research Fleet Coordination Centre, Institute for Geology, Hamburg University, and BRIESE research for their comprehensive support in logistic preparation of the cruise. On behalf of the scientific crew, I would like to thank Captain Tilo Birnbaum and the ship's crew for their outstanding assistance and support during all survey operations.

## List of participants

1. Engels, Martin, Dr.	Fahrtleiter / Chief Scientist	BGR
2. Barckhausen, Udo, Dr.	Magnetics	BGR
3. Behrens, Thomas	Reflection Seismics	BGR
4. Demir, Ümit	Reflection Seismics	BGR
5. Deppe, Joachim	Magnetics	BGR
6. Ebert, Timo	Reflection Seismics	BGR
7. Ehrhardt, Axel, Dr.	OBS/Reflection Seismics	BGR
8. Heyde, Ingo, Dr.	Gravity	BGR
9. Kuckuck, Jan	Reflection Seismics	BGR
10.Ladage, Stefan	Hydroacoustics	BGR
11.Lutz, Rüdiger, Dr.	Hydroacoustics	BGR
12. Schauer, Michael	OBS/Reflection Seismics	BGR
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15. Steinborn, Peter	Reflection Seismics	BGR
16.Bartels, Thies	OBS	GEOMAR
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18.Dannowski, Anke, Dr.	OBS	GEOMAR
19.Filbrandt, Christian	OBS	GEOMAR
20. Jegen, Anna	OBS	GEOMAR
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22. Fröhberg, Nico	CTD/Trace metals	CUB
23.Pedre, Ignacio, Dr.	CTD/Trace metals	CUB
24.Gallucci, Luici	CTD/Microbiology	UNIHB
25.Mette, Jonathan	CTD/Oceanography	UNIHB
26. Raphael Deeban Raj, Shareen,	Dr. CTD/Microbiology	UNIHB
27.Renzelmann, Henri	CTD/Oceanography	UNIHB
28.Wegener, Gunter, Dr.	CTD/Microbiology	UNIHB
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30. Gomez de Souza, Berenice	Marine Mammal Observer	EPI

BGR: Federal Institute for Geosciences and Natural Resources, Hannover, Germany GEOMAR: Helmholtz-Zentrum für Ozeanforschung Kiel, Germany CUB: Constructor University, Bremen, Germany UNIHB: Universität Bremen, Germany EPI: EPI Limited, United Kingdom

Station No.	Date and Time [UTC]	Device / Remarks	Latitude [S]	Longitude [E]	Depth [m]
SO301_1-1	24.11.2023 21:09	EL1 Releasertest	23° 11,000'	64° 32,998'	4122.8
SO301_2-1	26.11.2023 07:03	CTD 01 SS-CTD	25° 27,794'	69° 22,710'	2993.7
SO301_3-1	26.11.2023 11:27	CTD 02 Ti-CTD	25° 27,789'	69° 22,716'	2987.4
SO301_4-1	26.11.2023 15:47	OBS 01 Deployment	25° 27,794'	69° 22,717'	2987.2
SO301_5-1	27.11.2023 03:00	CTD 03 SS-CTD	25° 19,220'	70° 02,423'	2429.5
SO301_6-1	27.11.2023 20:51	CTD 04 Ti-CTD	25° 19,233'	70° 02,426'	2429.2
SO301_7-1	28.11.2023 00:35	CTD 05 SS-CTD	25° 18,959'	70° 02,557'	2317.1
SO301_8-1	28.11.2023 15:49	CTD 06 Ti-CTD	25° 19,214'	70° 02,430'	2434.8
SO301_9-1	28.11.2023 20:11	CTD 07 SS-CTD	25° 18,948'	70° 02,728'	2331.7
SO301_10-1	29.11.2023 07:49	CTD 08 SS-CTD	25° 19,021'	70° 01,918'	2589.0
