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Short Cruise Report R/V SONNE SO306

Port Louis, Mauritius – Durban, South Africa 08.08.2024 – 09.09.2024 Chief Scientist: Dierk Hebbeln Captain: Tilo Birnbaum



Track chart of RV SONNE cruise SO306.

Objectives

The aim of the RV SONNE expedition SO306 was to systematically study the important bathyal CWC ecosystems in the West Indian Ocean for the first time with state-of-the-art marine technology, and to use the newly acquired data to analyse CWCs in the context of their global distribution and importance. The overarching goal of expedition SO306 was to gain a sound understanding of how environmental conditions and their temporal variability - often triggered by climate variability - affect the vitality of CWC ecosystems in the West Indian Ocean. The main objectives were as follows: For the present-day situation, we aimed to (i) identify potential CWC habitats based on high-resolution mapping, (ii) conduct a systematic inventory of CWCs and their associated fauna through video mapping and faunal sampling, (iii) characterise controlling environmental factors through measurements of oceanographic parameters and water sampling in the immediate vicinity of CWCs, and (iv) analyse o the plankton community as a relevant part of the trophic net. In order to reconstruct the response of CWCs to past climatic and environmental changes, further goals were to (i) identify past CWC growth phases using sediment cores collected from CWC mounds, (ii) reconstruct paleoenvironmental changes using so-called reference sediment cores collected from the flat seabed, and (iii) assess the environmental factors that controlled the emergence or decline of CWC reefs under different climatic conditions in the past.

To reach these goals, a standardized monitoring and sampling programme was carried out for each of the work areas selected for cruise SO306 (Fig. 3.1), starting with hydroacoustic mapping using the multibeam echosounder systems (MBES), the PARASOUND (PS) subbottom profiler and the Acoustic Doppler Current Profiler (ADCP). Based on the hydroacoustic mapping, a total of 13 dives were conducted with the remotely operated vehicle ROV MARUM SQUID to characterise the existing facies and fauna in detail. These observations were complemented by studies of the structure and variability of the water column and its plankton communities using a CTD (14 single casts and 2 YoYo-CTD; supplemented by water sampling), a benthic lander system (2 deployments), and a multiple closing net (multinet; 7 stations). Special emphasis was placed on extensive surface sediment sampling using a video-guided giant box corer (TV-GBC) at 14 stations and an epibenthic sledge (EBS) at 11 stations. Long sediment cores were successfully retrieved with a gravity corer at 12 stations and will be used to study past environmental changes.

Narrative

Wednesday 06.08. - Sunday 11.08.2024 \diamond After two busy days of unloading containers, installing sampling gears on deck and preparing laboratories, RV SONNE left the harbour of Port Louis (Mauritius) on 8th of August at 8 am and set course to the first working area near the island of Mayotte. After three days of transit, we reached our first station in deep waters north of Mayotte on Sunday morning, where a first CTD-cast (GeoB26101) was conducted to obtain a sound velocity profile through the water column. Then, we started with some mapping transects to calibrate the EM122 MBES (GeoB26102).

Monday 12.08.2024 \diamond The night was spent to map (MBES/PS; GeoB26103) the western slope of the island while steaming along a line ~3 nm from the fringing coral reef of West Mayotte. Another CTD-station (GeoB26104) SW of the island preceded the first deployment of the ROV SQUID (GeoB26105). During the ROV dive, we observed a diverse fauna between black basaltic rocks and coarse sandy areas in 900-1000 m water depth. After the dive, one of

the benthic SML landers was deployed to remain on the seafloor for several days to continuously collect hydrographic data (GeoB26106).

Tuesday 13.08.2024 ♦ During the night, we continued the hydroacoustic mapping (GeoB26107). After breakfast, the ROV was deployed close to the position where the dive the day before ended (GeoB26108). After only ~2 hours, the dive had to be aborted due to technical problems. In the afternoon, the TV-GBC, newly designed by MARUM, was successfully deployed for its maiden cast (GeoB26109-1). We continued with deployments of the EBS (GeoB26109-2) and the multinet (GeoB26109-3). The night was spent with a YoYo-CTD to continuously measure water mass properties through the water column across a full tidal cycle (GeoB26110).

Wednesday 14.08.2024 \diamond The day started with an ROV dive (GeoB26111) targeting a slightly deeper area off Mayotte (1100-1200 m depth). The ROV dived across sandy areas and large basaltic rocks. One striking observation was the presence of large patches of gorgonian rubble, which was surprising given the few living gorgonians in the area. As on the previous day, the station work was completed by deploying the EBS (GeoB26112-1) and the multinet (GeoB26112-2), followed by hydroacoustic mapping during the night (GeoB26113).

Thursday 15.08. & Friday 16.08.2024 \diamond The ROV was deployed in the morning (GeoB26114), this time targeting a comparably shallow site in 600-700 m depth. Diving upward a steep basaltic cliff, again a diverse fauna was observed, however with many more organisms compared to the previous dives in deeper waters. As this was the last day in the working area off SW Mayotte, we recovered the lander (GeoB26115) and finished the work with two more deployments of the EBS (GeoB26116/17). In the evening of 15. August, we started the transit towards Tanzania, which lasted roughly 30 hours.

Saturday 17.08.2024 \diamond At 6 am, we entered the work area off Tanzania and started our station work with a CTD-cast down to ~2600 m water depth to obtain a sound velocity profile for hydroacoustic calibration and to collect water samples (GeoB26118). During the subsequent hydroacoustic mapping (MBES/PS; GeoB26119), which took us close to the Tanzanian coast, some mound-like structures were detected at 250-450 m water depth. We deployed the TV-GBC and inspected two of the mapped "mounds" (and additionally sample one; GeoB26120/21). Both seabed structures appeared to result from slumping rather than being coral mounds. However, the shallower structure at 270 m depth revealed a rich benthic fauna (incl. corals) covering a rocky and steep landscape, which did not allow sampling (GeoB26121). After another CTD-cast (GeoB26122), the night was spent with hydroacoustic mapping (GeoB26123).

Sunday 18.08.2024 \diamond The bathymetric map produced during the night showed some more mound-like structures, but again these appeared to be the result of submarine landslides rather than CWC mounds. An ROV dive that began in the morning took us to a submarine canyon that may be a favoured habitat for CWCs (GeoB26124). Although we did not find any corals, we did find (and sample) numerous remains of plants (seagrass, mangrove leaves), demonstrating the important role of these channels in transporting carbon from the land and shallow waters towards the deep sea. In order to assess the different components of the regional trophic net, the ROV dive was followed by sampling with the TV-GBC (GeoB26125/26), multinet (GeoB26127), and EBS (GeoB26128/29).

Monday 19.08.2024 \diamond This day started with a big surprise. The overnight hydroacoustic mapping (GeoB26130) revealed a very conspicuous structure on the seafloor: a "mound" with a diameter of ~750 m and a height of 80 m. During the subsequent ROV dive (GeoB26131), it quickly became clear that this was a seepage site - a discovery that surprised everyone onboard. The seepage became obvious by the presence of authigenic carbonates, large accumulations of shells, and finally the discovery of large beds of live chemosymbiotic mussels near the eastern summit of the structure at a depth of ~870 m. Afterwards, we collected a seafloor sample with the TV-GBC (GeoB26132) from a very small sediment pocket on this structure. Then, we placed the benthic SML lander (GeoB26133-2) on the summit close to the living chemosymbiotic mussels and deployed the CTD twice (GeoB26133-1/34) to collect water samples at different depths of the seep structure, which is characterised by spatially very different benthic life: corals vs. mussels.

Tuesday 20.08.2024 \diamond The overnight hydroacoustic mapping (GeoB26135) showed no more of these structures, so we decided to conduct another ROV dive (GeoB26136) at the same seepage structure. The dive started at the eastern summit area, covered by the extensive mussel beds, and ended at the western summit characterised by rock outcrops and large boulders colonised by a variety of CWCs. Various rock samples and greenish mud collected by the ROV indicate that this 80 m high seep structure is a mud volcano (MV). Another carefully positioned TV-GBC (GeoB26137) followed by a multinet (GeoB26138) completed the sampling. During the night, we extended the hydroacoustic mapping (MBES/PS; GeoB26139) to the NE into deeper waters.

Wednesday 21.08.2024 \diamond This day was spent to collect sediment cores with the gravity corer, which will be used for paleoceanographic studies. We took four cores with recoveries between at water depths ranging from ~400 m to ~1500 m (GeoB26140/41 & 43/44). The transit between the coring sites was used to fill in some gaps in the MBES map (GeoB26142). During the day, the mapping team was able to identify several flares in the water column above this MV likely reflecting rising gas bubbles. They also identified the locations where these flares emanated from the seabed. During the night, we did a YoYo-CTD (GeoB26145) on top of one of these sites, hoping to record variations in the water column corresponding to the flares, but without success.

Thursday 22.08.2024 \diamond This day began with an unwelcome surprise: the combination of swell and currents (>1.5 kn) did not allow the planned deployment of the ROV. Instead, we took the opportunity to extend our MBES map to greater water depths and search for further mound structures (GeoB26146). In the afternoon, we recovered two more gravity cores (GeoB26147/48), before the night was again spend with hydroacoustic mapping (GeoB26149).