SO301_11-1	29.11.2023 14:32	OBS 02 Deployment	25° 16,264'	69° 48,846'	2029.1
SO301_12-1	30.11.2023 02:55	SEISSRC 01 Refraction	24° 42,443'	70° 43,694'	3814.1
SO301_13-1	01.12.2023 05:14	OBS 03 Recovery	25° 28,934'	69° 21,721'	2788.5
SO301_14-1	02.12.2023 14:32	OBS 04 Deployment	25° 13,988'	69° 44,994'	3120.4
SO301_15-1	02.12.2023 12:47	CTD 09 SS-CTD	25° 18,439'	70° 03,731'	2681.0
SO301_16-1	03.12.2023 03:31	CTD 10 Ti-CTD	25° 19,496'	70° 02,245'	2631.7
SO301_17-1	03.12.2023 07:56	CTD 11 SS-CTD	25° 19,497'	70° 02,250'	2626.5
SO301_18-1	03.12.2023 18:19	CTD 12 Ti-CTD	25° 19,281'	70° 02,123'	2549.5
SO301_19-1	04.12.2023 03:19	SEISTR MCS Profiles	25° 59,123'	70° 14,767'	2952.8
SO301_20-1	18.12.2023 14:02	CTD 13 SS-CTD	25° 18,825'	70° 00,601'	2824.3
SO301_21-1	19.12.2023 00:29	CTD 14 Ti-CTD	25° 19,198'	70° 02,392'	2465.5
SO301_22-1	19.12.2023 04:34	CTD 15 SS-CTD	25° 18,370'	70° 02,825'	2447.4
SO301_23-1	19.12.2023 15:22	CTD 16 Ti-CTD	25° 19,283'	70° 02,259'	2544.4

S0301_24-1   19:12.2023   CTD 17   25° 19,097'   70° 02,808'   2302.4     S0301_25-1   20.12.2023   OBS 05   25° 19,342'   70° 02,076'   2580.8     S0301_26-1   20.12.2023   SEISSRC 02   25° 19,332'   69° 56,053'   4031.1     O7:10   Refraction   70° 02,421'   2421.9   3778.4     S0301_27-1   21.12.2023   CTD 18   25° 19,656'   70° 02,421'   2421.9     S0301_28-1   23.12.2023   CTD 19   25° 01,986'   69° 34,730'   2662.8     90:39   SS-CTD   25° 01,757'   69° 34,924'   2601.7     S0301_30-1   23.12.2023   CTD 21   25° 01,757'   69° 34,735'   2671.3     S0301_31-1   23.12.2023   CTD 21   25° 01,767'   69° 34,735'   2601.7     S0301_32-1   23.12.2023   CBS 07   25° 01,986'   69° 34,735'   2671.3     S0301_33-1   24.12.2023   BEISSRC 03   25° 51,71'   69° 59,682'   3132.0     O2:12   SU12.2023   SEISSRC 03   25° 51,71' <th></th> <th></th> <th></th> <th></th> <th></th> <th></th>						
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SO301_28-1   22.12.2023   CTD 18   25° 19,223'   70° 02,421'   2421.9     SO301_29-1   23.12.2023   CTD 19   25° 19,656'   70° 02,038'   2739.8     SO301_30-1   23.12.2023   CTD 20   25° 01,986'   69° 34,730'   2662.8     SO301_30-1   23.12.2023   CTD 20   25° 01,757'   69° 34,924'   2601.7     14:24   Ti-CTD   71° 02,876'   69° 34,924'   2601.7     14:24   Ti-CTD   25° 01,757'   69° 34,924'   2601.7     SO301_32-1   23.12.2023   OBS 07   25° 01,963'   69° 34,736'   2671.3     SO301_32-1   24.12.2023   EM122 01   25° 48,032'   70° 02,876'   3132.0     02:12   02:12   55   55,171'   69° 59,682'   3140.3     SO301_34-1   25.12.2023   CTD 22   25° 12,222'   69° 42,966'   2861.3     04:51   Recovery   70° 03,435'   3111.5   16:25   3001_37-1   28.12.2023   CTD 22   25° 12,222'   69° 42,966'   2959.9   00:57 <td></td> <td>12:57</td> <td>Recovery</td> <td></td> <td></td> <td></td>		12:57	Recovery			