Friday 23.08.2024 ◊ With less swell and slower currents, the ROV was deployed after breakfast (GeoB26150). The target was once again the MV, which we named "Mtwara mud volcano" as suggested by our Tanzanian colleagues. During the dive, we again observed large mussel fields. Unfortunately, the currents increased and after a few hours of diving, we lost the data communication to the ROV. Without being able to control the ROV, the recovery in the strong current conditions (>1.5 kn) became quite tricky, but was successfully completed. Two further deployments of the TV-GBC on the MV allowed targeted sampling of a sandy patch (GeoB26151) and of a mussel field (GeoB26152-1). At the latter station, an additional CTD-

cast was conducted to collect bottom water samples needed for aquaria experiments (GeoB26152-2). The night was again spent to extend our MBES map in search of additional seabed structures (GeoB26153).

Saturday 24.08.2024 \diamond Current velocities approaching 3 kn did not allow for an ROV dive at a shallow site in ~300 m water depth. Instead, we used the TV-GBC for a video survey (GeoB26154) and discovered a somewhat chaotic pattern of near-vertical walls up to 10 m high covered by rich benthic fauna (anemones, corals, etc.). Due to the absence of any seep fauna and authigenic carbonates, this structure has been interpreted as a mass wasting deposit. Sampling at this site was completed with the deployment of the EBS next to this structure (GeoB26155).

Sunday 25.08.2024 \diamond The overnight hydroacoustic mapping (GeoB26156) ended at the next CTD station in roughly 1800 m depth (GeoB26157), where we obtained a new sound velocity profile needed for the hydroacoustic calibration. Afterwards, we collected a gravity core at ~1650 m water depth (GeoB26158). We successfully recovered the lander from the MV, where it has recorded hydrographic data for almost one week (GeoB26159). A further deployment of the EBS at a deep station (GeoB26160) extended the depth transect covered with this instrument down to 1650 m. The night was spent with hydroacoustic mapping (GeoB26161).

Monday 26.08.2024 \diamond The newly discovered Mtwara MV lies above a major fault line and the MBES data obtained during the night revealed a second, circular structure with a little dome in its center at ~1600 m water depth. The wind was much weaker as the previous days, but due to the strong currents, it was not possible to use the ROV in this depth, therefore we inspected this structure with the TV-GBC (GeoB26162). We could not detect any seep fauna, but we saw several rocks similar to the authigenic carbonates discovered on the Mtwara MV. Unfortunately, sampling with the TV-GBC failed. From there, we moved on to an even deeper station at ~1800 m to collect another gravity core (GeoB26163-1) and to deploy the EBS (GeoB26163-2). The night was spent to complete the bathymetric map for our Tanzanian working area (GeoB26164).

Tuesday 27.08. – Thursday 29.08.2024 ◊ An ROV dive in the morning to investigate a steep canyon wall (>30° slope angle) in ~500 m water depth (GeoB26165) had to be aborted as the currents were still too strong to allow for a safe operation of the ROV. Upon recovery, we finally received the research permit for Mozambique and, consequently, we set the course south to start a ~2 days transit. On Thursday evening, we reached the next working area off Mozambique near to the Zambezi Delta, where station work commenced with deployments of the CTD (GeoB26166-1) and the multinet (GeoB26166-2). The night was used for hydroacoustic mapping (GeoB26167) of the area.

Friday 30.08.2024 \diamond The inspection of the MBES map produced during the night was disappointing at first glance: we only found some small elevations. However, some of the small elevations occurred along a straight line with one "conspicuous" kink. We deployed the TV-GBC (GeoB26168) and were surprised to see abundant small chimneys at the seabed, of which several could be collected by the TV-GBC. This observation led us to plan for an ROV dive in the afternoon. In between, we collected one gravity corer (GeoB26169) and one sample with the EBS (GeoB26170). The ROV dive (GeoB26171) revealed even more chimneys and also some bacterial mats, surrounded by some CWCs – now we were sure that we discovered

another MV (later on named "Zambezi mud volcano" as suggested by our Mozambican colleagues). This was also supported by the analysis of the PS data from the previous night. After a final CTD-cast (GeoB26172), we left the area off Zambezi to continue our transit south because the weather forecast predicted bad weather conditions for this area for the coming days.

Saturday 31.08. – Sunday 01.09.2024 \diamond The night to Saturday was quite rough and during the day, RV SONNE was only slowly progressing southward because it had to fight against winds of >7 Bft and waves of up to 5 m in height. During the night to Sunday, the weather conditions improved and allowed to reach the new working area off south Mozambique off the Limpopo Bay on Sunday evening, where we started station work with a CTD-cast (GeoB26173) to obtain a regional sound velocity profile and to collect bottom water samples. The following night was spent with hydroacoustic mapping (GeoB26174), during which we detected a field of several rather shallow seamounts.