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SO301_33-1   24.12.2023 02:12   EM122 01   25° 48,032'   70° 02,876'   3132.0     SO301_34-1   25.12.2023 10:38   SEISSRC 03 Refraction   25° 55,171'   69° 59,682'   3140.3     SO301_35-1   26.12.2023 04:51   OBS 06 Recovery   24° 57,564'   69° 34,606'   2861.3     SO301_36-1   27.12.2023   EM122 02   25° 47,042'   70° 03,435'   3111.5     SO301_37-1   28.12.2023   CTD 22 SS-CTD   25° 12,222'   69° 42,966'   2959.9     SO301_37-1   28.12.2023   CTD 23 SS-CTD   25° 13,386'   69° 41,261'   3328.3     SO301_39-1   28.12.2023   CTD 24 SS-CTD   25° 17,467'   70° 03,270'   2598.7     SO301_40-1   29.12.2023   CTD 24 SS-CTD   25° 20,723'   70° 01,690'   2915.7     SO301_41-1   30.12.2023   CTD 26 SS-CTD   25° 20,820'   70° 03,092'   2759.3     SO301_42-1   30.12.2023   CTD 27 SS-CTD   25° 19,118'   70° 03,066'   2262.1     SO301_43-1   30.12.2023   CTD 27 SS-CTD   25° 20,203'   70° 01,94	_	17:25	Deployment			
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$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	SO301_35-1	26.12.2023	OBS 06	24° 57,564'	69° 34,606'	2861.3
SO301_36-1   27.12.2023   EM122 02   25° 47,042'   70° 03,435'   3111.5     SO301_37-1   28.12.2023   CTD 22   25° 12,222'   69° 42,966'   2959.9     00:57   SS-CTD   25° 13,386'   69° 41,261'   3328.3     SO301_38-1   28.12.2023   CTD 23   25° 13,237'   69° 43,969'   3098.8     SO301_39-1   28.12.2023   MAG 01   25° 17,467'   70° 03,270'   2598.7     SO301_40-1   29.12.2023   CTD 24   25° 17,467'   70° 01,690'   2915.7     SO301_41-1   30.12.2023   CTD 25   25° 20,723'   70° 03,092'   2759.3     SO301_42-1   30.12.2023   CTD 26   25° 20,820'   70° 03,092'   2759.3     SO301_43-1   30.12.2023   CTD 27   25° 19,118'   70° 03,066'   2262.1     SO301_43-1   30.12.2023   CTD 28   25° 20,203'   70° 01,943'   2837.8     SO301_44-1   31.12.2023   CTD 28   25° 20,204'   70° 01,943'   2837.8     SO301_45-1   31.12.2023   EM122 0		04:51	Recovery			
16:25   CTD 22   25° 12,222'   69° 42,966'   2959.9     SO301_37-1   28.12.2023   CTD 23   25° 13,386'   69° 41,261'   3328.3     SO301_38-1   28.12.2023   CTD 23   25° 13,237'   69° 43,969'   3098.8     SO301_39-1   28.12.2023   MAG 01   25° 13,237'   69° 43,969'   3098.8     SO301_40-1   29.12.2023   CTD 24   25° 17,467'   70° 03,270'   2598.7     SO301_41-1   30.12.2023   CTD 25   25° 20,723'   70° 01,690'   2915.7     SO301_42-1   30.12.2023   CTD 26   25° 20,820'   70° 03,092'   2759.3     SO301_43-1   30.12.2023   CTD 27   25° 19,118'   70° 03,066'   2262.1     SO301_43-1   30.12.2023   CTD 28   25° 20,203'   70° 01,943'   2837.8     SO301_44-1   31.12.2023   CTD 28   25° 20,204'   70° 01,942'   2841.0     SO301_45-1   31.12.2023   EM122 03   25° 20,204'   70° 01,942'   2841.0	SO301_36-1	27.12.2023	EM122 02	25° 47,042'	70° 03,435'	3111.5