Monday 02.09.2024 ◊ In the morning, we started an ROV dive (GeoB26175) to a small ridge attached to the foot of a seamount in ~740 m water depth. Hoping for a sedimentary ridge formed by CWCs, we found a basaltic ridge colonised by very little benthic live. Possibly an indication that this lava flow has been put in place quite recently. Consequently, we ended this dive and moved to the top of this seamount, where ROV SQUID had its 100th dive (GeoB26176). The top of this seamount in ~290-320 m depth was a perfect target for such a special dive: it was covered by the most colourful and diverse coral garden we had so far encountered during this expedition. Afterwards, we deployed the CTD for water sampling (GeoB26177) and the multinet for plankton sampling (GeoB26178), followed by an overnight hydroacoustic mapping (GeoB26179).

Tuesday 03.09.2024 \diamond The ROV dive target planned for this day (GeoB26180) was a second seamount with an even shallower summit at 180 m water depth. As we slowly dived up the slope to reach the top, again encountering a colourful coral garden, we noticed that a surface buoy was anchored to the top. To prevent the ROV from becoming entangled in the buoy's anchor line, we decided to abort the dive. Once the ROV was safely back on deck, we left the sediment-starved seamount area and headed north, where the slope is covered by extensive drift deposits. There, we took two gravity cores at 1000 m (GeoB26181) and at 500 m water depth (GeoB26182-1) and an EBS sample (GeoB26182-2). We then began our transit south to our final working area off South Africa.

Wednesday 04.09.2024 \diamond What was supposed to be a full transit day ended already at 4 pm. Pushed by the wind (up to 10 Bft), waves (>3 m high), and strong currents (~4 kn), RV SONNE "sprinted" south. However, although, we reached our next working area off South Africa much earlier than expected, the weather conditions posed a problem for the planned work. An attempt to deploy the CTD had to be aborted and also the planned transects for hydroacoustic mapping (GeoB26183) had to be adjusted to be "doable" under these conditions.

Thursday 05.09.2024 \diamond The overnight mapping revealed some interesting mound-like structures. Despite the Agulhas Current rushing through the working area at >4 kn, we managed to deploy the TV-GBC (GeoB26184) and during a one-hour video mapping, we observed a silty sandy seabed. Due to the strong currents, we missed our targeted "mound" structure and had

to recover the TV-GBC. We planned for a second deployment of the TV-GBC (GeoB26185), this time reaching the seabed further upstream of our target structure, but strong bottom currents (>3 kn) made it difficult to identify objects on the seabed. In addition, just before the TV-GBC reached the targeted "mound" structure, part of the wire-guiding frame of the ship's crane broke off and the station had to be aborted. Increasing winds did not allow further deployment of the TV-GBC, instead the CTD (GeoB26186) and the multinet (GeoB26187) were deployed. During the night, we mapped an area closer to the coast (GeoB26188) in the hope being a bit better protected from the currents. However, this was not the case, instead the wind direction changed and we had to face strong winds and waves against the current, which made the situation even more difficult.

Friday 06.08.2024 \diamond Critical assessment of the wind and current situation in the morning revealed that seabed sampling in our target region would not be possible. Therefore, we decided to head to an area further offshore being less impacted by the Agulhas Current. At ~2 pm, we reached a suited station to collect a gravity core in ~1800 m water depth (GeoB26189). The night was spent with hydroacoustic mapping (GeoB26190).

Saturday 07.09.2024 \diamond Taking advantage of the greater water depths in this area, we started in the morning with a CTD-cast going down to ~2000 m (GeoB26191). After ~1 hour of transit, we reached the next station (GeoB26192), but the attempt to collect a gravity core failed because the core tube was bent when the corer hit a hard sediment layer. This was our final station for this expedition. We used the rather calm wind and wave situation to start storing the heavy equipment (ROV, TV-GBC, EBS, gravity corer) in the containers.

Sunday 08.09. & Monday 09.09. 2024 \diamond The day was spent to pack the laboratory equipment and the samples, clean the labs, and for a final science meeting, while RV SONNE was sailing to Durban. There, the expedition SO306 ended on 09. September at 1 pm with a few hours delay due to the again bad weather conditions hampering the transfer of the pilot to the vessel.

Acknowledgements

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SAM	Senckenberg am Meer, Wilhelmshaven, Germany
GEOMAR	Helmholtz Centre for Ocean Research, Kiel, Germany
DFFE	Department of Forestry, Fisheries & Environment, Cape Town, South Africa
DSFA	Deep Sea Fishing Authority, Zanzibar, Tanzania
IEO-CSIC	Spanish Institute of Oceanography Gijon, Spanish National Research Council, Spain
InOM	Oceanographic Institute of Mozambique, Maputo, Mozambique
NIOZ	Royal Netherlands Institute for Sea Research, Texel, The Netherlands
RSMAS	Rosenstiel School for Marine Sciences, University of Miami, USA
UB	University of Barcelona, Barcelona, Spain