SO301_37-1 28.12.2023 CTD 22 25° 12,222' 69° 42,966' 2959.9   SO301_38-1 28.12.2023 CTD 23 25° 13,386' 69° 41,261' 3328.3   SO301_39-1 28.12.2023 MAG 01 25° 13,237' 69° 43,969' 3098.8   SO301_40-1 29.12.2023 CTD 24 25° 17,467' 70° 03,270' 2598.7   SO301_40-1 29.12.2023 CTD 25 25° 20,723' 70° 01,690' 2915.7   SO301_41-1 30.12.2023 CTD 26 25° 20,820' 70° 03,092' 2759.3   SO301_42-1 30.12.2023 CTD 27 25° 19,118' 70° 03,066' 2262.1   SO301_43-1 30.12.2023 CTD 28 25° 20,203' 70° 01,943' 2837.8   SO301_44-1 31.12.2023 CTD 28 25° 20,204' 70° 01,942' 2841.0   SO301_45-1 31.12.2023 EM122 03 25° 20,204' 70° 01,942' 2841.0		16:25				
00:57   SS-CTD   25° 13,386'   69° 41,261'   3328.3     SO301_38-1   28.12.2023   CTD 23   25° 13,237'   69° 43,969'   3098.8     SO301_39-1   28.12.2023   MAG 01   25° 13,237'   69° 43,969'   3098.8     SO301_40-1   29.12.2023   CTD 24   25° 17,467'   70° 03,270'   2598.7     SO301_41-1   30.12.2023   CTD 25   25° 20,723'   70° 01,690'   2915.7     SO301_42-1   30.12.2023   CTD 26   25° 20,820'   70° 03,092'   2759.3     SO301_42-1   30.12.2023   CTD 27   25° 19,118'   70° 03,066'   2262.1     SO301_43-1   30.12.2023   CTD 27   25° 19,118'   70° 01,943'   2837.8     SO301_44-1   31.12.2023   CTD 28   25° 20,203'   70° 01,943'   2837.8     SO301_45-1   31.12.2023   EM122 03   25° 20,204'   70° 01,942'   2841.0	SO301_37-1	28.12.2023	CTD 22	25° 12,222'	69° 42,966'	2959.9
SO301_38-1 28.12.2023 CTD 23 25° 13,386' 69° 41,261' 3328.3   SO301_39-1 28.12.2023 MAG 01 25° 13,237' 69° 43,969' 3098.8   SO301_40-1 29.12.2023 CTD 24 25° 17,467' 70° 03,270' 2598.7   SO301_41-1 30.12.2023 CTD 25 25° 20,723' 70° 01,690' 2915.7   SO301_42-1 30.12.2023 CTD 26 25° 20,820' 70° 03,092' 2759.3   SO301_42-1 30.12.2023 CTD 27 25° 19,118' 70° 03,066' 2262.1   SO301_43-1 30.12.2023 CTD 28 25° 20,203' 70° 01,943' 2837.8   SO301_44-1 31.12.2023 CTD 28 25° 20,204' 70° 01,942' 2841.0   SO301_45-1 31.12.2023 EM122 03 25° 20,204' 70° 01,942' 2841.0		00:57	SS-CTD			
07:38   SS-CTD   69° 43,969'   3098.8     SO301_39-1   28.12.2023   MAG 01   25° 13,237'   69° 43,969'   3098.8     SO301_40-1   29.12.2023   CTD 24   25° 17,467'   70° 03,270'   2598.7     SO301_41-1   30.12.2023   CTD 25   25° 20,723'   70° 01,690'   2915.7     SO301_41-1   30.12.2023   CTD 26   25° 20,820'   70° 03,092'   2759.3     SO301_42-1   30.12.2023   CTD 26   25° 20,820'   70° 03,092'   2759.3     SO301_43-1   30.12.2023   CTD 27   25° 19,118'   70° 03,066'   2262.1     SO301_43-1   31.12.2023   CTD 28   25° 20,203'   70° 01,943'   2837.8     SO301_45-1   31.12.2023   EM122 03   25° 20,204'   70° 01,942'   2841.0	SO301_38-1	28.12.2023	CTD 23	25° 13,386'	69° 41,261'	3328.3
SO301_39-1 28.12.2023 13:47 MAG 01 25° 13,237' 69° 43,969' 3098.8   SO301_40-1 29.12.2023 20:13 CTD 24 SS-CTD 25° 17,467' 70° 03,270' 2598.7   SO301_41-1 30.12.2023 07:09 CTD 25 Ti-CTD 25° 20,723' 70° 01,690' 2915.7   SO301_42-1 30.12.2023 11:37 CTD 26 SS-CTD 25° 20,820' 70° 03,092' 2759.3   SO301_43-1 30.12.2023 20:45 CTD 27 SS-CTD 25° 19,118' 70° 03,066' 2262.1   SO301_44-1 31.12.2023 03:27 CTD 28 Ti-CTD 25° 20,203' 70° 01,943' 2837.8   SO301_45-1 31.12.2023 08:25 EM122 03 25° 20,204' 70° 01,942' 2841.0		07:38	SS-CTD			
13:47   CTD 24   25° 17,467'   70° 03,270'   2598.7     SO301_40-1   29.12.2023   CTD 24   25° 20,723'   70° 01,690'   2915.7     SO301_41-1   30.12.2023   CTD 25   25° 20,723'   70° 03,092'   2915.7     SO301_42-1   30.12.2023   CTD 26   25° 20,820'   70° 03,092'   2759.3     SO301_43-1   30.12.2023   CTD 27   25° 19,118'   70° 03,066'   2262.1     SO301_43-1   30.12.2023   CTD 27   25° 20,203'   70° 01,943'   2837.8     SO301_44-1   31.12.2023   CTD 28   25° 20,204'   70° 01,942'   2841.0     SO301_45-1   31.12.2023   EM122 03   25° 20,204'   70° 01,942'   2841.0	SO301_39-1	28.12.2023	MAG 01	25° 13,237'	69° 43,969'	3098.8
SO301_40-1 29.12.2023 CTD 24 25° 17,467' 70° 03,270' 2598.7   SO301_41-1 30.12.2023 CTD 25 25° 20,723' 70° 01,690' 2915.7   SO301_42-1 30.12.2023 CTD 26 25° 20,820' 70° 03,092' 2759.3   SO301_42-1 30.12.2023 CTD 26 25° 20,820' 70° 03,092' 2759.3   SO301_43-1 30.12.2023 CTD 27 25° 19,118' 70° 03,066' 2262.1   SO301_43-1 30.12.2023 CTD 28 25° 20,203' 70° 01,943' 2837.8   SO301_44-1 31.12.2023 CTD 28 25° 20,204' 70° 01,942' 2841.0   SO301_45-1 31.12.2023 EM122 03 25° 20,204' 70° 01,942' 2841.0		13:47				
20:13   SS-CTD   20:13   SS-CTD     SO301_41-1   30.12.2023   CTD 25   25° 20,723'   70° 01,690'   2915.7     SO301_42-1   30.12.2023   CTD 26   25° 20,820'   70° 03,092'   2759.3     SO301_42-1   30.12.2023   CTD 27   25° 19,118'   70° 03,066'   2262.1     SO301_43-1   30.12.2023   CTD 27   25° 20,203'   70° 01,943'   2837.8     SO301_44-1   31.12.2023   CTD 28   25° 20,203'   70° 01,943'   2837.8     SO301_45-1   31.12.2023   EM122 03   25° 20,204'   70° 01,942'   2841.0	SO301_40-1	29.12.2023	CTD 24	25° 17,467'	70° 03,270'	2598.7