Station list

Station	GeoB-ID	Gear	Date	Time	Latitude	Longitude	Depth	Remark
(SO306)			(ddmmyy)	(UTC)	('S)	('E)	(m)	
Mayotte	1			,	1			
SO306_1-1	26101-1	CTD+ROS	11.08.24	08:09	12°25.103	45°31.838	3265	sound velocity profiling; with mobile LADCP
SO306_2-1	26102-1	MBES/PS	11.08.24	09:54	12°26.699	45°31.593	3415	calibration mapping
			11.08.24	14:31	12°26.641	45°31.684	3200	end profile
SO306_3-1	26103-1	MBES/PS	11.08.24	23:11	12°38.302	45°17.861	1269	start
			12.08.24	07:01	13°01.721	44°54.993	885	end
SO306_4-1	26104-1	CTD+ROS	12.08.24	07:55	13°02.306	44°55.047	1166	water sampling; with mobile LADCP
SO306_5-1	26105-1	ROV	12.08.24	10:33	12°56.978	44°53.015	951	DIVE089; start dive: 11:53
			12.08.24	15:04	12°57.011	44°53.047	920	end dive: 13:45; 9 samples
SO306 6-1	26106-1	Lander	12.08.24	18:19	12°57.150	44°53.083	826	lander deployment
SO306 7-1	26107-1	MBES/PS	12.08.24	20:06	13°04.684	44°56.922	1540	start
			13.08.24	04:36	13°01.606	44°50.650	1432	end
SO306 8-1	26108-1	ROV	13.08.24	05:59	12°57.371	44°53.224	774	DIVE090 ; start dive: 06:55
_			13.08.24	09:39	12°57.389	44°53.272	770	dive end: 08:35; aborted due to technical problems: 5 samples
SO306 9-1	26109-1	TV-GBC	13.08.24	11:41	12°57.387	44°53.269	770	recovery: 3-19 cm
SO306 9-2	26109-2	EBS	13.08.24	13:53	12°57.387	44°53.240	775	start
			13.08.24	13:56	12°57,409	44°53.315	757	end
SO306 9-3	26109-3	MuNet	13.08.24	15:24	12°57,429	44°53.362	754	sampling at 5 depth levels (0-500m)
SO306_10-1	26110-1	CTD YoYo	13 08 24	16.39	12°57 224	44°53 182	790	11 casts: water sampling at cast 11
50500_10 1			14 08 24	03.00	12°57 232	44°53 182	788	(02:29); with mobile LADCP
50306 11-1	26111-1	BOV	14.08.24	05.50	13°01 410	44°52 088	1338	DIVE091 : start dive: 07:24
50500_111	20111 1		14.08.24	13.51	13°01.410	44 52.000	1139	end dive: 12:38: 14 samples
50306 12-1	26112-1	FBS	14.08.24	15.39	13°01.378	44°52.510	1124	start
50500_12 1	20112 1		14.08.24	15.33	13°01.430	44 52.400 44°52 387	1124	end
50206 12 2	26112.2	MuNot	14.00.24	17.00	1201.545	44 52.387	1120	sampling at 5 denth levels (0-500m)
SO306_12-2	20112-2		14.08.24	15.22	13 01.393	44 JZ.290	12/0	start
50500_15-1	20115	IVIDES/FS	15 09 24	04.44	12°55 045	44 52.515	660	end: profiling miles: 84 pm
50206 14 1	26114 1	POV	15.00.24	04.44	12 33.943	44 54.748	6009	DIVEO92: start dive: 06:09
30300_14-1	20114-1	NOV	15.08.24	12.16	12 30.120	44 54.425	570	end dive: 12:30: 24 samples
50206 1E 1	2611E 1	Landor	15.00.24	14.02	12 30.334	44 54.595	760	lander recovery (see GeoB26106-1)
SO206 16 1	26116 1		15.08.24	16.19	12 37.202	44 55.241	602	start
50500_10-1	20110-1	LDS	15.00.24	16.10	12 50.154	44 54.405	696	end
50206 17 1	26117 1	EDC	15.08.24	17.50	12 30.190	44 54.579	714	start
30300_17-1	20117-1	LDJ	15.00.24	12.03	12 30.283	44 34.419	542	and
Townski			15.06.24	18.05	12 30.319	44 54.560	542	ena
SO306_18-1	26118-1	CTD+ROS	17.08.24	03:53	10°01.927	40°57.911	2598	sound velocity profiling; water sampling; with mobile LADCP
SO306 19-1	26119-1	MBES/PS	17.08.24	07:15	10°14.542	40°38.476	1096	start
_			17.08.24	11:00	10°22.125	40°31.332	362	end; profiling miles: 27.9 nm
SO306 20-1	26120-1	TV-GBC	17.08.24	12:10	10°20.072	40°30.038	372	recovery: 0-20 cm
SO306 21-1	26121-1	TV-GBC	17.08.24	13:44	10°21.138	40°29.822	274	not released; video: boulders with corals
SO306 22-1	26122-1	CTD+ROS	17.08.24	14:42	10°21.325	40°29.835	2719	water sampling; with mobile LADCP
SO306 23-1	26123-1	MBES/PS	17.08.24	15:19	10°20.095	40°29.996	3642	start
		_, _	18.08.24	03:54	10°12.292	40°23.165	439	end; profiling miles: 94.1 nm
50306 24-1	26124-1	ROV	18.08.24	05:42	10°15,489	40°25.247	356	DIVE093 : start dive: 06:09
			18.08.24	11:01	10°15,205	40°24.848	354	end dive: 10:24; 7 samples
50306 25-1	26125-1	TV-GBC	18 08 24	11.01	10°15 193	40°24 814	339	recovery: 46 cm
SO306_25-1	26126-1	TV-GBC	18 08 24	12.59	10°15 326	40°25.051	429	recovery: 29 cm
SO306 27-1	26127-1	MUNet	18 08 24	14.10	10°13 510	40°26 249	545	sampling at 5 depth levels (0-500m)
SO306 20 1	26129 1	FRS	18 08 24	16.51	10°15 227	40°25 110	1/1	start
20300_20-1	20120-1		18 09 24	17.01	10°15 225	40°25 110	110	end
50306 20 1	26120 1	FBC	18 00 24	18.20	10°15 027	10°21 0E1	250	start
30300_29-1	20123-1	LDS	10.00.24	10.29	10015.037	40 24.901	242	end
50206 20 1	26120 1		10.00.24	10.30	10º11 420	40 24.933	545	start
30300_30-1	20130-1	IVIDL3/P3	10.00.24	19.34	10°12 525	40 23.791	220	end: profiling miles: 71 pm
1	1	1	13.00.24	04.40	10 12.000	-0 30.047	000	cha, projning nincs. / ± min