SO301_41-1 30.12.2023 CTD 25 25° 20,723' 70° 01,690' 2915.7   SO301_42-1 30.12.2023 CTD 26 25° 20,820' 70° 03,092' 2759.3   SO301_43-1 30.12.2023 CTD 27 25° 19,118' 70° 03,066' 2262.1   SO301_43-1 30.12.2023 CTD 27 25° 20,203' 70° 01,943' 2837.8   SO301_44-1 31.12.2023 CTD 28 25° 20,204' 70° 01,942' 2841.0   SO301_45-1 31.12.2023 EM122 03 25° 20,204' 70° 01,942' 2841.0		20:13	SS-CTD			
07:09   Ti-CTD   25° 20,820'   70° 03,092'   2759.3     SO301_42-1   30.12.2023   CTD 26   25° 20,820'   70° 03,092'   2759.3     SO301_43-1   30.12.2023   CTD 27   25° 19,118'   70° 03,066'   2262.1     SO301_43-1   31.12.2023   CTD 28   25° 20,203'   70° 01,943'   2837.8     SO301_44-1   31.12.2023   CTD 28   25° 20,203'   70° 01,943'   2837.8     SO301_45-1   31.12.2023   EM122 03   25° 20,204'   70° 01,942'   2841.0	SO301_41-1	30.12.2023	CTD 25	25° 20,723'	70° 01,690'	2915.7
SO301_42-1 30.12.2023 CTD 26 25° 20,820' 70° 03,092' 2759.3   SO301_43-1 30.12.2023 CTD 27 25° 19,118' 70° 03,066' 2262.1   SO301_43-1 31.12.2023 CTD 28 25° 20,203' 70° 01,943' 2837.8   SO301_44-1 31.12.2023 CTD 28 25° 20,204' 70° 01,942' 2841.0   SO301_45-1 31.12.2023 EM122 03 25° 20,204' 70° 01,942' 2841.0		07:09	Ti-CTD			
11:37   SS-CTD   25° 19,118'   70° 03,066'   2262.1     SO301_43-1   30.12.2023   CTD 27   25° 19,118'   70° 01,943'   2837.8     SO301_44-1   31.12.2023   CTD 28   25° 20,203'   70° 01,943'   2837.8     SO301_45-1   31.12.2023   EM122 03   25° 20,204'   70° 01,942'   2841.0	SO301_42-1	30.12.2023	CTD 26	25° 20,820'	70° 03,092'	2759.3
SO301_43-1 30.12.2023 CTD 27 25° 19,118' 70° 03,066' 2262.1   20:45 SS-CTD 25° 20,203' 70° 01,943' 2837.8   SO301_44-1 31.12.2023 CTD 28 25° 20,203' 70° 01,943' 2837.8   SO301_45-1 31.12.2023 EM122 03 25° 20,204' 70° 01,942' 2841.0		11:37	SS-CTD			
20:45   SS-CTD   20:45     SO301_44-1   31.12.2023   CTD 28   25° 20,203'   70° 01,943'   2837.8     03:27   Ti-CTD   70° 01,943'   2837.8   2837.8     SO301_45-1   31.12.2023   EM122 03   25° 20,204'   70° 01,942'   2841.0	SO301_43-1	30.12.2023	CTD 27	25° 19,118'	70° 03,066'	2262.1
SO301_44-1   31.12.2023   CTD 28   25° 20,203'   70° 01,943'   2837.8     03:27   Ti-CTD   25° 20,204'   70° 01,943'   2837.8     SO301_45-1   31.12.2023   EM122 03   25° 20,204'   70° 01,942'   2841.0     08:25   08:25   25° 20,204'   70° 01,942'   2841.0		20:45	SS-CTD			
03:27   Ti-CTD   SO301_45-1   31.12.2023   EM122 03   25° 20,204'   70° 01,942'   2841.0     08:25 <td< td=""><td>SO301_44-1</td><td>31.12.2023</td><td>CTD 28</td><td>25° 20,203'</td><td>70° 01,943'</td><td>2837.8</td></td<>	SO301_44-1	31.12.2023	CTD 28	25° 20,203'	70° 01,943'	2837.8
SO301_45-1 31.12.2023 EM122 03 25° 20,204' 70° 01,942' 2841.0		03:27	Ti-CTD			
	SO301_45-1	31.12.2023 08 <sup>.</sup> 25	EM122 03	25° 20,204'	70° 01,942'	2841.0