SO306_31-1	26131-1	ROV	19.08.24	05:44	10°12.485	40°32.924	946	DIVE094 ; start dive: 06:59
			19.08.24	13:37	10°12.396	40°32.816	963	end dive: 12:13; 17 samples
SO306_32-1	26132-1	TV-GBC	19.08.24	14:45	10°12.231	40°32.742	915	recovery: 28 cm
SO306 33-1	26133-1	CTD+ROS	19.08.24	16:17	10°12.263	40°32.711	862	water sampling; with mobile LADCP
SO306 33-2	26133-2	Lander	19.08.24	18:14	10°12.241	40°32.685	862	lander deployment
SO306_34-1	26134-1	CTD+ROS	19.08.24	19:28	10°12.266	40°32.737	920	water sampling; with mobile LADCP
SO306_35-1	26135-1	MBES/PS	19.08.24	20:40	10°12.931	40°31.927	859	start
			20.08.24	03:40	10°10.106	40°20.945	490	end; profiling miles: 49 nm
SO306_36-1	26136-1	ROV	20.08.24	05:34	10°12.521	40°32.847	942	DIVE095 ; start dive: 06:45
			20.08.24	13:19	10°12.478	40°32.793	942	end dive: 11:40; 18 samples
SO306_37-1	26137-1	TV-GBC	20.08.24	14:26	10°12.222	40°32.663	868	recovery: 10-20 cm
SO306_38-1	26138-1	MuNet	20.08.24	15:46	10°12.300	40°32.675	891	sampling at 5 depth levels (0-500m)
SO306_39-1	26139-1	MBES/PS	20.08.24	16:57	10°13.452	40°32.492	868	start
			21.08.24	05:30	10° 09.963	40°20.741	483	end; profiling miles: 49 nm
SO306_40-1	26140-1	GC	21.08.24	06:07	10°10.068	40°21.283	424	recovery: 577 cm; top lost (~20 cm)
SO306_41-1	26141-1	GC	21.08.24	07:43	10° 06.052	40°19.992	765	recovery: 665 cm; disturbed
SO306_42-1	26142-1	MBES/PS	21.08.24	09:15	10°11.023	40°27.017	758	start
			21.08.24	09:44	10°13.545	40°29.933	748	end; profiling miles: 3.9 nm
SO306_43-1	26143-1	GC	21.08.24	11:35	10°12.096	40°40.247	1211	recovery: 34 cm
SO306_44-1	26144-1	GC	21.08.24	13:45	10°08.804	40°46.350	1492	recovery: 404 cm
SO306_45-1	26145-1	CTD YoYo	21.08.24	16:03	10°12.197	40°32.662	881	12 casts; water sampling at cast 12 (03:00);
			22.08.24	03:43	10°12.233	40°32.682	872	with mobile LADCP
SO306_46-1	26146-1	MBES/PS	22.08.24	06:53	10°11.101	40°32.681	869	profiling miles: 44.1 nm
			22.08.24	12:31	10°01.547	40°17.987	1302	end profile
SO306_47-1	26147-1	GC	22.08.24	13:36	10°06.042	40°20.200	771	recovery: 546 cm
SO306_48-1	26148-1	GC	22.08.24	15:20	10°00.993	40°21.504	1121	recovery: 497 cm
SO306_49-1	26149-1	MBES/PS	22.08.24	16:25	10°01.434	40°18.051	1308	start
			23.08.24	04:16	10°10.092	40°33.177	1083	end; profiling miles: 94 nm
SO306_50-1	26150-1	ROV	23.08.24	05:21	10°12.476	40°32.852	948	DIVE096 ; start dive: 07:24
			23.08.24	12:04	10°12.583	40°32.932	941	end dive: 10:01; 4 samples
SO306_51-1	26151-1	TV-GBC	23.08.24	13:16	10°12.239	40°32.638	866	recovery: 9-26 cm
SO306_52-1	26152-1	TV-GBC	23.08.24	14:36	10°12.259	40°32.682	867	recovery: 30 cm
SO306_52-2	26152-2	CTD+ROS	23.08.24	15:52	10°12.282	40°32.707	905	water sampling for experiments
SO306_53-1	26153-1	MBES/PS	23.08.24	17:40	09°59.908	40°31.965	1468	start
			24.08.24	03:15	09°57.655	40°24.712	1350	end; profiling miles: 78 nm
SO306_54-1	26154-1	TV-GBC	24.08.24	08:25	10°21.118	40°29.802	274	recovery: 0-14 cm; video-mapping
SO306_55-1	26155-1	EBS	24.08.24	10:03	10°21.413	40°30.224	302	start
			24.08.24	10:16	10°21.460	40°30.258	302	end; EBS damaged during dredging
SO306_56-1	26156-1	MBES/PS	24.08.24	11:04	10°20.061	40°30.728	435	start
			25.08.24	06:49	09°57.685	40°44.399	1840	end; profiling miles: 157 nm
SO306_57-1	26157-1	CTD+ROS	25.08.24	07:42	09°57.224	40°44.228	1835	sound velocity profiling
SO306_58-1	26158-1	GC	25.08.24	10:13	10°04.597	40°46.140	1650	recovery: 836 cm
SO306_59-1	26159-1	Lander	25.08.24	12:50	10°12.280	40°32.744	?	lander recovery (see GeoB26133-2)
50306_60-1	26160-1	EB2	25.08.24	14:46	10°12.478	40°32.665	937	start
60006 64.4	26464.4		25.08.24	15:08	10°12.607	40°32.792	936	end
50306_61-1	26161-1	MBES/PS	25.08.24	18:20	09*57.954	40°44.693	1870	start
50205 52.4	26462.4	TV CDC	26.08.24	06:11	09*56.117	40°30.023	1563	end; projiling miles: 97 nm
SO306_62-1	26162-1	TV-GBC	26.08.24	09:11	09'56.075	40'30.271	1600	not released; video-mapping
SO306_63-1	26163-1	GC	26.08.24	13:00	09°57.004	40°43.595	1819	recovery: 463 cm
SO306_63-2	26163-1	EBS	26.08.24	16:20	09'57.125	40-43.889	1824	start
SO306_63-2	26163-2	EBS	26.08.24	16:32	10°02.001	40°43.888	1824	
50306_64-1	26164-1	INIBES/PS	26.08.24	19:15	10°03.901	40°54.683	2354	start
50205 65 A	26465.4	DOV	27.08.24	05:01	10-14.421	40°24.699	365	end, projning miles: 86 min
30306_65-1	20105-1	KUV	27.08.24	05:45	10°15.093	40°25.698	460	dive could not start due to starte surger the
Magazzi			27.08.24	08:57	10 14.989	40 25.635	490	uve could not start due to strong currents
iviozambiqu	e – off Za	mbezi	20.00.01	10.10	10951 500	2794 4 672	540	complian at E double lough (0.500 m)
SU306_66-1	26166-1	LID+ROS	29.08.24	16:40	18-51.529	3/14.673	513	sumpling at 5 depth levels (0-500m)
SU306_66-2	20100-2		29.08.24	10:50	18'51.544	37 14.697	512	sumpling at 5 aepth levels (U-480m)
50306_67-1	2016/-1	IVIBES/PS	29.08.24	18:50	18-52.260	37 16.993	05/	sturt
			30.08.24	05:24	18-51.288	3/~14.132	462	ena, projiling miles: 74 nm

SO306_68-1	26168-1	TV-GBC	30.08.24	07:04	18°51.518	37°14.166	471	recovery: 34 cm; video-mapping
SO306_69-1	26169-1	GC	30.08.24	08:31	18°54.245	37°14.309	580	recovery: 598 cm
SO306_70-1	26170-1	EBS	30.08.24	10:37	18°54.074	37°14.144	577	start
			30.08.24	10:38	18°54.068	37°14.147	576	end
SO306_71-1	26171-1	ROV	30.08.24	12:10	18°51.467	37°14.380	486	DIVE098 ; start dive: 12:47
			30.08.24	14:39	18°51.420	37°14.335	480	end dive: 14:03; 8 samples
SO306_72-1	26172-1	CTD+ROS	30.08.24	15:30	18°51.385	37°14.307	475	water sampling; with mobile ADCP
Mozambiqu	ue – off Lir	npopo	•			•	•	
SO306_73-1	26173-1	CTD+ROS	01.09.24	16:43	25°56.962	35°10.772	906	sound velocity profiling
SO306_74-1	26174-1	MBES/PS	01.09.24	17:46	26°00.624	35°13.049	840	start
_			02.09.24	4:04	26°02.407	35°07.059	1027	end; profiling miles: 80.6 nm
SO306 75-1	26175-1	ROV	02.09.24	05:29	25°59.140	35°9.602	742	DIVE099 ; start dive: 06:28
_			02.09.24	09:30	25°59.101	35°9.699	699	end dive: 08:24
SO306 76-1	26176-1	ROV	02.09.24	11:01	25°59.144	35°10.408	365	DIVE100 ; start dive: 11:26
_			02.09.24	14:12	25°59.159	35°10.419	363	end dive: 13:41; 9 samples
SO306 77-1	26177-1	CTD+ROS	02.09.24	14:48	25°59.209	35°10.360	296	sound velocity profiling
_								water sampling; with mobile LADCP
SO306_78-1	26178-1	MuNet	02.09.24	16:07	25°59.147	35°09.572	748	sampling at 5 depth levels (0-500m)
SO306_79-1	26179-1	MBES/PS	02.09.24	17:34	25°57.115	35°13.644	925	start
			03.09.24	04:33	26°00.133	35°9.272	837	end; profiling miles: 90 nm
SO306_80-1	26180-1	ROV	03.09.24	06:00	25°57.673	35°11.754	371	DIVE101 ; start dive: 06:28
			03.09.24	08:33	25°57.698	35°11.751	346	end dive: 08:01; aborted due to buoy on top
50206 81 1	26101 1	66	02.00.24	12.00	25040 240	25% 100	1055	of SIVIT; / samples
50306_81-1	20181-1		03.09.24	14.52	25 49.248	35 0.100	1022	
50306_82-1	20182-1		03.09.24	14:52	25 38.733	34 38.307	500	ctart
30306_82-2	20102-1	EBS	03.09.24	16:39	25 38.770	34 38.482	504	and
Couth Africa			05.09.24	10.42	25 56.759	54 56.506	505	chu
South Africa			04.00.24	10.55	20822.050	22802 466	700	at a st
50306_83-1	20183-1	IVIBES/PS	04.09.24	18:55	29 22.050	32 03.466	723	sturt
60006.014	26404.4	71/000	05.09.24	04:43	29°28.680	32°4.929	994	ena; profiling miles: 79.1 nm
50306_84-1	26184-1	I V-GBC	05.09.24	06:16	29°30.304	32°2.103	807	viaeo-mapping; no coring possible; aborted due to strong currents
SO306 85-1	26185-1	TV-GBC	05.09.24	10:06	29°29.664	32°2.364	804	video-mapping; aborted due to broken
								winch
SO306_86-1	26186-1	CTD+ROS	05.09.24	11:56	29°28.199	32°4.218	943	sound velocity profiling
							-	water sampling; with mobile LADCP
SO306_87-1	26187-1	MuNet	05.09.24	13:34	29°28.685	32°3.839	971	sampling at 5 depth levels (0-500m)
SO306_88-1	26188-1	MBES/PS	05.09.24	15:31	29°38.251	31°50.437	686	start
			06.09.24	04:49	29°38.046	31°50.227	676	end; profiling miles: 87 nm
SO306_89-1	26189-1	GC	06.09.24	11:52	29°33.480	34°51.111	1835	recovery: 957 cm
SO306_90-1	26190-1	MBES/PS	06.09.24	12:59	29°33.083	32°53.784	1834	start
			07.09.24	06:24	29°29.023	32°49.440	676	end; profiling miles: 139 nm
SO306_91-1	26191-1	CTD+ROS	07.09.24	07:11	29°28.976	32°49.439	1963	sound velocity profiling
50206 02 1	26102.1	CC .	07.00.24	00.44	20022 202	22ºE1 476	1011	water sampling; with MODIIE LADCP
30300 92-1	20195-1	UU	07.09.24	09:44	29 31.181	JJZ JI.4/6	11011	tube bent, empty

<u>Abbreviations</u>: WD, water depth; REC, recovery; CTD+ROS: CTD plus water sampler, MuNet: multinet, SML: satellite mini lander (GEOMAR), MBES/PS: surveys with Multibeam Echosounder and PARASOUND sub-bottom profiler, GC: gravity corer, TV-GBC: video-guided giant box corer, EBS: epibenthic sledge